Child Malnutrition and Mortality in Developing Countries: Evidence from a Cross-Country Analysis

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Abstract

In this paper we propose and test an interpretative framework on the social and economic determinants of child malnutrition and child mortality, two key human development indicators. The paper is organized as follows. Section 1 illustrates the main economic and social factors causing child malnutrition and mortality. Section 2 identifies the main clusters of food insecure and vulnerable households and briefly describes their livelihood profiles. Section 3 exposes our cross-country estimation methodology. Section 4 reports and discusses the results. Section 5 concludes.

Keywords: Malnutrition, Mortality, Cross-Country Analysis, Millenium Development Goals, Food Insecurity

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1 Introduction: Factors affecting child malnutrition and mortality[1]

Each individual's nutrition status is the outcome of a complex causative process depending on a number of physical, social, economic, institutional, and cultural factors (see Sen 1981). In turn, child malnutrition is a powerful determinant of child mortality, along with other factors - many of which, with different intensities, are the same ones affecting child malnutrition itself (see Pelletier and Frongillo 2003). To identify the main determinants of child malnutrition and mortality it is necessary to adopt a quasi-Rawlsian approach, analyzing the causal processes flowing from the macro- to the micro-level from the vantage point of food insecure[2] and vulnerable households, which tend in practice to be the most destitute ones living in the developing world. The key factors affecting child malnutrition and mortality are represented in Diagram 1, in a descending vertical order corresponding to a decreasing remoteness of various sets of factors from the point of view of households.[3] The same factors, and their reciprocal linkages, can also be conceptually positioned horizontally in the same diagram over a continuum range. This range features market forces (seen as the realm of non-coordinated, self-interest-driven, atomized transactions) on the right side, and non-market forces (such as culture and institutions, including the State), on the other side[4].

In each historical and geographic context, physical and environmental factors, jointly with technology, impose an upper bound to the maximum potential level of production of commodities and services, including food. In those circumstances where food production and other human activities are not ecologically sustainable, this bound is lowered, progressively or catastrophically. Structural characteristics of production and exchange patterns are not neutral with respect to environmental sustainability, and can be conducive to a gradual or sudden worsening of hunger

[1] This section and diagram 1 has been adapted from Gabriele and Schettino 2006.

[2] Food insecure households include households actually suffering from hunger in the form of material food deprivation and households that under normal circumstances face a structural risk of falling into that situation.

[3] Diagram 1 has some elements in common with Figure 1 in Smith and Haddad 2000. However, there are many differences. Our diagram attempts to identify a causal chain leading to both child malnutrition and child mortality, while Smith and Haddad only focus on the former. Another major difference is that Smith and Haddad assume the clear-cut existence of only two classes of determinants :basic determinants and underlying factors.. Our diagram, conversely, tries to illustrate a more complex causal chain, distinguishing 4 basic stages of causation and stressing as a key feature the positioning of each factors in the market-non market range.

[4] Of course, such a spatial representation of the complex chain of factors leading to hunger market and non-market forces is a merely indicative one.

(Moorehead and Wolmer 2001). This is, conceptually, the highest and broadest level where it is possible to identify a macro-microeconomic linkage between macroeconomic factors and human development outcomes (see Diagram 1, part 1).

Economic growth is the engine leading to wider availability of goods and services. It is the single most important factor influencing income-based poverty (see Ames et al.(2001). By the same token, economic growth has long been regarded as key to decrease food poverty, and to enhance human development, reducing hunger, and child mortality. However, growth only tells part of the story, especially if the concept of poverty is broadened to include physiological and social deprivation, and, a fortiori, hunger. The main reason is that, even in the relatively long run (i.e., 20-30 years), the linkage between GDP growth and income poverty[5] is mediated by the evolution of income distribution (Datt and Ravallion 1992, Kakwani 1993, Ravallion 1997, 2001, 2004, 2005a, 2005b). Moreover, the linkage between (income) poverty, child malnutrition, and child mortality must be complemented by the impact of public provision of basic services and other hunger- relieving and other pro-poor interventions (including food aid, targeted nutrition, health, and educational programs, safety nets etc)[6].

The availability and distribution of productive assets (including non-material ones, such as knowledge), and the role of the State constitute the structural background of macro-to-microeconomic linkages at the immediately lower level. The interaction of market forces and state intervention is key in determining economic development and the primary distribution of personal (labor and non-labor) monetary incomes (Diagram 1, part 2).

National marketed food supply, in particular, is determined by food production and trade. It is primarily a reflection of the level of development of both food-producing and non food-producing sectors, and to a lesser extent of the state's propensity to intervene in food trade. Income distribution, along with nutritional

[5] The term income poverty refers to the lack of purchasing power deriving exclusively from the total amount and the distribution of primary incomes, without taking into account the impact of direct provision of public services on the part of the state.

[6] The complexity of the linkages between economic growth, malnutrition, and human development is at the root of a number of well-known and less well-known "development puzzles". Some examples are as follows. Positive trends in child malnutrition were recorded in Chile during the early Pinochet regime years, in spite of mounting income poverty (Amigo et al. 1994). Cuba's child malnutrition and mortality indicators improved in the late 1990s (FAO 2003a, FAO 2003b, WB WDI 2006).Kerala's human development indicators are exceptionally good, in spite of the fact that it is one of the poorest Indian states(Chen 2001, ISAE 2004; Marmot 2005;UNDP Kerala 2005). Vietnam's child mortality is lower than China's (Gabriele and Schettino 2006).

habits and the impact of state intervention on the prices of food and other goods and services (using policy tools such as taxes, subsidies, state-owned enterprises, and others), determines the structure of national food demand, and hence each household's income-based access to marketed food supplies. (Diagram 1, parts 3, 4).

Income-based access to food depends on each household's purchasing power, which is constrained by the prevalence and severity of income-based (food) poverty (see Baulch and Masset 2003, Hulme 2003). Food poverty is due to insufficient economic development and/or to unequal income distribution, and its magnitude can be partly modified by food subsidies and other price-distorting state interventions. Access to food, however, is also conditioned by people's knowledge and awareness of food quality (Webb and Thorne-Lyman 2006), as well as by other factors. As hunger and poverty are different, albeit closely related phenomena, there are factors (such as diverse consumption and intra-household distribution patterns[7], dietary habits and climatic conditions, and cultural factors) that cause significant differences in malnutrition among members of households at similar levels of poverty (see Baulch 2001, Devereux S. and Maxwell S. 2001, Hulme 2003, Hulme and Sheperd 2003, Baulch and Masset 2003, Gentilini and Webb 2006).

From a causal point of view, poverty affects the effective demand of food, but (food) poverty itself is influenced by food market prices. That's why the causal linkage between poverty and the food market is represented by a two-pointed arrow in Diagram 1 (part 3). Moreover, poverty also influences malnutrition and child mortality through other channels (represented by a long vertical arrow flowing part 3 to part 4 of Diagram1) which constrain household's market-based access to non-food commodities and basic services affecting child mortality (such as drugs, sanitary facilities, health and education services.).

Availability of and access to food are also influenced by subsistence food production and other non–market factors (such as the state of transport infrastructure, or the existence of food aid programs). Food utilization patterns determine the linkage between access to food and nutrition. They are shaped by a set of subjective (largely cultural and behavioral) and objective (dependent mainly on the development

[7] Recent empirical research provides sometimes contradictory hindsights. For instance, Aromolaran 2004 fails to find evidence of a positive impact on calorie intake of women's share of household total income in South Western Nigeria. Gabriele and Schettino 2006a,b, , on the contrary, using a cross-country model, find a significant and strong positive impact of women's status on children's malnutrition and child mortality.

of health and sanitary services) factors . Ultimately, people's nutritional status is determined jointly by two main sets of factors. One of them governs market- and income-based access to food. The other set of factors is constituted by the overall array of public policies affecting non–income[8] based access to and utilization of food (see Amigo et al. 1994, Balk et al. 2005) (Diagram 1, part 4). In the specific case of children, an inadequate nutritional status (reflected by anthropometric indicators of child malnutrition, such as the prevalence of wasting, stunting, and underweight) is a major determinant of child mortality. However, child mortality is also affected by non-nutritional factors. The most important is the availability of basic services (which is influenced essentially by public policies, but cultural, behavioural, and environmental factors also play an important role.(see Aromolaran 2004, Balk et al. 2005, Gabriele and Schettino 2006) (Diagram 1, part 4).

According to the approach sketched above, market-determined income and distribution patterns are fundamental determinants of child malnutrition and mortality, but a complementary key domain is constituted by the economic and social role of the state, which belongs essentially to the realm of political econom, and is shaped by parameters such as the share of national resources commanded by the state and the its propensity to spend these resources on anti-hunger interventions. In a broad sense, such a "propensity to spend" can be understood as including the government's propensity to spend political capital, intervening proactively in domestic food markets. In sum, the state's capacity to engage in pro-poor public interventions depends, on one hand, on its relative strength vis a vis the private sector, and, on the other hand, on its willingness and capability to use them for hunger-reducing purposes (see Dreze and Sen 1989, Maxwell 2001, Ford Runge et al. 2003).[9]

Policy changes in the domain of domestic markets can affect the price of food inside the country, or cushion it from changes in the world price. In India and China, for instance, public distribution systems for foodgrains, albeit imperfect, have effectively contributed to reduce hunger and food insecurity (see Zhou Z. and Wan G.

[8] The term "non-income" refers to income in a narrow sense, only as a budget constraint. Of course, relative income and class also affect behaviour, and thus also tastes and nutritional habits, quite apart from their obvious impact of budget constraints.

[9] Macroeconomic conditions constrain the state's capacity to provide hunger-reducing basic services and to engage in other anti-hunger public interventions. During Peru's crisis in the late 1980s, for instance, malnutrition and infant mortality rose also due to the collapse in public expenditure on health (Paxson and Schady 2005).

2006, Cheriyan 2006). Besides interfering directly in domestic food markets (through subsidies, price caps, export bans, etc.) governments also affect domestic food prices via a number of other policy interventions, such as investments in transport and storage infrastructure and reforms in domestic food markets aimed at fostering competition and lowering risks and transaction costs (see Pinkney 1993). Food-focused interventions in domestic markets exert a direct impact on access to food, and, if effective, tend to improve hunger indicators more than poverty indicators. However, their market-distortionary nature makes them more complex and riskier than direct, targeted anti-hunger and anti-poverty programs [10] (Coggiola 2007).

By the same token, public provision of basic infrastructure and services (such as sanitation facilities, health and education services) affects a wide range of factors different from malnutrition which contribute to determine the level of child mortality.

