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Beyond 2015:
Assessing the Economic Sustainability of the Millennium Development Goal to Halve Poverty

Yaniv Stopnitzky

Development Studies Institute

London School of Economics and Political Science

Houghton Street   **Tel: +44 (020) 7955 7425/6252**

London   **Fax: +44 (020) 7955-6844**

WC2A 2AE UK   **Email: d.daley@lse.ac.uk**

Yaniv Stopnitzky

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Abbreviations

CO_2	Carbon Dioxide
ECA	Eastern Europe and Central Asia
GS	Genuine Savings
GDP	Gross Domestic Product
GNI	Gross National Income
GNP	Gross National Product
MDG	Millennium Development Goals
MENA	Middle East and North Africa
OECD	Organization for Economic Cooperation and Development
PPP	Purchasing Power Parity Exchange Rates
SD	Sustainable Development
SS	Strong Sustainability
UN	United Nations
WDR	World Development Report
WDI	World Development Indicators
WS	Weak Sustainability

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1 Introduction

The United Nations Millennium Summit in 2000 culminated in the unanimous commitment by the member states of the UN to accelerated betterment of global human development by 2015. This agenda was subsequently operationalised through the Millennium Development Goals (MDGs), a set of eight specific human development goals with accompanying sub-targets.[1]

Amongst these ambitious objectives the goal that assumes primacy is the halving of global poverty between 1990 and 2015. This MDG represents an international commitment to reduce the incidence of those living on less than $1 per day from approximately 30 percent to 15 percent of the developing world population. In light of anticipated population growth, the attainment of this goal would entail the abrogation of extreme poverty for an estimated 1 billion people. This paper is focused primarily on assessing the extent to which progress toward this goal can be considered sustainable.

The manner by which such an amelioration of poverty can be achieved is unclear. Economic growth will play a crucial but perhaps insufficient role. The likelihood that growth alone will result in adequate poverty reduction seems especially unlikely in regions such as sub-Saharan Africa, where growth has been slow, non-existent or negative in recent years. In other regions, historical and/or projected growth trends

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[1] www.developmentgoals.org

suggest the possibility but not the inevitability that the target will be met. Only the East Asia and Pacific region appears likely to surpass its target, largely driven by China's outstanding economic growth over much of the 1990s. Indeed, this region may have already halved regional poverty over the last decade alone. Such assessments depend, however, on the precise definition of poverty used, the relative optimism or pessimism of projected growth rates, and the accuracy of measurements of within-country distributions of income or consumption. These factors combine to create a somewhat murky picture of global poverty trends, rendering the assessment of progress toward the MDG more difficult.

This paper begins with a detailed examination of the issues related to poverty and economic growth in order to outline the general economic growth requirements for achieving the poverty target. The clear relationship between poverty reduction and economic growth will be established, so as to be able to focus attention upon economic growth per se and its crucial role in poverty reduction rather than on other mechanisms for reducing poverty. We will see that, though the available evidence indicates a positive and consistent relationship between economic growth and poverty reduction, the elasticity of poverty reduction with respect to growth varies across regions, and likely across individual countries as well. These differing elasticities become crucial in considering the economic growth necessary to achieve the MDG and may be one principal reason why prior evaluations of progress in this arena demonstrate such inconsistencies of results. The added accuracy afforded by an empirical approach to regional elasticities of poverty with respect to growth, as constructed by Besley and Burgess (2003), will be applied in order to obtain estimates of the regional growth rates necessary to achieve the MDG. This will permit the comparison of the economic growth needed with historical and recent averages, resulting in more accurate and reliable estimates regarding the probability of various world regions meeting their poverty targets by 2015.

Another MDG calls for countries to ensure environmental sustainability by incorporating principles of sustainable development into their poverty alleviation policies and programmes. The pursuit of this second MDG is a further theme of this discussion. In the next section, it will be shown why it should not be accepted as automatically given that these environmental goals overlap with the goals of economic growth. In many countries a heavy reliance on exhaustible resources and/or other forms of environmental degradation and pollution may be allowing short-term economic gains at the possible expense of long-term future growth. If this is indeed the case, then the realities of modest growth rates compounded by degradation may provide additional grounds for pessimism with respect to the successful halving of poverty. Further, these trends may indicate in many countries the inability to sustain growth in the future, raising the spectre of increasing poverty levels in these countries at some future point.

The relationship between the dual objectives of poverty reduction and environmental sustainability will be examined by using a theoretically justified indicator of sustainability, namely genuine savings.[2] This measure builds on standard national accounting practice by incorporating depreciation of capital assets, thereby offering a more nuanced picture of increases or decreases in total productive capital assets. Negative rates of genuine saving will be shown to imply future declines in welfare, providing the theoretical basis for its use as an indicator of sustainability. Genuine savings will serve to orient this paper's analysis of the economic sustainability of the MDG on poverty reduction.

The subsequent section will present findings on genuine savings (GS) rates in 126 countries for the period 1995 to 2001. The data set constructed and utilized in this

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[2] The World Bank has shifted away recently from the term 'genuine savings' in favour of 'adjusted net savings'. Other researchers make the case that because the term 'savings' usually refers in national accounting practice to private savings, 'genuine investment' is a more accurate term that may avoid unnecessary ambiguity (see e.g. Dasgupta (2001) and Neumayer (2003)). These semantic differences do not change, however, the underlying concept, and all refer to the same theory and measurement. This paper will use 'genuine savings', which remains the predominant term found in the literature, and 'genuine investment' interchangeably.

investigation represents the most comprehensive and up-to-date compilation of available statistics, filling in several missing data points and buttressing the World Bank's recently published figures on GS rates with the addition of data from several countries heretofore not included. These updated data suggest that GS rates remain fairly stable at the regional scale across time, even while those of individual countries may exhibit fluctuations in GS behaviour. The relative steadiness of the patterns suggests the methodological validity of projecting GS rates out to 2015 based on recent averages. These GS projections will be applied by region to both expected economic growth rates and the growth rates necessary to achieve the MDG on poverty.

Section 4.2 introduces population growth into the analysis. Data for GS and population growth rates are used to calculate the average annual change in per capita genuine wealth. It becomes evident that many countries initially appearing to be weakly sustainable according to the GS criteria no not meet these standards after adjusting for population growth. Implications of this analysis for the MDG target will be elucidated by comparing growth rates, in terms of genuine wealth, with the GDP per capita growth rates needed to successfully meet the poverty reduction goal.

The final section will highlight the main findings of this paper and assess generally the prospects of reaching the poverty target in an economically sustainable manner.

2 Global Poverty and the Role of Economic Growth

The exact target of the MDG on poverty reduction is to halve by 2015 the proportion of poor people living in 1990 on $1.08 or less per day. This halving of poverty entails reducing the proportion of individuals living at or under the international poverty line from 28.3 percent to 14.2 percent of the world population. As noted earlier, the attainment of this goal in light of population growth implies that approximately 1 billion people will escape absolute poverty.

2.1 Measuring Poverty: Constructing the International Poverty Line

Although recent research has advanced our understanding of global poverty, there is no consensus on the absolute levels of poverty in the world, and thus no perfect agreement on the direction of trends. Problems with the measurement of absolute poverty abound. In order to produce accurate judgements of its incidence, there is a need for data comparability across countries and for reliable information on Purchasing Power Parity (PPP) exchange rates, within-country income distributions, Consumer Price Indices (CPI), and so on. Only such detailed data can yield a reasonably precise headcount index of global poverty. The results of various studies confirm that discrepancies in data sources significantly impact upon poverty figures. Deaton (2002), for example, cites two World Bank papers published within a two year period that paint dramatically different portraits of poverty in the world. He notes that in the *World Development Report* (WDR) *2000/2001: Attacking Poverty,* it is asserted that the absolute number of people subsisting

on less than a dollar per day has risen from 1.18 billion in 1987 to 1.20 billion in 1998. He then cites a subsequent World Bank publication, *Globalization, Growth, and Poverty: Building an Inclusive World Economy*, published shortly thereafter (2001a), in which it is claimed that the number of people living in poverty fell by 200 million from 1980 to 1998, with no clear evidence of an increase between 1987 and 1998, the same period for which the WDR 2000/2001 presents an increase in the poverty count of some 200 million people.

Understanding the empirical roots of these discrepant results is crucial for assessing progress toward the MDG. However, while these issues are important as background, such debates about the measurement of poverty and income distribution are beyond the scope of this paper.[3] The dominant methodology used within the World Bank for quantifying global poverty will now be examined, under the assumption that current methodological approaches are imperfect but provide the best estimates available.