2. Main clusters of food insecure and vulnerable households.

The multiple macro-microeconomic linkages identified in the previous section bear uneven relevance in determining the level, intensity, and evolution of hunger and destitution in different areas of the world where food insecure and vulnerable households live. Popular perception tends to assume that most hungry people are African traditional subsistence farmers, living in remote areas fully detached from markets, where – as environmental deterioration and/or increasing demographic pressure dramatically decrease per capita food supply - there is just no food. In fact, food insecure population groups with this type of characteristics do exist, but they constitute only a small part of the overall hunger scenario on a global scale.

A very important and so far insufficiently exploited source of information on the livelihoods of food insecure and vulnerable households is constituted by dozens of WFP food security assessment reports carried out in many developing countries. by WFP in 2005-2006. A synthetic review of these studies carried out by WFP (WFP 2007) has showed that the vast majority of rural food insecure households:

[10] Targeted anti-hunger programs, f properly designed and implemented, can be very effective even if their cost (and, therefore, the sacrifice they imply for non-benficiaries) is marginal for the society as a whole. For example, the cost of the Fome Zero program in Brazil - which benefits over 30 million people and has been contributing significantly to combat mass hunger - is less than 0.2% of the country's GDP (Coggiola 2007).

- do buy at least part of their food, especially during the lean period;
- are net food buyers[11];
- interact in non-food markets such as: labor markets, local financial markets, markets for agricultural and other primary commodities;
- are usually made more severely food poor (i.e., see their ability to buy food diminished) by the underdevelopment of the markets they interact with, implying problems such as: high transport and transaction costs; high price volatility; uncertainty; lack of information; high degrees of monopoly on the part of traders(see Abdulai and CroleRees 2001).

WFP surveys also show that food poverty overlaps to a very large extent to with other forms of destitution caused by income poverty, such as the inability to purchase basic health and nutrition services on a market base (besides, usually, a lack of access to public services, where they do exist). Therefore, food insecure rural households are likely to exhibit high levels of child malnutrition and mortality, due both to nutritional and non-nutritional deficiencies.

The findings of WFP 2007 should be interpreted along with the stylized facts emerging from the most recent and comprehensive estimate of world hunger, which were provided respectively by FAO in 2004 (FAO 2004)and by the UN Millennium Project in 2005 (UN 2005;seeee also Balk et al.2005). FAO (2004) estimated the world number of undernourished at 852 million, 815 million of which lived in developing countries. More than half were concentrated in India (221 million) and Sub-Saharan Africa (204 million) (see UNDP India 2006). Other large pockets of undernourishment were found in China (142 million) and in the rest of Asia (156 million).

UN (2005) attempted to estimate hunger at the sub-national level, identifying "hunger hotspots" characterized by a prevalence of under-5 children underweight above 20%. Malnourished children born in these large clusters of poor and food insecure households are likely to exhibit particularly high levels of child mortality, not only owing to the direct impact of malnutrition itself, but also due to non-food factors largely related to lack of access to basic services.

[11] This key finding stems from considering jointly several answers to the questionnaires, but cannot be proven statistically in a clear fashion due to the structure of the assessments.

The methodology of UN 2005 appears to be more detailed and probably more statistically reliable than that of FAO 2004[12], and therefore it is accorded more attention in this sub-section. The results of UN 2005 show that most underweight children (over 70%) are Asian. Out of them the vast majority lives in South Asia. India alone is home to 40% of the world's underweight children, but the prevalence of the phenomenon is even worse in Bangladesh and Pakistan (see Ravallion and Subbarao 1992, Datt and Ravallion 2001, Deaton and Dreze 2002, Larson et al. 2004, Cheriyan 2006). Most of the remaining underweight children are in Sub-Saharan Africa , while much smaller hunger pockets exist in Latin America (mainly in Central America, Peru, Bolivia, and Brazil). Due partly to methodological differences with respect to FAO 2004 and partly to the real phenomenon of very fast reduction in hunger in China, the most populous country does not figure among the regions characterized by an alarming level of child hunger (see Table 1).[13] Malnourished children born in these large clusters of poor and food insecure households are likely to exhibit particularly high levels of child mortality, not only owing to the direct impact of malnutrition itself, but also due to non-food factors largely related to lack of access to basic services.

The sub-national mapping exercise carried out by the authors of UN 2005 allows them to sketch a basic profile of the world hungry (see Table 2). No matter how rough, this information is precious because (to our knowledge) it is the only available source that allows to classify globally the hungry poor according to their prevalent form of livelihood.[14] The main findings are as follows:

- the majority of hungry people live in rural areas;
- about half are "smallholder farming households unable either to grow or to buy enough food to meet the family's requirements", i.e. food-poor small farmers;
- one fifth are landless rural people;

[12] FAO undernourishment estimates are derived from national food balance sheets, and are not fully consistent with ex post anthropometric indicators of malnutrition such as the prevalence of wasting, stunting, and underweight.
[13] Hunger reduction in China has also been accelerated by internal migration and by the convergence of regional agricultural labour productivity since 1992 (McErlean and Wu 2003)
[14] WFP national food assessment reports provide comparable information for some individual countries.

- one tenth are households basing their livelihood on pastoralism, fishing, or forest activities;
- the remaining fifth is made up by urban poor, leaving mostly in slums. Its absolute and relative weight is growing rapidly.

Table 1. Underweight children in major developing regions

1a Hunger hotspots*

Region	Subnational units analyzed	Hunger hotspots*
Africa	366	229
Asia	172	76
LA & Caribbean	106	8
Total	644	313

2a Underweight children under 5 in hunger hotspots

Region	Millions	Share of the region's total (%)
Africa	28	88
Asia	78	95
LA & Caribbean	0.4	17
Total	107	79

3a Total number of underweight children (estimate)

Region	Total number of underweight children	Share of world underweight children (%)
Africa	31.8	27.37
Asia	82.1	70.65
LA & Car	2.3	1.98
Total	116.2	100

* Units with over 20% of under five children underweight
Source: UN 2005

Table 2. Main groups of food insecure households

	Share of world total (%)
Smallhoders	50
Landless rurals	20
Pastoralists, fisherfolk, forest people	10
Urban poor	20

Source: UN 2005

Three (or four) large clusters of food insecure households

Utilizing heuristically (in absence of more detailed statistical information) the findings briefly illustrated in the two preceding sub-sections, it is possible to sketch a limited number of food insecure households representative profiles, according to their livelihood profile (the main factor responsible for their food insecurity), and geographical location (see Table 3). About two-thirds are Asian and Sub-Saharan

African rural households primarily, but not exclusively, engaged in agriculture, who constantly or occasionally participate in food markets and other markets often characterized by a low degree of development and integration. They lack sufficient assets (land, human, and non-human capital) to self-produce enough food and/or to obtain enough money from agricultural and other activities. In turn, this large grouping can be divided into two different sub-groups, or clusters, of uneven size (see table 3). These estimates are consistent with the well-established fact that the highest rates of child malnutrition worldwide are those of South Asia, although poverty and child mortality are highest in Sub-Saharan Africa (see Table 4).

Table 3. Main clusters of food insecure households

	Share of world total (%)	Trend Absolute number	Prevalence (%)
Land poor South Asian agriculturalists	40-50	Up	?
SSAn smallholders	25-30	Up fast	Up
Urban informal workers	20-25	Up	Up
Marginal Chinese and Vietnamese farmers	?	Down fast	Down fast

Source WBWDI

Table 4. Poverty, child malnutrition, and child mortality in South Asia and in Sub-Saharan Africa

	South Asia	Sub-Saharan Africa
Poverty*	31.2	44
Under-5 child mortality	92	168
Underweight (% of children under age 5)	27	35

* Share of people living with less than $1/day
Latest available data, 2000-2004
Source WBWDI

The first, and by far the largest cluster is constituted by South Asian smallholders and landless farmers. Most of them are Indian, and live in densely populated areas with reasonably well-functioning, albeit often poorly developed, markets. Their numbers are increasing in absolute terms, while in relative terms (i.e., as a share of the total population in their countries) available evidence is contradictory - some estimates indicate a modest improvement, while others point towards increasing malnutrition in India since the mid-1990s.

The second cluster is made up by rural Sub-Saharan African households (a little more than a quarter of the total, a share that is rapidly increasing due to Africa's unfavourable macroeconomic trends). To imagine them as fully engaged in subsistence agriculture, hunting, and gathering would be widely out of mark: withy few exceptions, and under normal circumstances, they do interact with numerous markets, including food and labor markets. Yet, it is true that they are penalized by the lack of infrastructure, and by the thinness and underdevelopment of many markets to a larger extent than their Asian counterparts. The main constraint keeping them hungry is usually not the inadequacy of land endowments, but low agricultural productivity, stemming from a complex set of environmental, institutional, technological, economic and social factors, among which drought and lack of productive and transport infrastructure are paramount (see Swift and Hamilton 2001).

The third large cluster of food insecure households is constituted by poor urban households, many of which recently migrated from the countryside, mostly living in slums and engaged in the informal sector. Urban food insecure households are present in all continents, already constitute a fifth of the world hungry, and their numbers are growing. According to some, but not all estimates, there is still another large cluster of rural food insecure households in East and South- East Asia. Its bulk is constituted by Chinese and Vietnamese farmers[15] who do enjoy quasi-property rights on small but not minuscule plots of land, but are food-poor due to a combination of intrinsically low land productivity and scarcity of infrastructure and capital, including human capital. Many of them live in marginal and remote areas and belong to minority ethnic communities. From a statistical viewpoint, as poverty and malnutrition are decreasing very fast both in China and Vietnam, the conditions and size of these population groups have also being changing rapidly, with many crossing the threshold separating food insecurity from food security. Therefore, their level of food poverty and malnutrition is difficult to pinpoint, and an estimate of the number of the hungry is highly dependent on the methodology and the timing of surveys, and on the threshold chosen to determine households' food insecurity conditions. This difficulty explains why some sources, such as UN 2005, fail to spot any significant clusters of child malnutrition in China and Vietnam, taking into account that

[15] Chronic hunger and food poverty are also widespread in smaller countries such as North Korea, Laos and Cambodia.

according to some other indicators (such as wasting, stunting, and child mortality) it is clear that hunger still affects tens of millions in the two countries.