Chen and Ravallion (2004) have published the most current and complete effort to provide such estimates, by applying an international poverty line constructed with primary data from 454 surveys in 97 developing countries that together comprise 93 percent of the developing world population. These researchers use the surveys to calculate consumption distributions, attempting where possible to eliminate salient comparability problems by re-estimating consumption aggregates, or, in extreme cases, by ignoring data for which this method was insufficient. These authors readily admit, however, that problems with the data remain in cases where dissimilarities in questionnaire design or definitions cause "non-negligible" differences in the data. Ravallion et al. (1991) had initially established the $1 per day international poverty line at 1985 Purchasing Power Parity (PPP) exchange rates from the Penn World Tables.

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[3] Representative perspectives on the debate can be found, for example, in Bhalla (2002), Deaton (2001), Wade (2002), Reddy and Pogge (2002), and Sala-i-Martin (2002). See Dreze and Deaton (2002) for an in-depth look at poverty in India, which demonstrates the sensitivity of results to methodology and which differs from the official World Bank figures. See Chen and Ravallion (2004) for a similar discussion with respect to China.

Subsequently, Ravallion and Chen (2001, 2004) turn, for reasons of consistency, to World Bank figures on PPP exchange rates derived from new price and consumption basket data collected by the 1993 International Comparison Project, which included 110 countries. These new 1993 figures were used to update the $1 per day standard to the 1993 PPP-adjusted $1.08 per day, still referred to in common parlance as the "dollar per day" poverty line. The main results from Chen and Ravallion (2004) are presented in the table below as percentages of the population living below the poverty line.

Table 1. Population living below $1.08 per day at 1993 PPP

Headcount index (% living in households that consume less than the poverty line)

Region and Country Information	1990	1993	1996	1999	2001
East Asia and Pacific	29.6	24.9	16.6	15.7	14.9
China	33.0	28.4	17.4	17.8	16.6
Eastern Europe and Central Asia	0.5	3.7	4.2	6.3	3.7
Latin America and the Caribbean	11.3	11.3	10.7	10.5	9.5
Middle East and North Africa	2.3	1.6	2.0	2.6	2.4
South Asia	41.3	40.1	36.6	32.2	31.3
India	42.1	42.3	42.2	35.3	34.7
Sub-Saharan Africa	44.6	44.0	45.6	45.7	46.9
Total	**27.9**	**26.3**	**22.8**	**22.2**	**21.1**

Source: www.worldbank.org/research/povmonitor

According to these figures, a global reduction of 6.8 percentage points in the number of people living in extreme poverty has been realized from 1990 to 2001. In absolute numbers this figure signifies a decrease of 125.7 million people living in extreme poverty over the given period. These results are driven by the success of poverty reduction in China, where the proportion of extremely poor people dropped from 33.0 percent in 1990 to 16.6 percent in 2001, lifting roughly 153.2 million people out of poverty in this period. Depending on the validity of these figures, China has almost achieved the MDG, nearly

leading the entire region to similar success. At the global level, however, Chinese success was offset somewhat by the catastrophic decline of sub-Saharan Africa, in which the number of extremely poor people rose during the same period from 226.8 million to 315.8 million people, an increase of nearly 90 million. Thus, a clear spatial pattern emerges in which massive improvements in East Asia are concurrent with modest progress elsewhere, such as in South Asia and Latin America, as well as with dramatic declines in welfare across sub-Saharan Africa and Eastern Europe/Central Asia (ECA).

These official World Bank figures (Chen and Ravallion, 2004) have become the standard by which progress toward the MDG is evaluated. It appears that, despite the inconclusive nature of empirical findings in the relevant literature, the *proportion* of those living in extreme poverty seems to be lessening. However, changes in the absolute numbers of the global poor are less discernable (Deaton, 2002; Besley and Burgess, 2003).

2.2 Economic Growth and Poverty Reduction: Reviewing the Evidence

Much of the regional difference in poverty reduction over the last decade is attributable to economic growth. In East Asia, fast regional growth rates over the past two decades have coincided with striking improvements in the situation of the average poor person. Contrastingly, the stagnating economies across much of sub-Saharan Africa do not appear to have improved significantly general welfare. The relationship between economic growth and poverty reduction appears to be a key determinant of regional or country performance toward the MDG target.

There exists, in fact, a growing consensus in the empirical literature suggesting that economic growth has a direct effect on the reduction of aggregate poverty in a society. Dollar and Kraay (2002), for instance, document that average incomes in the poorest quintile of society rise proportionately with increases in a society's overall average

income. This finding is consistent across 92 countries over the last four decades even when controlling for regional differences, income levels, time periods and growth rates. Such an empirical relationship implies that economic growth is good for the poorest members of society across all societies. Squire (1993) found a similar relationship when regressing the rate of economic growth on poverty based on the $1 per day poverty line. In this study, every percentage point increase in the growth rate resulted in a 0.24 percent reduction in the poverty headcount. Similarly, Bruno, Ravallion and Squire (1998) regressed changes in survey mean incomes on changes in the proportion of the poor living on less than $1 per day. The authors found a statistically significant regression coefficient of –2.12, focusing on 20 developing countries during the period 1984 to 1993. The consistently positive effects of economic growth on poverty was further confirmed in Adams (2002), which provided evidence from a new data set that economic growth reduces both the incidence and depth of poverty, as measured by the $1 per day line and the poverty gap index respectively. More recently, Kraay (2004) uses poverty decomposition techniques to identify sources of 'pro-poor growth'. He finds that growth in average incomes explains about half of the variation in short-run changes in poverty. Over longer time periods, growth in average incomes accounts for between 66 and 90 percent of the variation in changes in poverty. Further studies confirming this general point include Gallup et al. (1998), Datt and Ravallion (1999), Easterly (1999), Barro (2000), Foster and Szekely (2001), and Ravallion (2001).

Given the consistent empirical regularity of this positive relationship between economic growth and poverty reduction, to what extent can we predict the possibility of achieving the MDG based on economic growth alone? In one of the more optimistic studies, Collier and Dollar (2001) use a set of growth projections prepared by Easterly (1999), which regress current growth rates on past growth rates, controlling for current economic policy using the World Bank's Country Policy and Institutional Assessment. In this way, these authors are able to project likely economic growth rates given current economic policy

environments. Their analysis concludes that strong per capita income growth in East and South Asia, coupled with the large size of these respective populations, means there is a "pretty good chance" that the MDG will be met (Collier and Dollar, 2002, p. 12).

This optimistic scenario suffers, however, from an assumption unlikely to be substantiated. Owing to differences in policy environments, factor endowments, disease burden, human capital stocks, etc., there is persuasive reason to believe that the elasticity of poverty with respect to income (or growth) will vary across countries. Yet they cite Ravallion and Chen (1997) in which a "large number" of empirical cases had a median poverty elasticity of about 2, and then apply this one elasticity to all the countries in their sample. It is with this figure for poverty elasticity that they project reductions of poverty from 85% to 40% in South Asia and 57% to 10% in East Asia (based on the $2 per day poverty line), rationalizing this move by their desire to maintain a large sample of countries. These authors reason that some countries will have actual poverty elasticities higher than 2, while others will have poverty elasticities that are in reality lower, each roughly canceling out the errors of the other. This is preferable, they explain, to eliminating important countries from their analysis.

By contrast, Besley and Burgess (2003) calculate poverty elasticities for both their whole sample and for each region. They find that economic growth reduces poverty over their whole sample, providing more evidence of the empirical relationship outlined above. Relaxing their assumption that the poverty elasticity is uniform across their sample, they produce figures for poverty elasticity for each region. These region-specific poverty elasticities with respect to income per capita are then used to estimate the growth rates necessary to halve global poverty by 2015. Their results are summarized in the following table.

Table 2. Poverty Elasticities and Economic Growth Projections, 1990–2015

Measure	Whole Sample	East Asia and Pacific	Eastern Europe and Central Asia	Latin America and Caribbean	Middle East and North Africa	South Asia	Sub-Saharan Africa
Elasticity of poverty with respect to income per capita	-0.75 (0.25)	-1.00 (0.14)	-1.14 (1.04)	-0.73 (0.29)	-0.72 (0.64)	-0.59 (0.36)	-0.49 (0.23)
Annual growth rate needed to halve global poverty	3.8%	2.7%	2.4%	3.8%	3.8%	4.7%	5.6%
Historical average growth rate 1960-1990	1.7%	3.3%	2.0%	1.3%	4.3%	1.9%	0.2%
Total growth needed to halve poverty	95%	70%	61%	94%	95%	117%	141%

Source: Besley and Burgess (2003).   Note: Standard errors in parentheses.