Other, smaller groups of FIHs are present in both the developing and the developed world. Extremely poor and food insecure rural households in Latin America are mainly concentrated in the Southern states of Mexico, Central America, North-Eastern Brazil, and the Andes. Albeit less dramatically than in the 1990s, chronic hunger is present to varying degrees in Russia and in several small and middle-sized countries in the Middle East, Central Asia, and Central Europe, in many cases due to long-lasting conflicts or the inability to recover after the collapse of previously centrally-planned economies (see and Anderson 1997; Atal 1999; HFTN 2006; FAO 1997; Lokshin M. and Yemtsov R 2005; AmeriCares 2006[16]).[17]

3 Methodology

Many cross-country studies have been carried out on the factors determining human development indicators.. Most of them employed OLS regression techniques on cross-sections and/or panel data, in some cases refining the analysis with tools such as country fixed-effects and instrumental variables. Anand and Ravallion (1993) ran OLS regressions to explore the impact of national income, poverty, and public health on life expectancy and infant mortality in 22 countries. Pritchett and Summers (1996) used instrumental variables to estimate the impact of income and other factors (such as education) on infant mortality and life expectancy. Two studies by the U.N. Administrative Committee on Coordination's subcommittee on nutrition (UN ACC/SCN 1993,1994), as well as and Frongillo, de Onis and Hanson (1997) analyzed the determinants of child malnutrition in developing countries. Osmani 1997 focused on the "South Asian Puzzle" (why are malnutrition rates higher in South Asia than in Sub-Saharan Africa, while poverty rates are similar and child mortality rates are lower?), identifying the high prevalence of low-birth-weight rates and

[16] In Mongolia, for instance, " since 1990, cereal harvests … have fallen by up to 70 percent, unemployment has increased, chronic child under-nutrition has risen to 25 percent and there is a "growing population of vulnerable, low income people who have been experiencing a dramatic fall in nutritional standards" (FAO 1997).

[17] Varying degrees of malnutrition also affect significant population groups in developed countries, most of them belonging to ethnic minorities: for instance, a recent study has shown that 5% of Hispanics and 8% of Non-Hispanic blacks regularly go hungry in the US, while lack of healthy food affects about 20% of Hispanics and Non-Hispanic blacks and 5% of Non-Hispanic whites (NCLR 2006).

women's low status as the most important explanations. Martorell 1999, Svedberg (2000, 2004) and Behrman , Alderman Hoddinott, 2006 examined the relationship between economic growth, poverty and child malnutrition.

Smith and Haddad (1999, 2000, 2001, 2002) carried out a particularly accurate research on the main causes of malnutrition in developing countries. In Smith and Haddad (1999, 2000) they applied country fixed-effects multivariate regressions on a 63 country sample sample with 1970-1995 data. The authors identified four underlying (or proximate) factors (health environment, women's education, women's relative status, and per capita food production) and two "basic" factors (per capita national income and democracy), with the latter affecting child malnutrition via their impact on the former. In Smith and Haddad 2001, 2002 they used the same conceptual framework to analyze the impact of food availabity and economic growth. They find that such impact is positive but progressively declining, and that other non-income, non-food factors are also very important.

Turning to our own statistical exercise, it consists in a cross-country analysis covering all the developing countries (i.e., those classified by the World Bank as low income, lower middle income, and upper middle income countries).[18] With one minor exception, the data used in our cross-country analysis were obtained from a single database, the World Bank World Development Indicators 2006 (WBWDI 2006). In our view, data in WBWDI 2006 present three main advantages. First, they are reliable, and updated. Second, they are homogeneus and therefore easily comparable with each other. Third, they cover all developing countries for which data are available.

Realizing the limited availability of annual data for many of the series reported in WBWDI 2006 (such as those with anthropometric indicators of malnutrition), we preferred to avoid the interpretative ambiguity that could be implied by analyzing a panel including for each country few data quite scattered over time.[19] Therefore, we preferred to conduct most of our analysis in levels, utilizing the latest values available for each indicator (most of which refer either to

[18] The methodological approach described here constitutes a development of the cross-sectional one used in Gabriele and Schettino 2006.

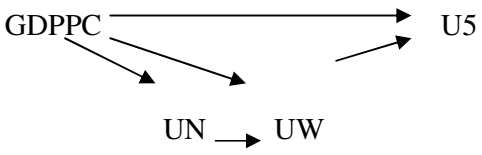
[19] This type of panel analysis has the advantage of using more information, but its results cannot properly take into account the changes occurring over time. I.e., if two data are taken for country A, one in 1992 and another in 2001, and two for country B , in 1994 and 1999, the result of the analysis will reflects underlying patterns working in both countries over the last 10-15 years, but it will not properly reflect the situation in any single year.

2004 or to the early 2000s) and applying the OLS methodology. Our results can be interpreted both as static ones (what are the factors determining malnutrition at the present time) and as the product of a very long historical process, which led over time to a different evolution of various relevant factors, and thus to different outcomes in terms of malnutrition and child mortality in different countries. Taking into account the paucity of available data, we also estimated some models in growth rates, attempts to single out a few basic factors common to all countries explaining trends in malnutrition and child mortality over the 1990s and early 2000s.

The analysis in levels was conducted in successive steps, focusing initially only on income–based factors (economic development and income distribution), and widening successively the scope to include non-income factors. Thus, we first analyzed the basic statistical interrelationship between GDP per capita in purchasing power parity terms (GDPPC) and two human development indicators, underweight(UW), and under-5 child mortality (U5). In some cases, we also included in our models the FAO's undernourishment (UN) indicator. According to the conceptual framework proposed in Diagram 1, we expect GDPPC to be a key determinant of access to food (reflected by the UN indicator). Inadequate access to food, in turn, is the most obvious cause of malnutrition, measured by the underweight (UW) indicator. Malnutrition is a primary factor influencing child mortality (U5).

GDPPC → UN → UW → U5

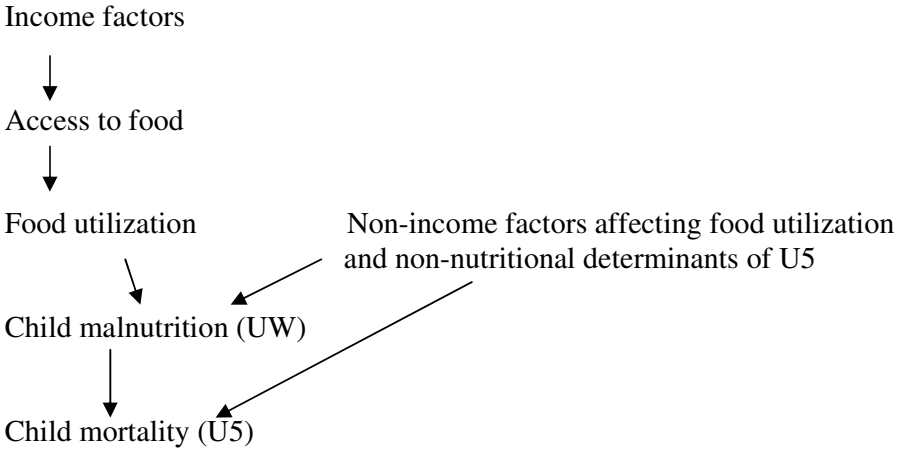
However, we also expect these causal linkages to explain only part of cross-country variability in the malnutrition and child mortality indicators[20], taking into account the role of inequalities in (primary) income distribution and of non-income (non-food???) factors, some of which are in turn partly determined by the level of income per capita. Thus, the "true" causal flow is in fact:



[20] The paucity of data and the intrinsic imperfection of some of our indicators (especially in the case of UN) must also be taken into account.

The second step consists in considering, along with GDPPC, the other factor determining people's market-based access to food: income distribution. To this purpose, we added GINI (the most recent figure for the Gini coefficient reported in the WDI database) as an additional explanatory variable.

In the third step we analyze the impact on child malnutrition and mortality (if any) of factors different from those affecting the distribution of primary incomes, and therefore different from those governing households' market-based[21] access to food and basic services[22]. They affect both food utilization (i.e., child care, sanitary conditions, and other elements governing the translation between access to food and nutritional status) and determinants other than nutrition contributing to influence the prevalence of child mortality[23] (see Diagram 1, Part 4).



Previous research has shown that the main non-income factors affecting child malnutrition and mortality are likely to be the availability of basic services and

[21] Market-based access to food can be seen as including market-based access to inputs needed for subsistence production, and is by far the most important element governing access to food in general. Overall access to food on the part of households, however, is also influenced to some extent by other factors, such as non-market access to inputs and assets needed for subsistence production and food aid programs.

[22] Undernourishment only concerns the access dimension of nutrition, and is essentially determined by the level and distribution of primary incomes analyzed above. Thus, in this third step UN is not examined along with UW and U5 as a dependent variable. Rather, it is taken in some models as a right end variable to discuss its impact on underweight and child malnutrition.

[23] Most non-income factors affect child malnutrition both indirectly (via their impact on child malnutrition and directly .

cultural factors affecting women's status (see Smith and Haddad, 1999, 2000). Taking into account data availability constraint in the WB WDI data base, we selected six indicators of basic services supply, plus one indicator of women's status. The services variables are as follows[24]: HP (the share of public health expenditure on GDP); SANIT(the percentage of the population having access to improved sanitation facilities); WATER (the percentage of the population having access to improved water sources); IMM(the percentage of children aged 12-23 months immunized against measles); BA (Percentage of births attended by skilled health staff);
PCRF (female primary school completion rate). However, many of these services variables are in turn reciprocal correlated to varying extents (more advanced countries tend to have better indicators in all areas), making it difficult to identify each other's impact and statistical significance. Therefore , we also constructed an additive variable (SERV5) – the sum of SANIT,WATER,IMM, BA, and PCRF - which represents synthetically each country's effort in providing these five basic infrastructural, health-related, and educational services.[25] The proxy for the relative status of women is the ratio between female and male life expectancy (RATIO).

A problem of collinearity arises when observing that these seven variables are all highly correlated with GDPPC (see Svedberg 2004 and table 5). This finding reflects a true stylized fact: although many differences exist from one country's experience to another one's, economic, social, and cultural development tend to move together in the long run. According to the "materialistic" approach sketched in Section1,, and without underestimating the myriad of reciprocal interactions among different factors[26], economic development is to be seen as the main underlying force, creating the material conditions needed for the development of social services and also, to some extent, favouring the evolution of gender relations towards a higher degree of equality. As we are actually interested in the above-mentioned national differences, we regressed each of the seven variables on GDPPC, and took the residuals as additional explanatory variables. The residuals can be interpreted as

[24] For all the variables, we used the latest available figure in WB WDI.
[25] We considered public expenditure on health as conceptually different from the others, because (even if it is positively correlated with the level of economic development) it is expressed as a ratio over GDP, and thus its value is not so closely dependent on the absolute level of GDPPC as in the case of the other services variables. For this reason, we did not include HP in the calculation of the additive variable along with the other five.
[26] The most relevant of these interaction is given by the opposite causation flow running from the availability of social services to growth (mainly via their impact human capital and labor productivity). Cultural factors also affect economic development.

representing each country's willingness to earmark resources towards health, education, and other services, depurated from the – often overwhelming – influence exerted by sheer economic development. As such, these new variables have two important advantages. First, they are not correlated with GDPPC, and therefore overcome the problem of collinearity[27]. Second, in the case of the first six variables, they represent true policy-related variables, because they reflect each country's government autentic (log-term) propensity to spend on each service, beyond (or less)[28] than what could be predicted only on the basis of each country's GDPPC[29]. The other component of public social expenditure, conversely, can be seen as the physiological amount which is normal among developing countries for each level of GDPPC, and does not indicate any prioritizing effort on the part of the government . In this respect, an interpretative caveat is also warranted.. A corollary of the way these models are constructed is that the coefficient of the GDPPC variable captures not only the impact on the dependent variables stemming directly from income per se, but also those of the second component of social public expenditure, i.e. the average amount of services which the typical developing country provides at each level of development. That's why, for instance, in the initial simple models where GDPPC is the only explanatory variable its coefficient is so high (see below, section results, table 6). Even with the inclusion of the residual services variables on the right side of the equation, GDPPC still captures the impact of the "normal" supply of basic services typically associated to that level of development, while the residual variables only reflect the impact of each country's own autonomous propensity to prioritize these services. Therefore, an even modest magnitude of their coefficients (as far as they are significant) would strongly underscore the relevance of relatively autonomous social policy choices quite independently from the level of economic development. On the contrary, high GDPPC coefficients must be seen as embodying also the impact of the normal expansion in supply of basic services that is, on average, attached to that level of economic development in a given moment of history (see below, section 4, Table9)..

[27] Table 5 shows that the variables are also correlated with each other, but their reciprocal correlation coefficients are much lower than those between each of them and GDPPC.

[28] As they are constructed as series of residuals, these indicators do exhibit also negative values, indicating that some countries accorded to a given service a degree of priority lower than the average of other developing countries at a comparative level of economic development.

[29] This methodological approach is aimed at addressing the issue of variable endogeneity (see Behrman and Deolalikar 1988, Simth and Haddad 1999).

Finally, we understand that many researchers have argued that political factors, and the each country's degree of democracy in particular, are also paramount, as they affect the state's propensity and ability to earmark public resources in favour of the poor (see, Smith and Haddad 1999, 2001; Mc Guire 2002; Shandra et al 2005). Smith and Haddad, in particular, have utilized a democracy index as a key underlying variable, along with economic development, which in turn affects in a virtuous way other variables ultimately determining child malnutrition. We also probed the significance of an index of democracy, DEMO. It is the Economist Intelligence Unit's Index of Democracy (see EIU 2007)* , and is thus the only one among our variables which was not taken from the WBWDI database. However, the variable DEMO (like other services and cultural variables), is itself highly correlated with GDPPC). Actually, historical experience shows that, in very general terms, long-term economic development creates conditions favourable to the emergence of democracy.[30] Thus, to try meaningfully the significance of DEMO as an explanatory variable, we depurated it from the component dependent on economic development, by regressing it on GDPPC and taking the residuals, as we did with the other explanatory variables.
A few additional methodological observations are still worth mentioning before presenting the results. As some degree of endogeneity was likely to be present among explanatory variables, we ran some trial regressions applying the instrumental variables method[31]. Results do not change significantly from those produced by Ordinary Least Squares, and they are not presented in this paper[32]. We also tested for the significance of regional fixed effects[33]. In most cases regional fixed effects were not significant, with the notable exception (in some models) of South Asia and Sub-Saharan Africa (see below, section 4).

[30] To some extent, the causation flow runs both ways, as political regimes do affect economic development. The sign of this causation is, however, controversial: the view according to which political democracy is unambiguously conducive to faster economic growth is notoriously controversial.
[31] The method of instrumental variables eliminates the estimation bias due to the correlation of a regressor with the error term...
[32] They are available upon request.
[33] World Bank 2006 classifies each developing country as belonging to one of the following six regions: East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, South Asia, Sub-Saharan Africa.

4 Results

Basic relationships between the level of economic development and social outcomes indicators

Charts 1-3 show graphically the relationship between GDPPC and UN, UW, and U5 respectively. Most points are condensed along the axis, showing that the negative correlation between income, undernourishment, and human development is very strong in very poor countries and then weakens progressively at higher levels of development.. In the regression models shown in Table 6, GDPPC is taken as the only explanatory variable , and UN, UW, and U5 as the dependent variables. The RESET test applied to the simplest model showed that the relationship between the variables conveys a high degree of non-linearity. Both polynomials including powers of GDPPC and log models exhibit high and quite similar adjusted R2 indicators. Due partly to data limitations[34] , the best fit was obtained with U5 models. Differences in economic development explain about 70% of inter-country variability in child mortality. The coefficient in the log model (which can be interpreted as a long-term elasticity) is close to 1, suggesting that a 1% increase in GDPPC leads to an almost equal reduction in U5. The correspondent models for UN and UW show that differences in economic development explain about half of inter-country variability in undernourishment and child malnutrition, and that GDPPC growth tends to bring about a slightly smaller (0.8) improvement in these indicators than in the case of child mortality.

These finding can be interpreted as follows. Economic development strongly affects access to food, child malnutrition and child mortality in developing countries. However, GDPPC's impact is highly non-linear, showing that it decreases sharply at increasing levels of economic development, and suggesting that it manifests itself also indirectly, via the action of other factors which are in turn associated to each country's income per capita. The causal relationship between GDPPC and U5 is stronger than that between GDPPC and UN and UW respectively. This is due partly

[34] Due to factors related to the frequency and difficulty of data measurement and reporting, the degree of availability, accuracy, and comparability of child mortality, malnutrition, and undernourishment indicators is uneven. Child mortality computed from censuses, is reported regularly for most countries and is the most trustworthy indicator. Underweight data are only available for some countries and their quality is lower, due to the limited size of samples and to difficulties in measurement. Undernourishment data are calculated by FAO on the basis of nationwide food balances.

to the above-mentioned data limitations[35], and partly to the fact that economic development affects child mortality not only through access to food and malnutrition, but also in other ways (among them, the provision of health and other services).

The last models in table 6 illustrate the basic the causal relations among the UN, UW, and U5. The impact of UN on UW appears to be a linear one (model 10 passes the RESET test, and does not differ much from the following model in logs), but the regression explains only about one third of inter-country variability in child malnutrition. Again, this result is due in part to data limitations and in part to the fact that malnutrition is affected not only by availability of and access to a sufficient quantity of food but also by food quality and by factors shaping food utilization (such as health and child care). Conversely, a RESET test performed on the simplest model including U5 as the dependent variable and UW as the explanatory variable (not reported in Table 6) showed that the causal relationship between malnutrition and child mortality is a non-linear one. The quadratic and log-linear models 12 and 13 show that differences in malnutrition explain about one half of inter-country differences in child mortality – a result in line with the finding of previous studies (see Smith and Haddad 1999) – and that hunger is still a major factor causing child mortality. A similar (and, in fact, statistically more robust)[36] results holds for the causal relationship between undernutrition and child mortality.

GDP per capita and primary income distribution: income factors

The second step of our analysis consists in considering, along with GDPPC, the other factor determining people's market-based [37] access to food: income distribution. To this purpose, we added GINI (the most recent figure for the Gini coefficient reported in the WDI database) to the right side of the equations. The Pearson correlation coefficient between GINI and GDPPC is only -0.06, showing that

[35] Due to factors related to the frequency and difficulty of data measurement and reporting, the degree of availability, accuracy, and comparability of child mortality, malnutrition, and undernourishment indicators is uneven. Child mortality computed from censuses, is reported regularly for most countries and is the most trustworthy indicator. Underweight data are only available for some countries and their quality is lower, due to the limited size of samples and to difficulties in measurement. Undernourishment data are calculated by FAO on the basis of nationwide food balances.

[36] The "true" causal relationship between undernourishment and child mortality passes through malnutrition, and thus the linkage between UW and U5 should be stronger than that between UN and U5. However, UN estimates in our database are more numerous and (notwithstanding their own imperfections) probably closer to the (unknown) true value than child malnutrition estimates. This explains why in our models UN turns out as more significant and robust than UW.

[37] Subsistence not statistically taken into account etc

the degree of inequality in income distribution across developing countries s not systematically correlated with their respective level of economic development (See Table 6). Therefore, including GINI on the right side of the equation along with GDPPC does not raise problems of multicollinearity. The results are reported in table 7. They show that GINI is a highly significant income-related variable (both in the non-linear[38] and in the log-linear specifications) affecting undernourishment and child mortality. GINI's coefficients in the log-linear models (which can be interpreted as elasticities) are close to those of GDPPC, which in turn are not far from 1. Conversely, the GINI variable was not significant when added to the models which included UW as the dependent variable. This result is probably due to the usual data limitations.

Non-income factors

The third step of our analysis focuses on the impact of non-income services, cultural and political variables. They are represented by the variables HP, SANIT, WATER, BA, PCRF, RATIO, and DEMO - all expressed as series of residuals obtained regressing the original variables on GDPPC - and by the additive variable SERV5. When the new variables were added on the right end side of the equations, only some of them probed significant. Moreover, their inclusion caused GINI to become no longer significant, suggesting that the distribution of primary incomes is important by itself, but its impact on malnutrition and child mortality is less relevant than that of the direct provision of basic services.

The first model a linear one, in which UW is the dependent variable and, apart from GDPPC, only HP, SANIT and BA turned out as significant (see Model 1, Table 8)[39].The coefficients of the main explanatory variable are expressed in quite different orders of magnitude, and they cannot be immediately compared with each other. However, adapting a simple procedure proposed by Smith and Haddad (1999), each coefficients can be transformed into a number indicating the (absolute) increase in the explanatory variable which would be needed for 1% reduction in the dependent variable (see table 8). Thus, for instance, the first four numbers under heading XII of

[38] Model 3 in Table 7 does not (albeit marginally) pass the RESET test, showing that a certain degree of non-linearity is still not explained by the model

[39] Besides GINI, WATER, IMM, PCRF, RATIO and DEMO had the expected sign, but their t-statistics were too low. The model, however, does not pass the RESET test, suggesting a high degree of non-linearity in the underlying causal structure.