Two points should be noted with respect to these poverty elasticity calculations. The first is that they vary across regions; this could be expected by theory for the reasons mentioned above, which include better or worse policy environments and institutions, the diversity of factor endowments, other geographical characteristics like disease burden, and so on. The evidence provided supports the general theoretical reflection that a variety of influences impact upon the translation of economic growth into poverty reduction. Secondly, the poverty elasticities provided are of a different order than that used by Collier and Dollar (2002), who applied a uniform poverty elasticity of 2 (or more accurately, -2) across their sample. Besley and Burgess explain that one should expect poverty elasticities based on national income to be smaller than those derived from consumption surveys. In this case the elasticities vary, on average, by a factor larger than 2. The implication is straightforward: growth in the Collier and Dollar (2002) study will predict more than twice the amount of poverty reduction than will the figure for world poverty elasticity above. Using the Besley and Burgess figures, therefore, will result in

far more conservative estimates of future poverty reduction, and thus progress toward to the MDG as well. This is indeed the case. Whereas Collier and Dollar find that, given current trends, "there is a pretty good chance" that the MDG will be met, Besley and Burgess show that the growth needed to halve poverty is more than two times the historical average. These latter authors conclude that economic growth alone is unlikely to halve global poverty by 2015.

Clearly, the optimism or pessimism with which we view the likelihood of meeting the criteria specified in the MDG on poverty hinges on the choice of measure used for poverty elasticity with respect to growth. And, as illustrated above, this figure depends in turn on methodological considerations such as the use of national income or consumption survey data. In the analysis that follows, therefore, it is important to bear in mind that the growth projections we will be using (Besley and Burgess, 2003) represent one set of several possible choices. There is a methodological criterion for this selection, however. Because we will be using an array of data from countries' national accounts to assess the economic sustainability of the MDG on poverty, it is more coherent to use national income-based numbers for calculating economic growth than it is to mix national income data with data on poverty elasticities and growth projections derived from consumption surveys. In consequence, it is possible that the conclusions of this paper are more conservative than they would be if applying consumption survey-based data. Nevertheless, the method applied in this paper shows how adjustments can be made to our conception of wealth and how such adjustments impact our assessments of progress in alleviating poverty. From the perspective of this analysis, therefore, the anticipation of a given level of poverty-reducing growth is of secondary concern to the economic sustainability of that growth.

2.3 Poverty and Sustainability: Issues and Linkages

Achieving the required amount of economic growth is only one aspect of successful, long-term poverty reduction. Equally important is ensuring that the poverty reduction is lasting, that is, sustainable over time. Poverty should not decrease now at the expense of future generations' ability to forestall it. Surely, no one would advocate that a dramatic increase in economic activity be fuelled by the rapacious and unsustainable consumption of non-renewable resources. Yet many of the economies that most need economic growth, such as those in sub-Saharan Africa, rely on non-renewable (as well as renewable) resource endowments for much of their meager growth. The Middle East and North Africa (MENA) and Central Asia regions also stand out as heavily reliant upon natural resources as a source of income. In such contexts, understanding the sustainability of economic programmes that depend upon the natural resource base should weigh heavily on the poverty reduction agenda.

There is an increasingly understood two-way relationship between poverty and environmental degradation. Many of the poor, especially the rural poor, are directly dependent on local natural resources as a source of their livelihoods. It is estimated, for instance, that forests contribute to the livelihoods of 1.2 billion people worldwide.[4] These resources often comprise a significant proportion of the income of the poor. Jodha (1995) presents evidence from 80 Indian villages to estimate that approximately 15-25 percent of the income of poor families was sourced directly from the local commons. Cavendish (1999) provides even higher estimates for Zimbabwe. In the villages surveyed for his study, an average of 35 percent of income was based on the local environment.

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[4] MDG website: www.developmentgoals.com/environment

Watersheds, fisheries, agricultural and grazing land, forests, etc. all provide direct services to the lives of the poor, and, in many areas, may substitute for one another during times of hardship, thereby serving as a type of insurance against crop failure or other acute environmental and economic risks (Falconer and Arnold, 1989). At the same time, extreme poverty can lead people to discount the future at a high rate, driving people to intensify the detrimental over-use of environment goods for short-term gain. On occasion, such economic urgency can result in discount rates approaching 100 percent, as in a study by Holden, Shiferaw and Wik (1998), for which a sample of villages in Indonesia and sub-Saharan Africa were interviewed. Further, the rural poor are often disproportionately affected by inadequate access to credit and insurance. In such contexts, as in sub-Saharan Africa amongst the nomads and pastoralists, domestic animals assume the role of assets that substitute for imperfect capital and insurance markets. The extra animals owned as a form of insurance against drought then degrade the commons more than would be if properly functioning capital markets existed (Dasgupta, 1993; Dasgupta and Mäler, 1997). Again, we can see bidirectional causality in the relationship between poverty and environmental degradation, with the circumstances of poverty leading to increased degradation on the one hand, and with continually deteriorating environments exacerbating the condition of poverty on the other.

Presumably, such concerns are the motivation for the MDG on environmental sustainability outlined in the introduction to this paper. Target 9 of that particular goal calls for countries to "integrate the principles of sustainable development into country policies and programmes, and to reverse the losses of environmental resources."[5] The ambiguity of this MDG stands in stark contrast to the precise target established by the MDG on poverty reduction. It is unclear, for instance, what reversing the loss of environmental resources means in policy terms, but it can be assumed that this is not an endorsement for refusing *all* use of non-renewable resources, for which utilization is by

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[5] MDG website: www.developmentgoals.com/environment.

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definition irreversible. Other targets identified within the larger MDG objective of environmental sustainability are more specific. Target 10 strives to "halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation." Target 11 aspires to "have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers." If fulfilled, both Targets 10 and 11 will make a valuable contribution toward the betterment of well-being of the extremely poor.

This paper is organized within the general thematic of integrating principles of sustainable development into country policies. More specifically, the aim here is to apply recent advancements in sustainability indicators to assess the economic sustainability of countries' progress toward the MDG on poverty reduction. Although this analysis will focus intently upon environmental degradation and natural resource depletion, it is less an attempt to study directly the likely environmental consequences of achieving 95% total growth in world output—as Besley and Burgess (2003) deemed necessary to halve global poverty—than to make explicit the function of environmental resources in sustaining economic welfare over time. In this way, the trends toward (or away from) poverty reduction across the world will be more understandable, and we will be better equipped to assess the sustainability of those trends.

3 Theories of Weak and Strong Sustainable Development

The term sustainable development (henceforth SD) was popularized by the Brundtland Commission Report (1987), which defined SD as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This has been widely interpreted to mean that each generation should bequeath for the next a total productive asset base at least as large as the one inherited from its precursor. Such a move would allow future generations to face at least the same economic opportunities afforded their predecessors. This conception is in line with Pezzey (1989), which established non-declining utility over time as the criterion of SD.

Scholars disagree, however, on the types of economic decisions and paths available to ensure that well-being does not decline intertemporally. Two main clusters of opinion have emerged. One tends to highlight the contexts in which substitution possibilities exist between different capital assets. The other, meanwhile, emphasizes the situations in which a lack of substitution possibilities precludes the accumulation of one type of capital at the expense of another without incurring deleterious effects on welfare. This concern about the (im)possibility of substitution amongst forms of capital, especially in the case of natural capital, has enormous implications for any assessment of SD. Though both conceptualizations refer to a non-declining productive asset base over time, they differ substantially in their application. These differences are explored in more detail below.

'Weak' and 'strong' sustainability are the common terms given to these different interpretations, a distinction usually credited to Pearce et al. (1989). Although both theories of sustainability are based on non-declining utility or well-being over time, weak sustainability (henceforth, WS) implicitly assumes infinite substitution possibilities for types of capital assets, specifically allowing replacement of depleted natural capital with human and/or manufactured capital. This is said to be sustainability according to the Hartwick-Solow rule, following the work of Hartwick (e.g. 1977) and Solow (e.g. 1986). Contrarily, advocates of strong sustainability (henceforth, SS) hold that certain critical stocks of natural capital serve irreplaceable functions that limit—in part or in entirety—substitution possibilities.

In an extensive study of these opposing paradigms, Neumayer (2003) provides a useful summary of the central tenets of WS and SS with respect to natural capital. According to Neumayer, proponents of WS generally accept one or more of the following: (1) natural resources of "super-abundant"; (2) the elasticity of substituting man-made for natural capital in the production function is "equal to or greater than unity"; and/or (3) technological progress can surmount any resource constraint (2003, p. 22-23). These characteristics of the WS paradigm are, according to this author, reflections of "resource optimism", or in other words, the optimism that depletion of natural resources, and the concomitant decrease in well-being, will be adequately compensated by raised levels of consumption. In contrast, the reasoning that supports the SS paradigm is based on one or more of the following: (1) uncertainty and/or ignorance about the consequences of depleting natural capital; (2) the irreversibility of much natural capital loss; (3) the fundamental life-support functions performed by natural capital; and/or (4) a strong aversion among many individuals to losses in natural capital (Neumayer, 2003, p. 26).

There is no consensus regarding which of these approaches is a more dependable basis for SD. Neumayer (2003) concludes that, given current scientific and economic knowledge,

neither paradigm is fully verifiable and neither is falsifiable. He demonstrates that the selection of one over the other depends on debatable assumptions that existing disciplines are not yet equipped to answer, though a strong case can be made for caution in the face of uncertainty.