Model 1, table 8, are 275.86, 0.25 and 4.33 respectively. They show that a 1% decrease in children undernutrition could be brought about by a 275.86 rise in per capita GDP or, alternatively, by a 0.25% increase in the percentage share of public health over GDP, or by a 4.33 growth in the percentage of women received specialized professional assistance when giving birth. The following (XIII) heading shows another euristic indicator, obtained estimating approximately which percentage of the whole developing countries' sample range variation is represented by the numbers above. Thus, the value of 1.62 for GDPPC suggests that (approximately) a1% decrease in children undernutrition requires an increase in GDPPC between 1 and 2% over the range of variation among all the countries in the sample. As explained above in section 3, in this evaluation we are implicitly factoring in the improvements in the supply of basic services that accompany GDP growth under normal circumstances. The other two numbers (4.23 and 5.03) suggest that (for a given level of GDPPC) a similar progress in reducing children malnutrition could be obtained enhancing the state's propensity to spend on either public heath or medical assistance to women giving birth , by a rather modest extent (of the order of 4-5% of the whole developing countries' variability range). Similar results are obtained in Model 9 (see below), showing (under heading XIII) that a modest improvement (less than 2%) in a country' relative position with respect to the total intercountry variability in willingness to provide improved water sources and girls' education would be similarly sufficient to obtain a 1% decrease in children mortality. These findings confirm that political determination to earmark resources towards basic public services constitutes a potent force to combat children malnutrition and mortality. It also suggests that such political determination can in principle enjoy a relevant degree of freedom with respect to the complex web of compatibilities and constraints that jointly shape growth and development strategies.

Successive adaptations led to model 2, which shows that the impact on UW of both GDP and BA is quadratic (it progressively decreases as the level of each variable increases), while that of sanitation is proportional to the square of the indicator. significant. The fit improves with respect to model 1 (Adjusted R2 reaches 0.73), and the RESET test shows most of the nonlinearity is accounted for. An alternative formulation of this non-linear model includes the additional variable SERV5 in stead of SANIT, WATER, IMM, BA, and PCRF. SERV5 - a synthetic proxy for the state's propensity to invest in basic services – turns out as being is highly significant

(model 3). Still another specification (model 5) was built adding the two regional dummies SA and SSA to model 2. Only SA was significant, showing that region-specific factors contribute to worsen child malnutrition in South Asia, and thereby confirming the persistence of the "South Asian puzzle" previously identified by other researchers (see Osmani 1997, Bhargava and Osmani 1997, ACC/SCN 1997, Navaneetham and Jose 2005).

These results show that child malnutrition is strongly affected by the level of economic development (but, as expected, less and less so with raising levels of GDP per capita) and by the availability of basic services, and that the state's propensity to spend on public health in general and to provide in particular sanitation facilities and birth attendance services is paramount. Conversely, women's status and democracy do not appear to have a significant and theory-consistent impact.[40]

We turn now to the determinants of under-5 child malnutrition. A regression specification analogous to that of Model 1 (not shown in table 3) did not pass the RESET test, suggesting again the presence of nonlinearity. The best fit was obtained with model 6, where the impact of GDPPC on U5 exhibits a high degree of non-linearity. Along with GDPPC, also WATER, PCRF, and RATIO are significant and theory-consistent. The impact of PCRF, like that of GDPPC, is non-linear, suggesting, like GDPPC, a progressively decreasing impact at higher levels of female school enrolment. The adjusted R2 is very high (0.78), suggesting that this specification captures the determinants of most of the overall inter-country variations in child mortality, without recurring to country- or region-specific fixed effects. As in the case of malnutrition, substituting the additive variable SERV5 to the five services variables also produces a well-fitting specification (model 7). Finally, as in the case of child malnutrition, an attempt was made to add to model 4 the two regional

[40] Also Wiesman et al. (2000) did not detect a strong statistical correlation between democracy and nutrition. In our view, there are two plausible explanations for this finding. First, democracy is surely a good thing by itself, but most real-world democratic systems suffer from several imperfections, especially in developing countries. The elite's monopoly on media and popular culture, along with corruption, often ensure the perpetuation of extreme inequalities and the exclusion of the majority from real decision-making, and thus do not allow to postulate a clear-cut one-way causation from democracy to effective empowerment of the poor. As a matter of fact, the correlation index between the variables DEMO and GINI in table 5 is positive (albeit low), showing that there is not a systematic tendency for income distribution to be better in democratic countries than in non-democratic ones. Second, the influence of political regimes on social and economic outcomes works in very complex and multiple ways (through its impact on economic development, income distribution, public services, schooling, and even the relative status of women), which are often indirect and very difficult to identify. Therefore, political regimes and other factors (such as historical legacy, cultural tradition, etc.) ultimately affect social and economic variables, but belong essentially to a different, deeper level of causation.

dummies SSA and SA. The result is shown in model 8. [41]As expected, SSA was very significant, showing that specific regional factors contribute to aggravate child mortality in Sub-Saharan Africa.

These results show that, apart from the strong but progressively diminishing impact of economic development per se, infant mortality is affected mainly by the access to clean water and female education, and also by women's relative status. The three non-income variables affect child mortality both indirectly (via their impact on child nutrition) and directly (via their influence on the household's sanitary environment and on the care children receive from mothers and other family members[42]).

Models in growth rates (1990-2004)

The statistical information available in the WB WDI database allows to extract or to estimate[43] two values for many (not all) of our variables, one for 1990 and one for 2004, for a limited number of developing countries. On this basis, we computed the annual growth rates for our dependent and explanatory variables and tried to identify the main statistically significant relations among them (if any). We realize that this exercise was being carried out for a rather limited sample (in fact, a subset of the large sample used in the previous models in levels), and that this and other statistical limitations do not allow even elementary theory-consistent relations among variables to be adequately captured by the data. This problem emerges clearly, for instance, from table 5, which shows the simple Pearson correlation coefficients between the rates of reduction of undernourishment (UNR), child malnutrition (UWR) and child mortality (U5R) respectively.[44] Moreover, the relative shortness of the time period considered could not have allowed to changes in many factors to be fully captured statistically, on one hand, and to produce a clearly recognizable impact on the dependent variables, on the other hand (see Svedberg 2004, pp.11-12). Taking

[41] The inclusion of SSA had the effect of making RATIO no longer significant, and of decreasing the coefficients of GDP, WATER, and PCRF. The SA dummy SA was also not significant.
[42] A high value of RATIO suggest a high relative status of women, which is likely to imply a comparatively high propensity of men to help them also in child caring. This virtuous effect is evident in the most advanced industrialized countries, but in the developing world it manifests itself mostly indirectly, as men increasingly relief women of other onerous tasks different from child care proper.
[43] Interpolating values reported for the late 1980s/early 1990s and for the early 2000s
[44] Not only all coefficients are lower than they could be expected to be (given the strong long-run causal relations running from access to food to child malnutrition and child mortality discussed above), but one of them (the one between UN and UW) is even negative, a clearly implausible result.

into account all these caveats, we expected to obtain some moderately significant results only for some of our explanatory variables.

Models 1, 2, 3 in table 9 and Charts 4, 5, 6 show the basic relationship between economic growth (GDPPCR) and the rates of reduction of undernourishment (UNR), child malnutrition (UWR) and child mortality (U5R) respectively. The causal relation appears to be linear in the case of UW (Model 2), and non-linear in those of UN and U5, confirming that – in very general terms – economic growth did contribute to improvements in terms of social outcome indicators in the 1990-2004 period. However, the adjusted R2 are very low, suggesting that the models only capture a small part of the story. [45] Adding the variable GINI only produced a significant result in the case of U5R, leading to Model 4. This model shows that inequality in income distribution did affect negatively in a statistically significant way child mortality reduction in developing countries.. Model 3 and Chart 6 also show that the best results in terms of reduction in child mortality were achieved by countries with moderate rates of economic growth, while those with very low or negative growth fared poorly. However, the (few) countries with particularly high growth rates did not obtain exceptionally good results in terms of child mortality reduction either, suggesting that a trade off might arise between economic and social goals in countries that single-mindedly push growth too far[46].

The attempt to add other explanatory variables on the hand side of the equations did not lead to significant results in most cases. The best fitting equations for UWR and U5R[47] are those presented in models 5 and 6 in table 4. Model 5 shows that reductions in child malnutrition were positively affected by economic growth and by the extension of access to sanitary facilities (expressed by the variable SANITR, the rate of growth of SANIT). It also shows that progress in combating malnutrition was slower than average in countries were its level is high (UW has a negative sign).

[45] The absolute value of the explanatory variable's coefficients of the models in growth rates (which can be interpreted as short-term elasticities) are much lower than those of the log-linear models in level (which can be interpreted as long term elasticities).
[46] An example in point is offered by China (see Gabriele and Schettino 2006).
[47] Reductions in UN can logically be expected to be affected only by changes in GDPPC and GINI, not in the variables representing non-income factors.

In other words, the poorest countries with a low level of human development are falling increasingly behind.[48]

When attempting to explore the non-income factors affecting the rate of reduction of child mortality, we found that no one of the rates of growths of the indicators relative to the services variables was significant if taken alone. Conversely, an additive variable formed as the sum of the growth rates in SANIT, WATER, IMM, and PCRF[49] (SERV4R) was significant[50]. Model 6 shows that reductions in child mortality over the 1990-2004 period were positively affected by economic growth (in a very non-linear fashion) and by the expansion of basic services[51].

Contrary to the results of the previous model, RATIO's sign is positive, suggesting that countries that were already more advanced in terms of relative women's status achieved more progress in child mortality reduction.

Finally, we included U5 (the level of child mortality in 2004) into the equation. The result is to make GDPPCR not significant, while U5 is significant and negative (Model 6). This finding shows that countries with a high level of child mortality (most of which are in Sub-Saharan Africa)[52] are falling further and further behind, for reasons depending only in part on lack of economic growth.

5. Concluding remarks

Each countries' overall level of economic development constrains the amount of resources potentially available for combating hunger and destitution. Inequalities in income distribution further restrict income-based access to marketed food supplies on the part of the poor. The importance of public policies - which affect non income-based access to and utilization of food on the part of households, as well as non-

[48]The variable RATIO has a negative sign too. This puzzling result suggests that progress was faster in countries were the relative status of women is bad. However, of course, it should not be interpreted as a hint that women's status is bad for child malnutrition, as RATIO enters the equation as a variable in level, not in growth rates term. Our database does not allow to measure changes in the RATIO variable over the 1990-2004 period.

[49] Lack of data did allow to calculate the rate of growth in BA over the 1990-2004 period.

[50] An attempt to include SERV4RATE in model 5 showed that it was not significant in explaining the rate of reduction in child malnutrition.