Illustrations of these complexities can be seen in the following two examples. The neo-classical economic orientation of WS holds that as a resource is depleted to zero, its scarcity value will increase to infinity, creating in the process incentives for less costly alternatives. This is likely to be the case assuming the absence of market failures, which seem to recur particularly where the environment is concerned. Knowing if the market will produce such optimal pricing is an uncertain affair with potentially disastrous environmental consequences. For the SS paradigm, on the other hand, science has made only limited progress toward an understanding of ecological thresholds and resiliencies. Thus, knowledge about so-called 'critical levels' of natural capital is still inadequate on which to base well-developed theory and policy.

Despite these uncertainties, relatively more progress has been made on indicators of weak sustainability. The next section will explore genuine savings/investment as one such indicator.

3.1 The Nature of Wealth and Sustainability: Further Theory

The theories of SD addressed here may disagree about the relative significance of various capital assets. They do not, however, quarrel over the value of maintaining a productive base that supports non-declining utility through time. Both theories value explicitly economic programmes and environmental policies that leave intact the *total* productive base, and thus economic opportunities, for future generations. However, as Dasgupta (2001) points out, the notion of an economy's productive base presents an

immediate problem of aggregation across a diversity of assets, including produced capital (such as machinery and infrastructure), environmental assets (such as forests, watersheds, and the atmosphere), human capital (knowledge and skills), social capital, institutions, and so on. He comments further that these myriad assets together determine the production, consumption and distribution possibilities of society. These are features of society that can be reasonably expected to vary across geographical space as well as across time.

Capital assets are of concern here because they function as important determinants of societal well-being. It follows that if we are interested in measuring well-being over time, then we should be interested in changes in the sum total of these capital assets. Dasgupta (2001) demonstrates in formal terms, reproduced below, that a country's wealth is the *social worth* of its capital assets.[6] This is a linear index of a society's well-being, in which accounting prices are positive for capital assets that improve well-being and are negative when they detract from well-being.[7] Thus an economy's wealth W at date t can be expressed as

$$W_t \; = \; \Sigma_i \, (p_{it} K_{it}) + \; \Sigma_j \, (h_{jt} H_{jt}) + \Sigma_k \, (r_{kt} S_{kt}) + \Sigma_l \, (q_{lt} Z_{lt}) \tag{2.1}$$

where K_{it} is the quantity of the ith manufactured asset, H_{jt} the quantity of the jth form of human capital, S_{kt} the quantity of the kth natural capital, and Z_{mt} the stock of the mth type of knowledge. In all cases the unit of account is social well-being at time t, and p_{it}, h_{jt}, r_{kt}, and q_{lt} are the spot accounting (i.e. shadow) prices of the respective assets. Equation (2.1)

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[6] The following discussion summarises Dasgupta (2001: 146-48).

[7] Note that the conception of wealth applied here can encompass any value imputed by the members of society to its constitutive assets, and thus accommodates both weak and strong forms of sustainability. Theoretically, if wealth is sufficiently broadly conceived, value derived from a specific ecological function could also be incorporated, irrespective of the value assigned to it by human society. Thus, the accounting price of an asset may reflect a social value about which humans are ignorant, as in the case of biodiversity for example.

is a broadly conceived definition of wealth: the "social worth of an economy's entire asset base" (Dasgupta, 2001, p. 147).

Net investment in these capital assets expands the productive base available to an economy, while disinvestment shrinks this base. Therefore, society's total wealth can increase in a given period only if there is net investment during that period. Such changes in the asset base can be formalized in the following manner. Considering time as continuous, differentiating equation (2.1) gives us the change in wealth at time t, equivalent to the net investment made during that period:

$$I_t = \sum_i (p_{it} dK_{it}/dt) + \sum_j (h_{jt} dH_{jt}/dt) + \sum_k (r_{kt} dS_{kt}/dt) + \sum_m (q_{mt} dZ_{mt}/dt) \qquad (2.2)$$

Dasgupta calls I_t genuine investment. In this formulation, if genuine investment is positive, then total wealth will increase by that amount. This signifies an increase in social well-being. By contrast, negative genuine investment implies that society's wealth, and thus social well-being, is in decline.

It is clear that the way accounting prices are estimated is central to this conception of genuine wealth and investment. Presently, accounting prices are usually estimated using the direct use-value of a resource, often ignoring non-commercial uses, intrinsic values, and the option-values of preserving a stock as a precaution against unforeseen circumstances (Bardhan and Udry, 1999). But, given properly estimated accounting prices, that is, prices that accurately reflect the social worth of an asset, then this conception of genuine wealth and investment holds true.

The theory outlined above provides the tools needed to assess sustainability understood as non-declining intertemporal social well-being. It shows that, if development is to be sustainable, there must be net genuine investment over time. Of course, it is possible to

have negative genuine investment at a point in time, but the theory predicts that consistent negative investment must eventually lead to reductions in wealth until consumption reaches zero. Interestingly, this premise holds for economies on an optimal path (Dasgupta and Heal, 1979; Hamilton and Clemens, 1999) as well as those on non-optimal ones (Dasgupta and Mäler, 2000). Thus, negative genuine investment can be consistently demonstrated to be an indicator of un-sustainability.

Equations (2.1) and (2.2) calculate the sum total of the stock of wealth and the flow of genuine investment, respectively. It could be assumed from their structure that increases in one type of asset can offset declines in another with no effect on the total amount. Such an interpretation would be a reflection of WS. This may often be the case, as when human capital substitutes for manufactured capital without lowering overall economic output. Indeed, Landes (1998) has argued that the discovery of previously unknown substitution possibilities was a primary force sparking the Industrial Revolution.[8] In other cases, however, the well-being afforded by a capital asset may not be easily substituted by other assets. Examples of this are evident in the differing intrinsic values assigned to environmental goods by individuals, groups, and cultures. To illustrate the point, note that the forest is for some a source of hardwood for homes; for others, it is primarily a source of fuelwood; for others still, it is source of spiritual value. Assigning an extremely high intrinsic value to a resource stock would generally suggest at least limited substitutability, if not outright un-substitutability. Theoretically, the accounting prices of the asset in question should reflect such priorities, which can be expected to differ across geographical and cultural space. Additionally, even for the same natural asset, site-specific ecological functions should result in numerous accounting prices, some of which approaching extraordinarily high values, as when degradation brings biodiversity loss to the systemic threshold beyond which ecological collapse occurs.

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[8] Cited in Dasgupta (2001: 127).

3.2 Expanding the Measures of Wealth[9]: Methodology

Theory identifies the reasons why sustainable development should be interested in the sum total of an economy's productive assets, which are to be valued at accounting prices that reflect their social worth. In practice, however, proper valuation of these assets, and changes in their sum, is a difficult undertaking. Efforts in this direction, however, can be found in the growing emphasis on 'green' national accounting, which adjusts national accounting practices to include environmental degradation and other depreciation of assets (see, e.g., Repetto et al., 1989; Hartwick, 1990; Mäler, 1991; World Bank, 1997). Oftentimes, making 'green' adjustments to the national accounts creates a substantially different picture of economic performance. For example, Solorzano et al. (1991) estimate that soil, fisheries, and forest depreciation amounted to 10 percent of Costa Rica's GDP in 1989. Another study of losses from soil erosion on Java (McGrath and Arens, 1989) found that declining soil productivity on the Indonesian island amounted to 0.5 percent of GNP. Thus, the adjustments necessary to account for degradation can occasionally be of a large magnitude. In the present section, we will review some of the methodological techniques available for measuring changes in the broadened conception of wealth we have been using, relating them to the underlying theory when appropriate. Subsequently, the methodology will be used to assess the sustainability of economic growth in different countries and regions.

As noted, numerous difficulties are implicit in valuating the diverse array of assets that comprise an economy's productive base. One problem is that of aggregation across types of capital assets. Another problem is created by the attempt to value intangible assets, such as social capital, which has proven an elusive concept (see, e.g., Arrow, 2000). A third set of problems relates to the technical difficulties of estimating accounting prices.

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[9] The title of this section was deliberately selected in reference to the World Bank publication (1997) by the same name.

Some of these issues were discussed above when explaining the significance of accounting prices for broadened conceptions of wealth and investment. In optimal economies, the estimation of accounting prices is straightforward: accounting prices are simply equal to the prevailing market prices of the good in question, and social worth is equal to private profits. Much of the world is characterized, however, by highly imperfect economies in which one cannot expect market prices to accurately reflect social priorities. In such cases, it may only be possible to roughly estimate the accounting prices of various assets.

Studies by Repetto et al. (1989) and Pearce and Atkinson (1993) are two of the first efforts to estimate genuine investment trends by incorporating depletion and depreciation of assets into national accounting data. *Expanding the Measures of Wealth* (World Bank, 1997) represents a similar attempt by the World Bank to adjust national accounting practice to reflect genuine investment across a large number of countries. These studies demonstrated that many countries appear to be on unsustainable paths because their gross savings are less than the value of total depreciation of assets in the economy. These countries were genuinely disinvesting and genuine wealth was in decline, violating the definition of sustainability above.