[51] The coefficient of SERV4R (which can be interpreted as an elasticity) is very low. Besides the usual data availability limitations, this result is probably due to the fact that the full impact of the expansion of basic services on child mortality can only be appreciated after a rather long period of time: the inclusion of SERV4RATE and RATIO2004 renders GINI is no longer significant.

[52] Introducing the dummy SSA instead of U5 in the model leads to similar results (results not shown in Table 4).

nutrition-related factors affecting child mortality – cannot be overstated. Other cultural and environmental factors also play a role.

We carried out a cross-country analysis utilizing a homogeneous database extracted from the World Bank World Development Indicators 2006. Our main findings are as follows. When child malnutrition and mortality indicators are regressed only on GDP per capita indicators, the results show a strong but very non-linear causal relation. Such non-linearity suggests not only that the impact of economic development on human development decreases at higher levels of GDP per capita, but also that this impact manifests itself also indirectly, via the action of other factors which are in turn associated to each country's level of income per capita. Inequalities in income distribution are also a very important determinant of household's market-based access to food and basic services.

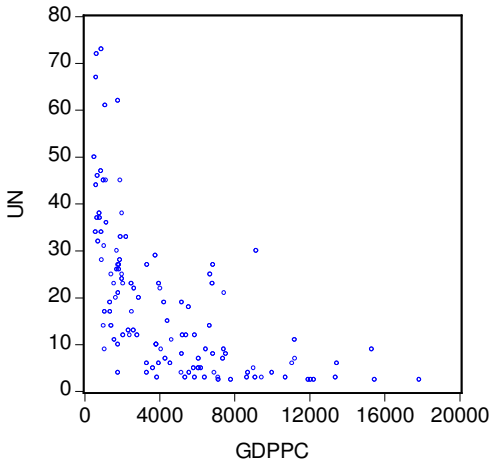
As the degree of public provision of basic services is positively correlated with per capita GDP, we regressed series of indicators for five of them on GDP per capita, and took the residuals as our main explanatory variables for policy-related non-income factors affecting human development. These variables, in fact, can be interpreted as each country's propensity to spend on basic services. The results showed that child malnutrition and mortality are strongly affected by the availability of basic services. The state's propensity to spend on public health in general and to provide in sanitation facilities and birth attendance services are the most significant non-income determinants of child malnutrition, while the propensity to spend on clean water provision and women's education are more relevant in the case of child mortality. Women's status is also a significant determinant of child mortality, while democracy is not. Other results showed that the impact of both GDP per capita and services is higher in the case of child mortality than in that of child malnutrition, and suggested the existence of region-specific factors which exacerbate child malnutrition in South Asia and child mortality in Sub-Saharan Africa respectively.

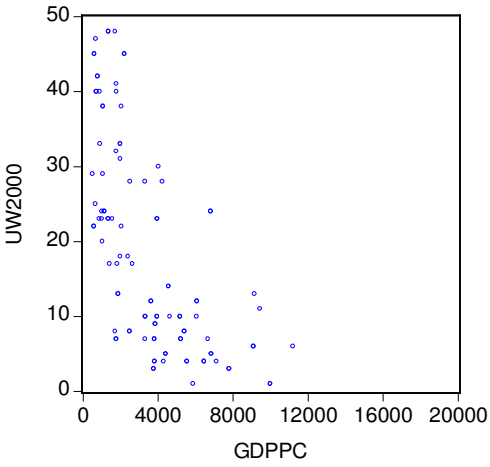
Due to limitations in data availability, models in growth rates produced only partly satisfactory statistical results. Economic growth was a major force driving human development in the 1990-2004 period, and the best results in terms of reduction in child mortality were achieved by countries with moderately high rates of economic growth. However, countries with particularly high growth rates did not obtain exceptionally good results. This finding suggests that a trade off might arise between economic and social goals in countries that push growth too far. Expansion of basic

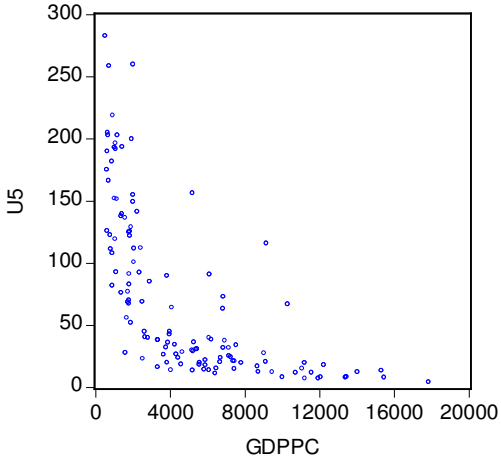
services provision also enhanced improvements in the two human development indicators. Inequalities in income distribution and the relative status of women affected changes in child mortality in opposite directions. Due to factors only partly captured by our models, most developing countries at very low human development levels (many of them African) are falling further behind.

Charts and Tables

Charts 1-3 Income, undernourishment, child malnutrition, and child mortality







Charts 4-6: Growth rates of GDPPC and rates of reduction of undernourishment, child malnutrition , and child mortality, 1990-2004,

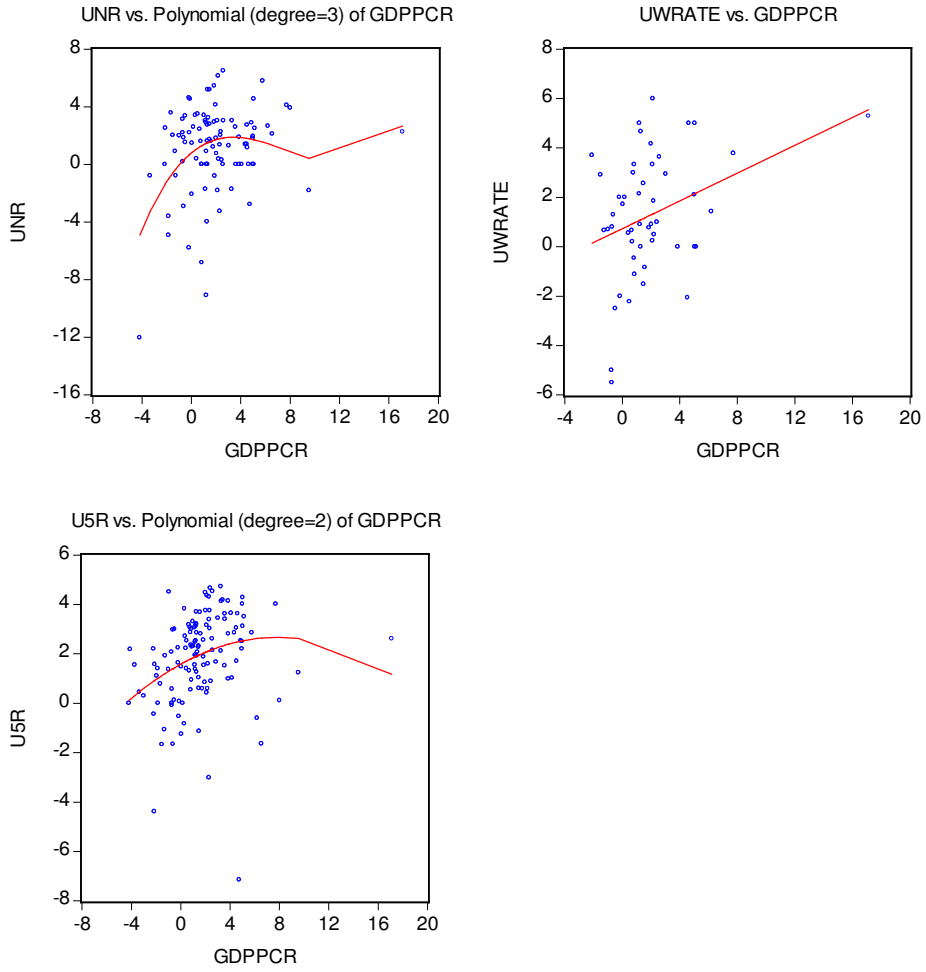


Table 5 Correlations among explanatory variables

	GDPPC	GINI	DEMO	HP	SANIT	WATER	IMM	PCRF	RATIO
GDPPC	1.00	-0.06	0.41	0.56	0.70	0.60	0.50	0.58	0.45
GINI	-0.06	1.00	0.13	0.06	-0.17	-0.01	-0.29	-0.10	-0.34
DEMO	0.41	0.13	1.00	0.34	0.23	0.29	0.28	0.41	0.24
HP	0.56	0.06	0.34	1.00	0.27	0.30	0.21	0.41	0.15
SANIT	0.70	-0.17	0.23	0.27	1.00	0.73	0.54	0.67	0.42
WATER	0.60	-0.01	0.29	0.30	0.73	1.00	0.54	0.65	0.31
IMM	0.50	-0.29	0.28	0.21	0.54	0.54	1.00	0.45	0.41
PCRF	0.58	-0.10	0.41	0.41	0.67	0.65	0.45	1.00	0.43
RATIO	0.45	-0.34	0.24	0.15	0.42	0.31	0.41	0.43	1.00

Table 6 The impact of income and the reciprocal interrelationships among undernourishment, child malnutrition, and child mortality

Model	No.Obs	Dep.Var.	Explanatory var.	Coeff.	Std.err.	T-stat.	Signif	Adj.R2	F-Stat	White C. (needed)	Reset T. (passes)
1	121	**UN**	**GDPPC**	-0.003	0.000	-7.761	***	0.360	68.460	y	N
			C	30.660	2.272	13.494	***				
2	121	**UN**	**GDPPC**	-0.023	0.004	-5.504	***	0.560	38.520	y	y
			GDPPC2	0.000	0.000	4.191	***				
			GDPPC3	0.000	0.000	-3.617	***				
			GDPPC4	0.000	0.000	3.296	***				
			C	56.090	5.447	10.298	***				
3	121	**LOGUN**	**LOGGDPPC**	-0.809	0.056	-14.480	***	0.580	166.480	n	y
			C	9.070	0.439	20.667	***				
4	73	**UW**	**GDPPC**	-0.003	0.000	-7.126	***	0.410	50.770	no	No
			C	31.310	2.027	15.443	***				
5	73	**UW**	**GDPPC**	-0.008	0.001	-5.460	***	0.480	34.790	y	y
			GDPPC2	0.000	0.000	3.374	***				
			C	38.633	2.776	13.411	***				
6	73	**LOGUW**	**LOGGDPPC**	-0.784	0.094	-8.375		0.490	69.400	y	y
			C	8.819	0.701	12.572					

7	126	**U5**	**GDPPC**	**-0.011**	0.001	-9.825	***	**0.430**	**96.530**	**Y**	**No**
			C	**128.824**	8.589	17.850	***				
8	126	**U5**	**GDPPC**	**-0.101**	0.014	-7.162	***	**0.680**	**62.210**	**no**	**Y**
			GDPPC2	0.000	0.000	4.869	***				
			GDPPC3	0.000	0.000	-3.811	***				
			GDPPC4	0.000	0.000	3.174	***				
			C	242.909	15.501	15.670	***				
9	126	**LOGU5**	**LOGGDPPC**	**-0.954**	0.053	-17.914	***	**0.720**	**320.900**	no	Y
			C	11.586	0.436	26.604	***				
10	79	**UW**	**UN**	0.498	0.065	5.971	***	0.320	35.650	y	y
			C	9.100	1.744	4.262	***				
11	**79**	**LOGUW**	**LOGUN**	0.625	0.092	6.803	***	0.360	42.760	no	y
			C	0.946	0.287	3.299	***				
12	**79**	**U5**	**UW**	9.208	1.607	5.729	***	0.440	30.190	y	y
			UW2	-0.134	0.034	-3.972	***				
			C	-13.799	10.230	-1.349	ns				
13	**79**	**U5**	**LOGUW**	0.739	0.069	10.745	***	0.510	81.110	y	y
			C	2.179	0.180	12.121	***				

14	**135**	**U5**	**UN**	5.297	0.795	6.666	***	0.470	60.030	y	y
			UN2	-0.045	0.014	-3.115	***				
			C	4.572	6.053	0.755	ns				
15	**135**	**LOGU5**	**LOGUN**	0.771	0.771	14.437	***	0.520	148.560	y	y
			C	1.938	1.938	12.877	***				

Table 7 – Income Factors

	No.Obs	Dep.Var.	Explanatory var.	Coeff.	Std.err.	T-stat.	Signif	Adj.R^2	F-Stat	White C.	Reset T.
1	**96**	**UN**	**GDPPC**	-0.019	0.004	-4.250	***	0.53	22.7	N	Y
			GDPPC2	0.000	0.000	3.253	***				
			GDPPC3	0.000	0.000	-2.881	***				
			GDPPC4	0.000	0.000	2.717	***				
			GINI	0.203	0.087	2.324	***				
			C	40.051	7.356	5.445	***				
2	**96**	**LOGUN**	**LOGGDPPC**	-0.771	0.064	-12.031	***	0.59	69.32	N	Y
			LOGGINI	0.744	0.256	2.908	***				
			C	5.983	1.223	4.892	***				
3	**97**	**U5**	**GDPPC**	-0.094	0.013	-7.108	***	0.76	56.77	n	n
			GDPPC2	0.000	0.000	5.076	***				
			GDPPC3	0.000	0.000	-4.184	***				
			GDPPC4	0.000	0.000	3.725	***				
			GINI	1.260	0.377	3.347	***				
			C	180.551	23.063	7.829	***				
4	**97**	**LOGU5**	**LOGGDPPC**	-0.956	0.051	-18.937	***	0.76	151.88	y	y
			LOGGINI	0.883	0.283	3.117	***				
			C	8.317	1.251	6.646	***				

Table 8 – Non-income factors

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
	No.Obs	**Dep.Var.**	**Explanatory var.**	**Coeff.**	**Std.err.**	**T-stat.**	**Signif**	**Adj.R2**	**F-Stat**	**White C.**	**Reset T.**	**Incr. Exp.**	**% of developing countries sample range**
1	71	**UW**	**GDPPC**	-0.00363	0.000387	-9.37817	***	0.65	33.09	no	no	275.86	1.62
			SANIT	-0.26473	0.067886	-3.89957	***					3.85	4.75
			HP	-3.93932	2.1519	-1.83063	*					0.25	4.23
			BA	-0.23103	0.0519	-4.45144	***					4.33	5.03
			C	31.67467	1.609565	19.67902	***						
2	71	**UW**	**GDPPC**	-7.03E-03	1.21E-03	-5.81338	***	0.68	31.33	no	y	142.17	
			GDPPC2	3.64E-07	1.23E-07	2.95576	***						
			SANIT	-0.25555	0.064301	-3.97423	***					3.91	
			HP	-4.08763	2.036501	-2.00718	**					0.24	
			BA	-0.21663	0.049343	-4.39038	***					4.62	
			C	36.76342	2.298459	15.99481	***						
3	71	**UW**	**GDPPC**	-0.00701	0.001333	-5.25679	***	0.69	34.24	no	y		
			GDPPC2	3.19E-07	1.35E-07	2.36534	***						
			HP	-2.47142	0.935902	-2.64068	***					0.40	
			SERV5	-0.09302	0.018047	-5.15435	***					10.75	
			C	36.83855	2.501623	14.72586	***						
4	71	**UW**	**GDPPC**	-0.00747	0.000969	-7.71395	***	0.76	44.98	n	y		
			GDPPC2	4.17E-07	8.51E-08	4.898657	***						

			SANIT	-0.23262	0.050507	-4.60571	**					
			BA	-0.14039	0.060654	-2.3146	***					
			SA	16.5166	3.217487	5.133385	***					
			C	35.98488	2.08973	17.21986	***					
5	97	**U5**	**GDPPC**	-0.07034	0.014749	-4.76941	***	0.78	44.7	Y	Y	14.22	0.08
			GDPPC2	1.21E-05	3.94E-06	3.079143	***						
			GDPPC3	-9.53E-10	3.79E-10	-2.51729	***						
			GDPPC4	2.68E-14	1.19E-14	2.259043	***						
			WATER	-0.59084	0.292045	-2.02312	**					1.69	1.51
			PCRF	-0.84544	0.195783	-4.31824	***					1.18	1.85
			PCRF2	0.018372	0.007505	2.447815	***						
			RATIO	-261.722	112.9523	-2.3171	***					0.004	
			C	190.3639	16.14286	11.79245	***						
6	94	**U5**	**GDPPC**	-0.08124	0.01619	-5.01772	***	0.77	51.43	Y	Y	12.31	
			GDPPC2	1.38E-05	4.09E-06	3.378381	***						
			GDPPC3	-1.05E-09	3.81E-10	-2.77123	***						
			GDPPC4	2.89E-14	1.17E-14	2.472505	***						
			SERV5	-0.34079	0.064315	-5.29879	***					2.93	
			RATIO	-221.589	120.0269	-1.84616	*					0.005	
			C	215.0751	18.58426	11.57297	***						
7	100	**U5**	**GDPPC**	-0.01933	0.002694	-7.17497	***	0.84	103.42	y	y	51.73	
			GDPPC2	8.74E-07	1.53E-07	5.721482	***						
			WATER	-0.43894	0.231729	-1.89418	*						
			PCRF	-0.73478	0.174712	-4.20564	***						
			SSA	55.57121	7.877148	7.054738	***						
			C	113.9966	9.560407	11.92382	***						

Table 9 **Models in growth rates**

No.Obs	Dep.Var.	Explanatory var.	Coeff.	Std.err.	T-stat.	Signif	Adj.R2	F-Stat	needed White C.	passes Reset T.
98	**UNR**	**GDPPCR**	0,71	0,19	3,77	***	0,11	4,86	N	no *
		GDPPCR2	-0,13	0,05	-2,72	***				
		GDPPCR3	0,01	0,00	2,23	***				
		C	0,79	0,38	2,23	***				
50	**UWR**	**GDPPCR**	0,28	0,11	2,53	***	0,1	6,37	N	y
		C	0,73	0,40	1,84	*				
126	**U5R**	**GDPPCR**	0,28	0,08	3,34	***	0,07	5,65	N	y
		GDPPCR2	-0,02	0,01	-2,15	***				
		C	1,58	0,19	8,47	***				
98	**U5R**	**GDPPCR**	0,15	0,07	2,19	***	0,09	5,71	N	y
		GINI	-0,05	0,02	-2,60	***				
		C	3,69	0,81	4,55	***				
44	**UWR**	**GDPPCR**	0,28	0,10	2,67	***	0,27	4,83	N	y
		SANITR	0,13	0,07	1,86	*				
		UW	-0,07	0,03	-2,66	***				
		RATIO	-20,29	8,66	-2,34	***				
		C	22,92	9,30	2,46	***				
36	**U5R**	**GDPPCR**	1,29	0,40	3,18	***	0,37	5,22	N	y
		GDPPCR2	-0,28	0,09	-2,98	***				
		GDPPCR3	0,01	0,00	2,85	***				
		SERV4R	0,07	0,02	2,68	***				
		RATIO	38,04	9,49	4,01	***				
		C	-40,05	10,15	-3,95	***				
37	**U5R**	**SERV4R**	0,05	0,02	2,55	0,0157	0,36	7,64	N	y
		RATIO	20,85	8,66	2,41	0,0218				
		U5	-0,02	0,01	-4,15	0,0002				
		C	-19,40	9,29	-2,09	0,0446				