More recently, Hamilton and Clemens (1999) provide estimates of genuine investment trends for over 100 developing countries. Their methodology involves calculating what they refer to as 'genuine savings' (GS) by subtracting depreciation of natural and produced (i.e. manufactured) capital from, and adding human capital investments to, standard GNP figures.[10]

Investment in human capital was valued at the marginal cost of creating one unit of human capital, operationally defined as the public expenditure on education in a given

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[10] Genuine savings is the theoretical equivalent of genuine investment as discussed in this paper.

year. This methodological decision has been criticized, however, as 'awkward', in that Hamilton and Clemens only add to GS for human capital investment but do not subtract for human capital depreciation when people die (Dasgupta, 2001). An important difference between standard accounting and GS methodology is the shifting of education expenditures from consumption to investment. This is defended by arguing that spending on teachers, books, etc. for students is more accurately considered an investment in future human capital rather than consumption.

Pollution damage was subtracted from the national accounts. Due to data scarcity, only carbon dioxide (CO_2) damage was used in these estimates. Including only one of a number of possible pollutants will tend to bias genuine investment upward, but there is not much to be done until data improves on non-CO_2 pollutants like carbon monoxide (CO), lead, mercury, asbestos, chlorofluorocarbons (CFCs), etc. Further, valuing damage to the atmosphere poses complications because it is a global public good and because many air- and water-borne pollutants cross borders. The methodology of Hamilton and Clemens (1999) considers the damage done to the global commons through global warming being a negative cost attributed to the polluter.   Following Fankhauser (1994), they apply the estimate of 20 dollars (per tonne of carbon dioxide emissions) as the marginal social cost associated with damage to the global atmosphere. This estimate is then multiplied by the quantity of CO_2 emissions (in tonnes) in a given country; the resultant figure is subtracted from the given country's national accounts.

The net-price method was used for calculating natural capital depreciation with respect to forest, mineral, and energy resources.[11] The value of this depreciation is given by total resource rents, as per Hotelling (1931), which are calculated as follows:

$$\text{Rent} = (\text{Market Price} - \text{Marginal Cost}) * \text{Resource Extraction} \qquad (2.3)$$

[11] Forest products include fuelwood, hardwood and softwood production. Energy resources are oil, natural gas, hard coal, and lignite. Minerals include bauxite, copper, iron lead, nickel, phosphate, tin, zinc, gold, and silver.

This is the theoretically valid method for calculating exhaustible resource rents in an optimal economy. In the case of renewable resources, such as forests, the term for resource extraction is the difference between resource extraction and regeneration rates. After attempting to adjust for country- and region-specific extraction costs[12], this general formula is applied to measure natural capital depreciation in Hamilton and Clemens (1999) as well as other World Bank studies of GS and genuine wealth (see e.g. World Bank, 1997, 2002). On occasion, this method yields bizarrely high figures for depreciation. This tendency usually occurs in contexts of extremely high reserve to production ratios. One manner available to avoid this problem is to use the El Serafy method for computing natural resource depletion.[13] Thus, it is important to keep in mind that for many of the energy-producing countries of MENA and Central Asia, calculations of depletion may be inaccurately high.

Computing depreciation and investment in the manner presented above provides estimates of the terms relevant for GS calculations. The stylized formula for GS appears below:

Genuine Savings = Gross Domestic Savings + Education Expenditure –

Depreciation of Produced Capital – Resource Rents –

CO_2 Damage   (2.4)

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[12] See Hamilton and Clemens (1999) for an in-depth discussion of methodology for adjusting for country- and region-specific differences in extraction/production costs, differences in quality of energy resources, and proportions of fuelwood, hardwood and softwood among total forest products.

[13] There exists a competing method for calculating natural capital depreciation based on El Serafy (1989) that has two main strengths over the net-price method. First, it does not rely on marginal costs; see below in text for implications of marginal and average costs. Secondly, the method may be more accurate for contexts in which very large resource reserves remain. However, practical use of the El Serafy method is impaired by the need for accurate data on total resource reserves, which are also frequently unavailable, and for an accurate discount rate. See this reference for more details.

It should be noted that calculating resource rents in this way is only an approximation of the theoretically valid method because, by substituting average cost for marginal cost, it assumes efficient resource pricing in a dynamic optimization model. This assumption is unlikely to hold in a wide variety of contexts for the same reasons we can expect accounting prices to inadequately reflect the true social worth of an asset, as discussed earlier. The paucity of data on marginal costs, however, compels the World Bank's use of average costs, which are more readily attainable. This switch is usually interpreted to imply higher actual figures for resource rents and, in turn, understated GS rates (see e.g. Hamilton, 1994; Hamilton and Clemens, 1999; Neumayer, 2004). The criticism holds for discussions of marginal cost but misses an important point with regard to market prices. The dynamic optimization model assumes efficient pricing of both marginal costs of extraction and the prevailing market price itself. Many if not most economies, however, are sub-optimal if not highly imperfect and characterized by externalities. This is particularly likely to be true of developing countries. Thus, there is no reason to assume market prices *necessarily* reflect the social worth of the asset in question. In many cases the resource may be drastically underpriced in the market. To the extent this is the case, resource rents are probably *understated*, by a possibly large amount, and thus GS will be proportionally *overstated* as well.

Much of the preceding discussion has focused on the importance of assuming efficient resource pricing in an intertemporally optimal economy. Yet there are other likely problems with a methodology that relies on an optimal model, as does the World Bank's GS calculations. GS is sensitive to three additional phenomena that could also result in inefficient pricing: exogenous technological change, terms of trade effects, and a non-constant discount rate (Dietz and Neumayer, forthcoming). Any of the preceding points could undermine the theoretical foundations underlying GS as an indicator of weak sustainability.

Despite these caveats, GS can still serve as a useful policy-guiding indicator. Much depends on the expectations with which it is held. GS cannot be a measure of strong sustainability, and should not be criticized on this account. It is perhaps best regarded as an indicator of unsustainability. Negative GS rates show simply that, given current trends, an economy is on an unsustainable path. Positive GS rates, on the other hand, cannot confirm the weak sustainability of an economy (Neumayer, 2003).

4 Analysis of Genuine Savings and Wealth

This paper is concerned with the (un)sustainability of countries' economic paths toward the goal of halving poverty by 2015. First, the fundamental role of economic growth in the halving of global poverty levels was reviewed. Estimates were provided of the amount of economic growth that would be needed to halve poverty on a regional and global basis. Subsequently, we explored the theoretical and practical bases upon which GS—an indicator of unsustainability—is founded. This paper will now apply the theory and methodology to a large sample of countries.

4.1 Genuine Savings: Applications and Implications

Using World Bank data and applying accounting formula (2.4), this paper recalculated GS figures for 126 countries during the period 1995 to 2001. Data on gross domestic savings, education expenditures, depreciation of produced capital, resource rents, and CO_2 damage come from the World Bank (2002). All data was converted from current US dollars to constant 1995 US dollars using the implicit GDP deflator. This shift from nominal to real currency allows for direct comparisons of absolute totals of GS in different years as opposed to the usual figures given by similar studies, which is the rate of GS expressed as a percentage of GDP or GNI. Rates of GS were also calculated as a proportion of GDP by dividing individual country GS (in absolute numbers) by GDP (in constant dollars) for each year. Regional averages are the average of individual country's

GS rates for a given year.   The general results are consistent with regional trends observed over the last two decades, as given by Hamilton and Clemens (1999).   The trends are presented graphically below.

Figure 1. Genuine Savings by Region
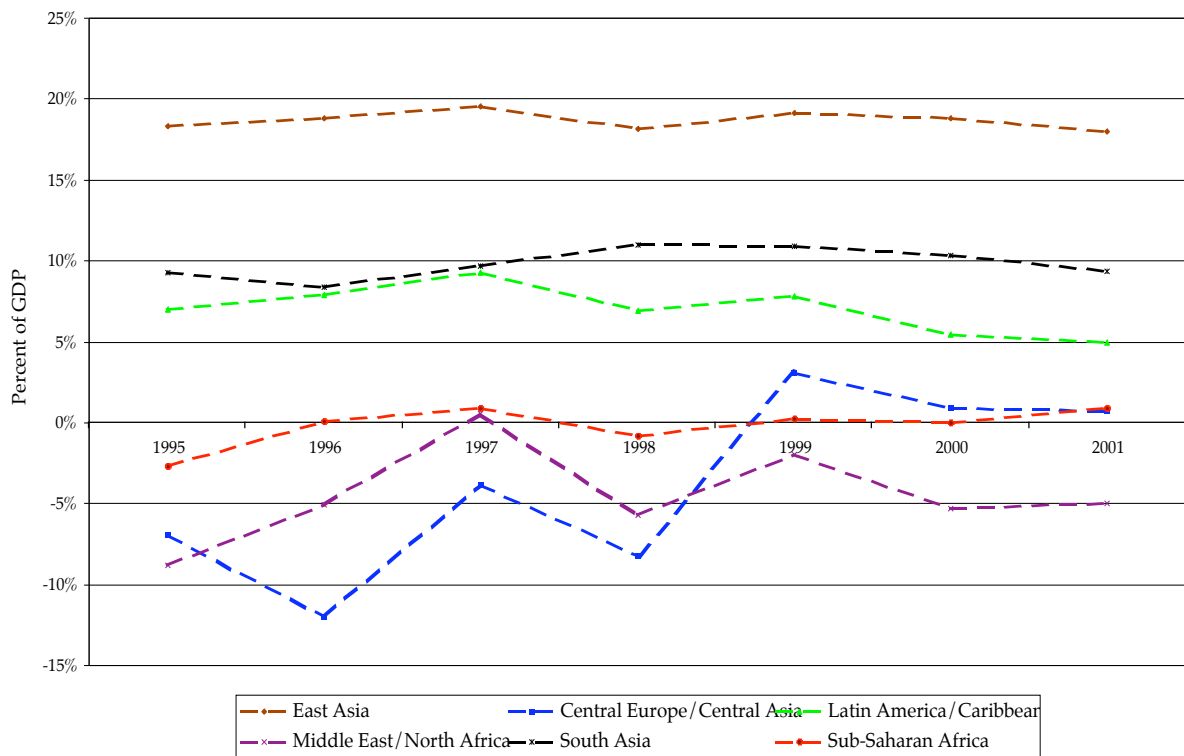
Source: Author's estimates using data from WDI (2003) and World Bank (2002).

The MENA region continues to be the poorest overall performer in terms of GS, to be expected on account of the region's heavy reliance on exhaustible resources. The Eastern Europe and Central Asia (ECA) region is also problematic from a GS standpoint, beginning the period with only slightly higher GS rates than MENA, then declining rapidly until 1998 when it begins to show some improvement; levels subsequently steady near zero. Sub-Saharan Africa shows no striking genuine saving or dis-saving, differing from previous studies. In Hamilton and Clements (1999), for example, the region dipped into negative GS savings rates at some point in 1978 and never recovered in the time

period they analyzed (i.e. through 1993). Our findings demonstrate limited improvement. Latin America and the Caribbean have consistently positive GS rates hovering around 5 percent of GDP. South Asia is very strong with positive GS rates near 10 percent; this trend mirrors the performance of high-income OECD countries (not shown). East Asia is the most outstanding case with figures approaching 20 percent of GDP. These extremely high rates of GS are driven by relatively strong economic growth (which enhances gross domestic savings), low economic dependency on domestic resource extraction, and high education expenditures.

Such regional aggregates, however, obscure individual country performances. Table A.1 in the Appendix presents for the years 1995 and 2000 the top ten performers in terms of GS as well as all countries with negative GS. Those countries with negative GS are located entirely in SSA, the transition countries, and MENA. Together, 37 out of 126 countries in our sample have negative GS rates in 1995; in 2000 this number grows to 39 countries. These countries are unsustainable at the respective points in time according to the criteria of weak sustainability.

Many of the countries in this category also have very low rates of economic growth. This signifies that even the small economic growth they are able to produce is unsustainable. Thus, the small chance that they will meet the MDG on poverty reduction is further damaged by the unsustainability with which they are trying to accomplish it. This paper is interested in analyzing such interactions between economic growth and GS to assess the sustainability of the MDG on poverty. The relationship between these variables is presented in the figure below, using average rates of GS and average per capita economic growth during the period 1995 to 2001.

Figure 2. Interaction Between Genuine Savings and Economic Growth, 1995-2001
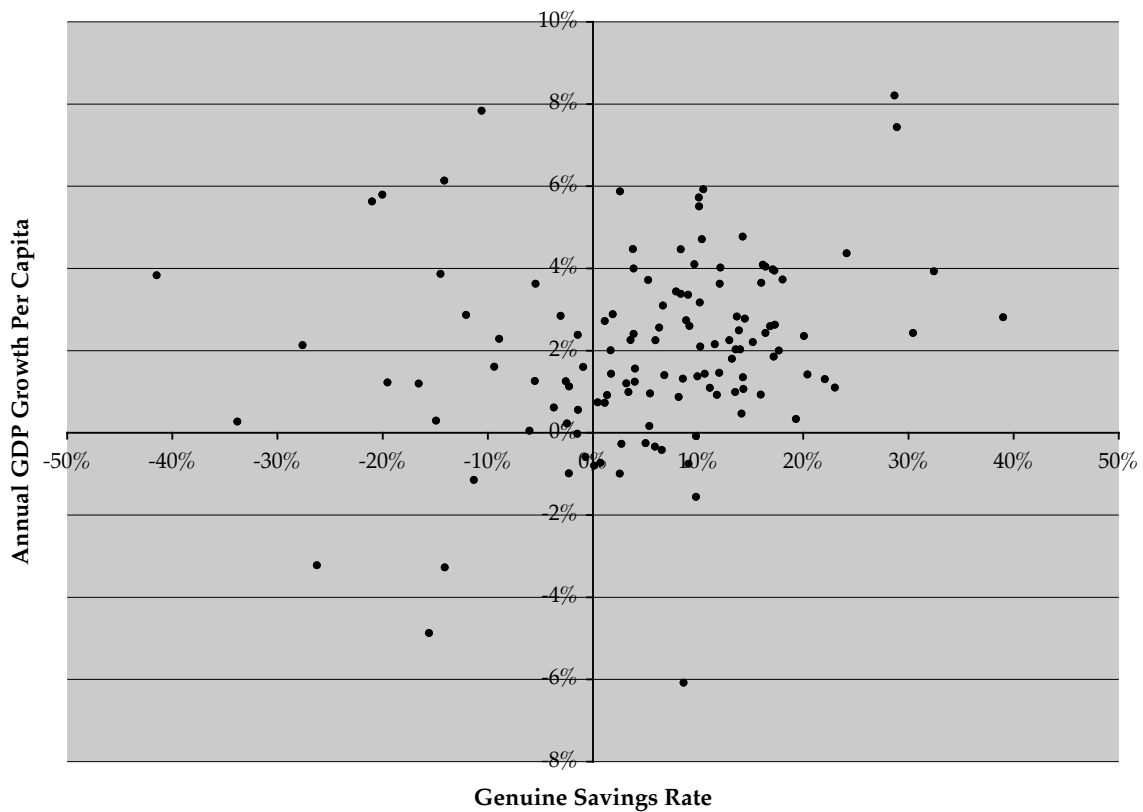
Source: Author's calculations from WDI (2003) and World Bank (2002).

There are several important points to observe about this graph. First, note the relative concentrations of countries with positive and negative GS. Second, there does not appear to be any strong correlation between economic growth and GS rates. This is surprising given the role of economic growth in boosting gross domestic savings rates. But the apparent absence of a clear relationship between these two variables suggests that other components of GS besides gross domestic savings are driving the results. Additional research into the specific roles of the components of GS in driving economic growth is needed. Third, there is a group of 11 countries exhibiting negative per capita economic growth but positive GS. Though there are clear problems with the economies of this subset (i.e. economic contraction and/or too high rates of population growth), these countries may be paving the way for future growth through net investment in their

productive assets. Fourth, there are a total of 18 countries in our sample that have negative per capita growth rates; all of these are highly unlikely to achieve their MDG target unless they massively improve their economic performance over the next decade. Finally, there are a significant number of countries in the second quadrant that have positive rates of economic growth (y-axis) but negative rates of GS (x-axis). The countries in this quadrant are of primary interest here. It is those countries that may be making progress toward the MDG on poverty but by doing so in an unsustainable way. Later, this paper will look closer at this group of selected countries.

4.2 Genuine Savings to Per Capita Changes in Genuine Wealth

For most of the preceding analysis a constant population has been implicitly assumed. However, a more appropriate line of inquiry would be to examine *per capita* changes because population growth is a significant factor in poverty trends. In sub-Saharan Africa, for example, the proportion of people living in absolute poverty remained fairly constant during the 1990s (see Table 1 above) but the absolute number increased by nearly 90 million due to an increasing population. By focusing on the national accounts without reference to this population growth, we may have been painting a biased picture of real world changes in genuine investment/saving activity. Moreover, we have until now been focused only on rates of GS as a proportion of GDP. This provides limited information, namely the ability to judge on the unsustainability of a country at a point in time (or over a given time period). It is a merely a rate of change of genuine wealth, as defined above. It does not provide direct information about per capita changes in genuine wealth. In this section we will present data on such changes in the stocks of genuine wealth.