References

1. Abdulai A. and Crole Rees A., , 2001, Determinants of income diversification amongst rural households in Southern Mali, Food Policy 26(4).
2. Ames B., Brown W., Devarajan S., Izquierdo A., 2001, Macroeconomic policy and poverty reduction, IMF-WB.
3. AmeriCares, 2006, "Easing the Effects of Malnutrition in Mongolia", in http://www.americares.org/site/c.ivIYIjN3JyE/b.2247273/k.5BDC
4. Amigo H, Diaz L, Pino P, Vera G., 1994, Evolution of child undernutrition in Chile and some of its conditioning factors: a time series analysis, Archivos Americanos de Nutricion 1994 Jun;44(2):87-91.
5. Anand, S., and Ravallion M., 1993, "Human Development in Poor Countries: On the Role of Private Incomes and Public Services." Journal of Economic Perspectives. Vol. 7, No. 1, pp. 133-150.
6. Anderson 1997, The Russian Mortality Crisis: Causes, Policy Responses, Lessons, International Union for the Scientific Study of Population, Policy and Research Paper N°11, in http://www.iussp.org/Publications_on_site/PRP/prp11.php
7. Aromolaran A.B., 2004, Household income, women's income share and food calorie intake in South Western Nigeria, Food Policy 29(5).
8. Atal Y., 1999 (ed.), Poverty in Transition and Transition in Poverty- Recent developments in Hungary, Bulgaria, Romania, Georgia, Russia, Mongolia, UNESCO.
9. Balk D., Storeygard A., , Levy M., Askell J.,, Sharma M., and Flo R., 2005, Child hunger in the developing world: An analysis of environmental and social correlates, Food Policy, 30(5-6).
10. Baulch B., 2001, Food Marketing, in Devereux S. and Maxwell S., (eds.)2001.
11. Baulch B. and Masset E., 2003, Do Monetary and Non-Monetary Indicators Tell the Same Story About Chronic Poverty? A Study on Vietnam in the 1990s, World Development 31(3).
12. Behrman, Jere R., and Anil B. Deolalikar, 1988, "Health and Nutrition." In Handbook of Development Economics, Vol. 3, ed. H. Chenery and T. N. Srinivasan. Amsterdam: North-Holland.
13. Bhargava A. and Osmani S. R., 1997, "Health and Nutrition in Emerging Asia", (mimeo) Asian Development Bank; Manila.
14. Chen L., 2001, "In Pursuit of Health Equity: The Kerala-Global Connections." T.N. Krishnan Memorial Lecture at the Achutha Menon Centre for Health Sciences, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram, Kerala, India, January 28, 2001.
15. Cheriyan G., 2006, Enforcing the Right to Food in India: Bottlenecks in Delivering the Expected Outcome UNU-WIDER Research Paper No. 2006/132
16. Coggiola O., 2007, Programas sociais focados no Brasil – Uma abordagem critica, Sao Paulo (BR), mimeo.
17. Datt G. and Ravallion M, 1992, -"Growth and Redistribution Components of Changes in Poverty: A Decomposition with Application to Brazil and India" (with G. Datt), Journal of Development Economics, Vol.38, April.
18. Deaton A. and Dreze J., 2002, Poverty and Inequality in India – A Re-Examination, Economic and Political Weekly, September 7.
19. Devereux S. and Maxwell S. (eds.), 2001, Food Security in Sub-Saharan Africa, ,IDS, London.
20. Dreze J. and Sen A., 1989, Hunger and Public Action, Oxford, Clarendon Press
21. Economist Intelligence Unit democracy index 2007 (EIU 2007), in www.economist.com/media/pdf/DEMOCRACY_INDEX_2007_v3.pdf;
22. FAO 1997, Dramatic fall in nutritional standards in Mongolia: chronic undernutrition in children on the rise, Global Watch, November 7, in http://www.fao.org/NEWS/GLOBAL/GW9720-e.htm
23. FAO 2003a, Cuba- Nutrition Country Profile, in http://www.fao.org/ag/agn/nutrition/cub-e.stm
24. FAO 2003b Perfiles nutricionales por pais: Cuba , Agosto, in www.fao.org/ag/agn/nutrition/cub-e.stm
25. FAO 2004, The State of Food Insecurity in the world, Rome
26. Ford Runge C., Senauer B., Pardey P.G., Rosegrant M.W., 2003, Ending Hunger in our Lifetime – Food Security and Globalization, The John Hopkins University press, Baltimore and London.
27. Fox J., 1991, "Regression Diagnostics: An Introduction" Sage Publications Inc.
28. Frongillo EA, de Onis M, Hanson KMP., 1997, Socioeconomic and demographic factors are associated with worldwide patterns of stunting and wasting. Journal of Nutrition 127:2302-2309.
29. Gabriele A. and Schettino F., 2006, Child Mortality in China and Vietnam in a comparative perspective (mimeo), Rome.
30. Gentilini U. and Webb P., 2006, "How are we doing on poverty and hunger reduction? A new measure of country-level progress". Tufts University, Food Policy and Applied Nutrition Working Paper No.31. Boston: Madison.
31. Hulme D., 2003, Chronic Poverty and Development Policy: An Introduction, World Development 31(3).
32. Hulme D. and Shepherd A., 2003, Conceptualizing Chronic Poverty, World Development 31(3).
33. Hope For The Nations Romania (HFTN), 2006, Malnutrition rife among Romanian children, in http://www.itv.com/news/romania_133d4107570e45787e7b115268328d99.html
34. Istituto di Studi di Analisi Economica (ISAE), 2004, Report-Public Finance and Redistruibution, Rome.

35. Kakwani N., 1993, Poverty and economic growth with Application to Cote D'Ivoire, Review of Income and Wealth, Vo. 39, June.
36. Khan Q. and Chase S., 2003, Yemen and the Millennium Development Goals, World Bank MENA Working Paper Series no.31.
37. Larson D.W., Eugene Jone E., Pannu R. S and Sheokand R. S., 2004, Instability in Indian agriculture - A challenge to the Green Revolution technology, Food Policy 29(3).
38. Lokshin M. and Yemtsov R 2005, Has Rural Infrastructure Rehabilitation in Georgia Helped the Poor?, The World Bank Economic Review 19(2).
39. Marmot M., 2005, Social determinants of health inequalities. The Lancet, Volume 365, Issue 9464,
40. Martorell R.,1999, "The Nature of Child Malnutrition and its Long-Term Implications", Food and Nutrition Bulletin 20: 288-292.
41. Maxwell S., 2001, "The Evolution of Thinking about Food Security", in Devereux S. and Maxwell S. (eds.), 2001.
42. McErlean S.and Wu Z., 2003, Regional agricultural labour productivity convergence in China, Food Policy 28(3)
43. McGuire J., 2002, Democracy, Social Provisioning, and Child Mortality in Developing Countries Interuniversity Seminar Series on Comparative Development, in www.watsoninstitute.org/events_detail.cfm?id
44. Moorehead S. and Wolmer W., 2001, Food Security and the Environment, in Devereux S. and Maxwell S.(eds.) 2001.
45. National Council of La Raza (NCLR), 2006, Sin Provecho: Latinos and Food Insecurity: An examination of the effectiveness of federal food assistance programs in allaying hunger and food insecurity in the Latino community, in www.nclr.org/content/news/detail/43370.
46. Navaneetham K. and Sunny Jose S., 2005, "Poverty, Malnutrition and Mortality in South Asia: A Review of Issues and Options", CICRED Seminar on Mortality as Both a Determinant and a Consequence of Poverty and Hunger, Thiruvananthapuram, India, February 23-25, 2005,
47. Osmani, S. R., 1997, "Poverty and Nutrition in South Asia." Text of the Abraham
48. Horwitz lecture. Chapter 3 in Nutrition and Poverty. Papers from the UN
49. 104 ACC/SCN 24th Session Symposium, Kathmandu. Nutrition Policy Paper #16, pp.
50. 23-51.
51. Paxson C. and Schady R. 2005, Child Health and Economic Crisis in Peru, World Bank Economic Review 19(2).
52. Pelletier DL, Frongillo E.A., 2003, Changes in child survival are strongly associated with changes in malnutrition in developing countries. Journal of Nutrition 133:107-119.
53. Pinkney T., 1993, "Is market liberalization compatible with food security? Storage, trade and price policies for maize in Southern Africa", Food Policy no.18(4).
54. Pritchett, Lant, and Lawrence H. Summers (1996), "Wealthier is Healthier." Journal of Human Resources. Vol. 31, No. 4, pp. 841-868.
55. Ravallion M., 1997, "Can High-Inequality Developing Countries Escape Absolute Poverty?", Economics Letters, Vol.56.
56. Ravallion M., 2001, Looking Beyond Averages in the trade and Poverty Debate, World Bank Policy Research Working Paper 3461, World Bank, Washington DC
57. Ravallion M., 2004, "China's (uneven) progress against poverty", Policy Research Working Paper WPS3408 World Bank.
58. Ravallion , M., 2005a, "Inequality is bad for the poor" Policy Research Working Paper , World Bank WPS3677.
59. Ravallion , M., 2005b, "A Poverty-Inequality Trade-Off?" Journal of Economic Inequality, Vol. 3(2), August.
60. Ravallion M., and Subbarao K. 1992, "Adjustment and Human Development in India", Journal of the Indian School of Political Economy, Vol.6, Jan-March.
61. Sen A.,1981, Poverty and Famines: An Essay on Entitlement and Deprivation, Oxford Press
62. Shandra J.M., Nobles J. E., London B. and Williamson J.B., 2005, Multinational Corporations, Democracy and Child Mortality: A Quantitative, Cross-National Analysis of Developing Countries, Social Indicators Research, Vol.73, No.2.
63. Smith L.C. and Haddad L., 1999, Explaining Child malnutrition in developing countries: A cross-country analysis, FNCD Discussion paper No.6, IFPRI, Washington D.C.
64. Smith L.C. and Haddad L., 2000, .Overcoming Child Malnutrition in Developing Countries: Past Achievements and Future Choices, Food, Agriculture and the Environment discussion paper 30, IFPRI, Washington D.C.
65. Smith, L. and Haddad, L. 2001, "How important is improving food availability for reducing child malnutrition in developing countries?," Agricultural Economics, Elsevier, vol. 26(3), pages 191-204, December.
66. Smith, L. and Haddad, L., 2002, 'How potent is economic growth in reducing undernutrition? What are the pathways of influence? New cross-country evidence', Economic Development and Cultural Change 51(1): 55-76
67. Svedberg, P., 2000, Poverty and Undernutrition: Theory, Measurement, and Policy,
68. Oxford: Oxford University Press.

69. Svedberg, P., 2004, “Has the Relationship between Undernutrition and Income Changed?”, comment on R Behrman J., Alderman H., and Hoddinott J.: “Hunger and malnutrition”, Copenaghen consensus opponents note May .
70. UN ACC/SCN (United Nations, Administrative Committee on Coordination/
71. Subcommittee on Nutrition) (1993). Second Report on the World Nutrition
72. Situation. Volume II. Geneva.
73. UN ACC/SCN (United Nations, Administrative Committee on Coordination/
74. Subcommittee on Nutrition) (1994). Update on the Nutrition Situation, 1994.
75. Geneva.
76. UN Millennium Project - Task force on Hunger, 2005 (UN 2005), Halving hunger: it can be done
77. UNDP India Report 2006 (UNDP 2006), in http://www.undp.org.in/
78. UNDP Kerala 2005, Kerala Human Developmentr Report 2005 in
79. http://www.undp.org.in/hdrc/shdr/kerala/default.htm)
80. Webb, P., Thorne-Lyman, A., 2006,: Entitlement Failure from a Food Quality Perspective: The Life and Death Role of Vitamins and Minerals in Humanitarian Crises UNU-WIDER Research Paper No. 2006/140.
81. Wiesmann D., Von Braun J., and Feldbrugge T., 2000, An International Nutrition Index as Comprehensive Tool for Countries’ Nutrition Situation, Montreux
82. World Bank World Development Indicators 2006 (WB WDI 2006), Washington, D.C.
83. World Food Program (WFP) 2007, Food Insecurity Surveys (misc.), Rome, mimeo
84. Zhou Z. and Wan G., 2006, : The Public Distribution Systems of Foodgrains and Implications for Food Security: A Comparison of the Experiences of India and China UNU-WIDER Research Paper No. 2006/98.