This analysis will follow the methodology outlined in Dasgupta (2001). It provides a means of incorporating population growth into our estimates of genuine wealth without

extremely technical calculations. First, the average GS rate as a percentage of GDP for each country (1995-2001) is multiplied by an assumed average output-capital ratio. As explained by Dasgupta, this figure is most often approximated to be 0.30 in standard national accounting practice. In this analysis, however, we are expanding the definition of an asset beyond what is normally considered, and thus 0.25 serves as a conservatively high figure to compensate for the upward bias of traditional estimates. The annual population growth rate is then subtracted from the product of average GS rates and assumed output-capital ratio.[14]

The picture that emerges gives reason for greater pessimism regarding the likelihood of meeting the MDG on poverty. Though every region shows some GDP per capita growth over the period, ranging from a low of 0.92 percent in MENA to a high of 3.35 percent in ECA, genuine wealth per capita is in rapid decline in sub-Saharan Africa and MENA. Further, Latin America/Caribbean, South Asia and ECA are only narrowly accruing total capital assets on a per capita basis. These findings are summarized in Table 3.

Table 3. Estimates of Changes in Per Capita Genuine Wealth

Region	GS (% of GDP)	Annual Growth GDP Per Capita	Annual Population Growth	Annual Growth Genuine Wealth Per Capita
East Asia	18.12%	2.93%	1.79%	2.74%
Eastern Europe/Central Asia	1.10%	3.35%	-0.09%	0.37%
Latin America/Caribbean	7.48%	1.09%	1.73%	0.04%
Middle East/North Africa	-4.35%	0.92%	2.18%	-3.26%
South Asia	9.87%	2.68%	1.95%	0.52%
Sub-Saharan Africa	-0.18	1.35%	2.56%	-2.61%

Source: Author's calculations using data from WDI (2003) and World Bank (2002).

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[14] Actual country-specific figures of the output-capital are likely lower than what is used here and would result in even lower estimates of per capita changes in genuine wealth.

These estimates describe a dramatic trend of total productive asset liquidation in MENA and sub-Saharan Africa. Despite very modest growth in GDP per capita, the total (genuine) wealth of these regions is being rapidly depleted. If these tendencies continue, the average MENA inhabitant or sub-Saharan African will become poorer by a factor of 2 within three decades. These trends forecast the future deepening of poverty in the absence of major shifts toward increased investment in natural and human capital and/or a diminution of population growth as well. For the three regions showing very small positive changes in per capita wealth, there is little reason to believe that major improvements in human development will occur given the continuance of current trends.

There are, however, reasons to think the picture of genuine wealth may not be as bleak as conveyed above. One of these was explained briefly in the section on methodology for estimating natural capital depreciation. For countries that have very large reserve to production ratios, depletion is likely overstated. This creates a downward bias in the estimates of genuine saving and wealth. In this light, MENA and ECA may be in a better situation than these figures imply. Additionally, there appears to be a global deceleration of population growth (United Nations, 2002). If this process can be maintained or accelerated, then we should expect improvements in future per capita wealth. Conversely, there are reasons to suggest that these results may be overstating genuine savings and wealth. One is the likely discrepancy between accounting prices and market prices of important goods, particularly with reference to environmental goods. Another reason is that the assumed output-wealth ratio given above is likely too high for many countries. Using more accurate data could very well reduce the figures still further. Cumulatively, these caveats suggest that the estimates provided here can only serve as general approximations of trends. More research is needed to fill in the remaining gaps of data and knowledge. Nonetheless, the application of the data currently at our disposal results in a dim portrait of current trends in the developing world.

4.3 Halving Poverty and Changes in Genuine Wealth

Broadening our conception of wealth leads, as we have seen, to different impressions of progress toward the MDG than those obtained by focusing on changes in per capita GDP. There are a number of countries that are exhibiting negative per capita growth and will thus fail to halve poverty irrespective of considerations of sustainability or unsustainability. But this analysis has shown that there exists a group of 25 countries with positive GDP per capita growth and negative GS rates, thereby implying that their current economic performance is unsustainable. This paper will now look at these selected countries in more detail.

Using Besley and Burgess' (2003) figures for the elasticity of poverty with respect to growth in income per capita, we are able to comment preliminarily on the countries that appear (or not) to be on a path of achieving the poverty target. Of these 25 countries, only six have experienced sufficient economic growth over the period 1995 to 2001 to suggest they are 'on target' or better. These countries are Rwanda, Albania, Kazakhstan, Armenia, Georgia, and Azerbaijan. The remainders have been growing too slowly despite their positive GDP per capita growth. Among the six that appear to be 'on target', however, the analysis of per capita changes in genuine wealth, as opposed to GDP per capita, shows that not one of these countries is accumulating total productive assets on a per capita basis.

The divergence between projected GDP growth and projected growth in genuine wealth, both calculated using constant prices, is shown in the figure below.

Figure 3. Growth Projections of GDP/Capita vs. Genuine Wealth/Capita, 1990 – 2015
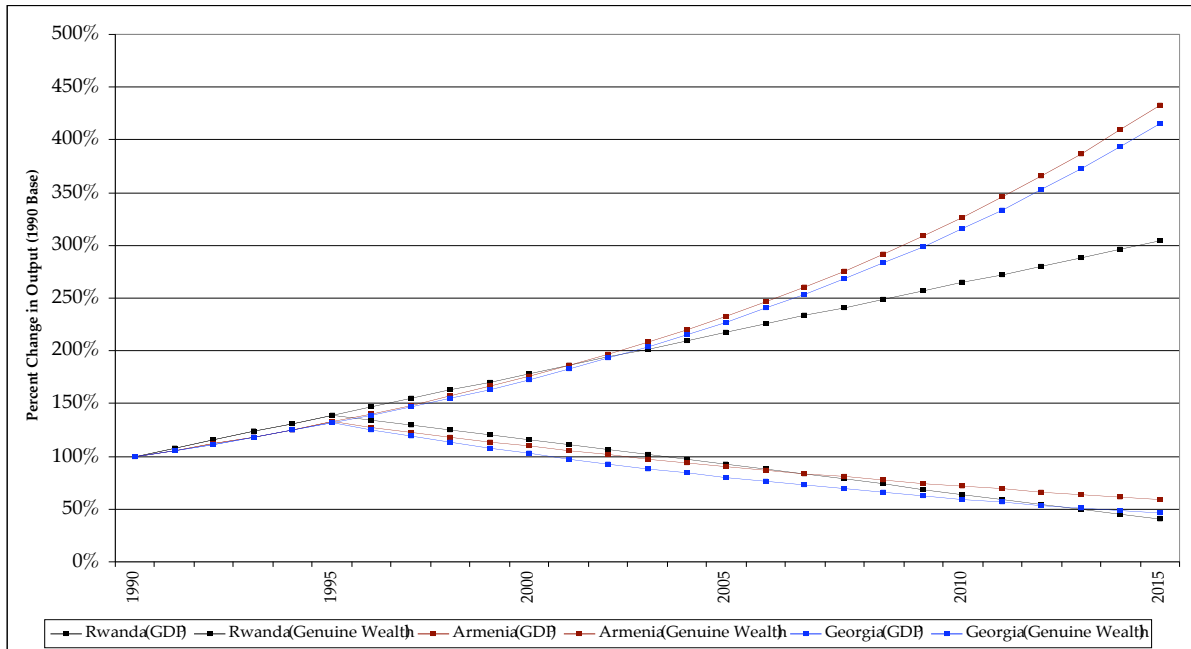
Source: Author's estimates.

The figure assumes that the year 1990 represented 100 percent of GDP for all three countries. Average real GDP growth rates per capita (1995-2001) were applied to each year between 1990 and 2015 to roughly estimate the total economic growth these countries can be expected to achieve if current trends prevail. Beginning in 1995, the period for which we have data, the graph concurrently applies real per capita changes in wealth. The year 1995 was chosen over 1990 in order to highlight the divergences among impressions of progress based on growth in GDP and those based on genuine wealth.

The sharp disjuncture at the year 1995 marks the point at which the graph begins to apply growth of genuine wealth. In reality, genuine wealth was probably declining from an earlier period. Further, the endpoints of the genuine wealth projections should be understood only as illustrations and not used to measure true output because the base year of the series was the value, in 1990, of GDP and not genuine wealth. It is possible, however, to see the relative percent change in total genuine wealth from 1995 to 2015. This should be interpreted to mean that this group of countries, assuming current trends,

will have depleted by 2015 their total capital base (per capita) by almost 70 percent. It should also be remarked that this graph represents a biased selection of countries, that is, those countries that have positive economic growth but negative GS. The intention of the graph, however, is to demonstrate the magnitude of the possible impact when using expanded measures of wealth for assessing economic progress. This is not an arbitrary broadening of wealth but one based on the criterion of weak sustainability. It can be asserted, therefore, that these countries' progress toward the poverty goal is accompanied by rapid and unsustainable dissolution of their total productive bases. The average citizen in these countries is becoming (genuinely) poorer not wealthier as the country 'develops' toward its poverty target.

5 Looking Beyond 2015: Increasing Poverty?

The preceding analysis underscores the significance of assessing the economic sustainability of countries' economic growth. After elucidating a theory of 'weak sustainability', the paper demonstrated that there existed a total of 39 countries at the turn of the millennium that could be identified as unsustainable, even by 'weak' standards, due to negative GS rates. Subsequently, a comparison of average GS and economic growth rates revealed that 25 countries have exhibited positive average GDP per capita growth but negative GS over the period 1995 to 2001. These economies were genuinely disinvesting, thereby diminishing their total stock of capital assets over the given period. Of this group of 25 countries, many have experienced recently insufficient growth to halve poverty, in addition to possessing negative GS rates, and are thus extremely unlikely to successfully halve poverty. Section 4.2 introduced considerations of population growth into an analysis of GS. This assessment of economic sustainability demonstrated that there exist 58 countries worldwide in which the total productive base per capita was shrinking from 1995 to 2001. Six of these countries were selected for further study on the criterion that they appear to possess sufficient levels of average economic growth per capita to reach the poverty goal. However, a detailed examination of these cases suggested that, despite such seemingly solid economic performance, genuine wealth per capita is being rapidly deteriorated. Their economic paths are almost certainly unsustainable. If such trends persist, there is substantial reason to suspect that poverty in these countries will increase in the (possibly near) future. If the global community aspires to reduce poverty beyond 2015, it would do well to consider the genuine wealth and economic sustainability of individual countries' and regions' progress

toward the MDG on poverty reduction. Incorporating depreciation of total capital stocks into our assessments and policies is one step toward ensuring both long-term reductions in poverty levels and environmental sustainability.

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Appendix

Table A.1 Ten Best Performers and All Countries with Negative Genuine Savings
(Absolute numbers expressed in constant 1995 US dollars)

	1995			2000	
Country	**Absolute**	**GS/GDP**	**Country**	**Absolute**	**GS/GDP**
Singapore	33,286,728,880	40.06%	Singapore	42,566,962,625	37.22%
Botswana	1,414,180,392	29.63%	Ireland	34,143,943,668	32.02%
China	197,076,692,868	28.14%	Botswana	2,108,428,611	32.02%
Korea, Rep.	130,983,658,125	26.77%	Malaysia	31,906,640,539	28.59%
Thailand	44,145,655,945	26.29%	China	272,775,499,943	26.20%
Panama	2,020,743,497	25.56%	Korea, Rep.	138,142,763,982	22.27%
Malaysia	22,240,778,971	25.04%	Hong Kong, China	35,935,207,404	21.84%
Ireland	16,211,842,584	24.36%	Norway	36,048,458,444	21.15%
Honduras	935,061,722	23.61%	Panama	1,886,238,221	20.13%
Slovak Republic	3,881,367,519	20.27%	Finland	32,757,392,222	19.80%
Algeria	-60,839,706	-0.15%	Egypt, Arab Rep.	-81,198,484	-0.10%
Central African Republic	-1,828,439	-0.16%	Zambia	-6,167,032	-0.16%
Benin	-14,628,994	-0.73%	Venezuela, RB	-200,413,861	-0.25%
Guinea	-41,922,326	-1.14%	Benin	-32,357,969	-1.25%
Ecuador	-265,422,509	-1.48%	Bolivia	-131,250,229	-1.65%
Guatemala	-268,169,708	-1.83%	Tajikistan	-42,518,657	-1.79%
Madagascar	-70,612,543	-2.23%	Congo, Dem. Rep.	-107,285,305	-2.30%
Tanzania	-156,773,456	-2.98%	Gambia, The	-11,364,248	-2.35%
Uzbekistan	-489,088,494	-4.81%	Colombia	-2,379,118,332	-2.46%
El Salvador	-457,844,511	-4.82%	Ukraine	-1,123,542,609	-2.53%
Malawi	-74,366,754	-5.21%	Guatemala	-455,373,606	-2.56%
Mozambique	-125,260,971	-5.42%	Moldova	-84,730,052	-3.11%
Angola	-275,899,402	-5.47%	Chad	-59,199,539	-3.53%
Uganda	-367,866,710	-6.39%	Malawi	-67,039,948	-3.85%
Chad	-97,293,194	-6.76%	Trinidad and Tobago	-286,211,038	-4.13%
Venezuela, RB	-6,693,102,320	-8.65%	Togo	-62,101,608	-4.25%
Gambia, The	-33,452,565	-8.76%	Uganda	-356,727,423	-4.62%
Niger	-168,839,658	-8.98%	Jordan	-449,223,147	-5.68%
Haiti	-265,341,650	-10.06%	Niger	-123,468,384	-5.71%
Albania	-310,901,721	-12.82%	Ecuador	-1,068,340,160	-5.93%
Ethiopia	-767,678,446	-13.28%	Rwanda	-133,904,106	-6.50%
Sierra Leone	-124,432,333	-13.38%	El Salvador	-796,715,101	-7.22%
Rwanda	-213,433,134	-16.50%	Mauritania	-125,702,309	-9.53%
Burundi	-168,125,945	-16.81%	Iran, Islamic Rep.	-10,303,099,870	-9.76%
Iran, Islamic Rep.	-14,733,148,754	-16.86%	Albania	-339,808,983	-11.08%
Mauritania	-182,247,684	-17.06%	Georgia	-383,797,661	-15.22%
Kazakhstan	-4,118,204,407	-20.67%	Lebanon	-1,940,644,323	-15.51%
Saudi Arabia	-30,070,913,945	-23.53%	Ethiopia	-1,144,652,790	-15.54%
Lebanon	-2,910,584,679	-26.18%	Saudi Arabia	-21,960,956,287	-15.70%
Armenia	-775,976,786	-26.88%	Syrian Arab Republic	-2,052,598,024	-15.97%
Syrian Arab Republic	-3,076,362,410	-26.99%	Armenia	-599,267,170	-16.15%
Georgia	-547,901,362	-28.83%	Burundi	-165,424,793	-17.48%
Kuwait	-9,112,349,541	-34.31%	Sierra Leone	-155,865,358	-20.26%
Lesotho	-374,903,850	-40.19%	Kazakhstan	-4,579,902,597	-20.33%
Eritrea	-227,436,526	-40.93%	Uzbekistan	-2,554,451,379	-20.79%
Azerbaijan	-1,584,435,171	-65.54%	Lesotho	-253,409,782	-22.71%
Tajikistan	-3,075,916,062	-129.42%	Kuwait	-7,530,859,062	-27.32%
			Eritrea	-204,947,136	-34.28%
			Azerbaijan	-1,574,904,193	-46.31%

Table A.2 Sample Countries and Regional Groupings

East Asia and Pacific	Latin America/Caribbean	Sub-Saharan Africa	High Income OECD
China	Argentina	Angola	Australia
Hong Kong, China	Barbados	Benin	Austria
Indonesia	Bolivia	Botswana	Belgium
Malaysia	Brazil	Burkina Faso	Canada
Mongolia	Chile	Burundi	Denmark
Laos	Colombia	Cameroon	Finland
Philippines	Costa Rica	Central African Republic	France
Singapore	Dominican Republic	Chad	Germany
Thailand	Ecuador	Congo, Dem. Rep.	Greece
Vietnam	El Salvador	Congo, Rep.	Ireland
	Guatemala	Cote d'Ivoire	Italy
	Haiti	Eritrea	Japan
Europe and Central Asia	Honduras	Ethiopia	Korea, Rep.
	Jamaica	Gambia, The	Netherlands
Albania	Mexico	Guinea	New Zealand
Armenia	Panama	Kenya	Norway
Azerbaijan	Paraguay	Lesotho	Portugal
Belarus	Peru	Madagascar	Spain
Bulgaria	Trinidad and Tobago	Malawi	Sweden
Czech Republic	Uruguay	Mali	Switzerland
Estonia	Venezuela	Mauritania	United Kingdom
Georgia		Mauritius	United States
Hungary		Mozambique	
Kazakhstan	**Middle East/North Africa**	Namibia	
Kyrgyz Republic		Niger	**South Asia**
Latvia	Algeria	Rwanda	
Lithuania	Egypt, Arab Rep.	Senegal	Bangladesh
Moldova	Iran, Islamic Rep.	Sierra Leone	India
Poland	Israel	South Africa	Nepal
Romania	Jordan	Sudan	Pakistan
Slovak Republic	Kuwait	Tanzania	Sri Lanka
Slovenia	Lebanon	Togo	
Tajikistan	Morocco	Uganda	
Turkey	Saudi Arabia	Zambia	
Ukraine	Syrian Arab Republic	Zimbabwe	
Uzbekistan	Tunisia		