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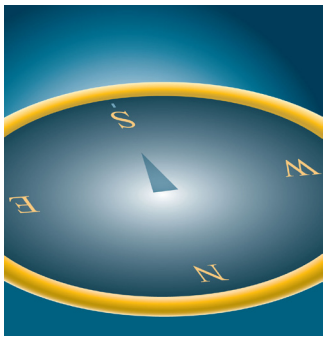

Development-Oriented Policies and Alternative Human Development Paths:

Aggressive but Reasonable Interventions

Frederick S. Pardee Center for International Futures. Edited by B. Hughes

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The Frederick S. Pardee Center for International Futures is the home of long-term forecasting and global trend analysis at the Josef Korbel School of International Studies, on the University of Denver campus.

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Development-Oriented Policies and Alternative Human Development Paths:

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ABSTRACT

Individual development-oriented policies can significantly impact human development, but analysing the relative effects of multiple policies on the long-term course of human development faces two comparison problems: 1) countries begin from very different starting points, so that 'one-size-fits-all' development goals may be unreasonable for some; and 2) many interventions cannot be expressed in terms of common metrics such as money spent. Another issue arises when moving from *relative to aggregate effects of policies*—the complicated, interactive impacts among individual interventions. We use the International Futures (IFs) long-term forecasting system, a representation of the dynamics of multiple interacting human systems, to analyse a range of policy interventions and identify 'aggressive but reasonable' expectations or targets for policy action, even in the face of these analytical challenges. The paper focuses on poverty, education, health, infrastructure and governance issues and targets. It looks also at policies in a more challenging environmental future.

INTRODUCTION

Development-oriented policies have a significant impact on the course of human development. Most of the literature exploring such policies focuses, however, on a single target issue (e.g., poverty reduction, education, health, agriculture or trade), and on a single policy or a small set of policies. One can see such specialization quite quickly simply by looking at leading studies—see, for example, Aghion and Durlauf 2005; Perkins, Radelet and Lindauer 2006; or Todaro and Smith 2012 (see also Box 1).

Such analytical focus is understandable in the face of the very large challenges of comparability and aggregation. With respect to comparability, policies cannot always be expressed in terms of financial expenditures, but often involve sociopolitical change. How can one contrast the development impact of spending more on an infrastructure investment such as roads, with that of requiring and facilitating universal primary school enrolment, with those of lowering fertility rates and infant mortality, or with that of reducing corruption in government? How does an analyst determine how far to push the lever of such policies in any comparative analysis?

Comparative policy analysis is further complicated by the reality of very different starting points for countries. High-income countries tend to be relatively similar in their levels of human development and their policy configurations. Anyone looking at such variables across low-income or middle-income countries, however, knows how incredibly variable they are. In spite of that, collections of targets such as those framed by the Millennium Development Goals (MDGs) are

*Many team members in the Frederick S. Pardee Center for International Futures contributed to this paper. Our thanks especially to Graham Emde, research assistant. For a full list of International Futures team members, visit www.ifs.du.edu/community/team.aspx. In addition, we thank José Pineda, of the UNDP Human Development Report Office's Research Team, for suggestions and feedback as we proceeded with the work underlying this paper. Errors remain our own.

often stated in universal terms, as if one size fits all, and without attention to the policy requirements of meeting them and the differential ability of countries to pursue such policies (for example, see Clemens and Moss 2005, and Easterly 2009 on how the MDGs were unfair to Africa).

Standing in sometimes sharp contrast to the limitations of policy analysis, policy-maker allocate scarce resources, be they of funds, time and attention, or political capital, and they must make trade-offs. They therefore wish to understand the relative implications of the pursuit of different goals and the use of different policy initiatives. Policy makers also work within complex, dynamic development systems, and are often pushing on many different parts of those systems. They therefore also wish to understand the aggregate effects of their actions.

The study presented in the following uses the IFs computer forecasting system to explore the current course of human development in countries and regions around the world, and analyse a range of policy interventions that might accelerate it. The paper considers not only the multiple types of, or targets of policy, but the magnitude and timing of effort. It attempts to identify 'aggressive but reasonable' levels of specific interventions in order to provide a stronger basis for first, avoiding unrealistic pursuit of targets, such as those that are often associated with universal goal-setting; second, making policy interventions more comparable across levers and targets, and across countries; and third, exploring the impacts of interventions in policy clusters and the aggregate across such clusters.

The questions that frame this study are:

1. What is the human development path that countries, regional groupings and the global system seem to be on through the middle of this century? We look to the Human Development Index (HDI) and its components to help describe that path.

2. What constitutes a reasonable set of policy interventions to explore in terms of their ability to accelerate the current development path? And what would be aggressive but reasonable magnitudes of intervention with respect to them?

3. How much impact might such aggressive but reasonable interventions, individually and collectively, have on the course of human development?

The ability to address these questions is inherently limited by analytical tools, but the IFs system helps tackle each of them, despite its many limitations. The following pages describe it, followed by the identification and analysis of policy levers.

Box 1: Studies of development processes

There are, of course, many important efforts to integrate analysis of development, especially at the theoretical level and often with considerable empirical support (see, for example, Galor 2005). Many of these go back to the notions of structural changes in the development process (Chenery, Robinson and Syrquin 1986) or even stages of growth (Rostow 1971). Many, however, are also emerging from efforts to endogenize economic growth (Aghion and Howitt 1992; Griliches 1998; Grossman and Helpman 1994; Lucas 1988; Romer 1990, 1994 and 2010), including efforts to determine the multiple, interacting drivers of productivity and growth (see Barro 1999, Barro and Sala-i-Martin 2004, Bosworth and Collins 2003, Chen and Dahlman 2004), and the masterful job of reviewing and analysing efforts by Durlauf, Johnson and Temple (2005), who concluded that such work, while still in its infancy and difficult to distil, nonetheless merits continued optimism and effort (p. 558). More recently, in the same tradition, see Abdih and Joutz 2008, Acemoglu 2008, Isaksson 2007, Jones and Romer 2010, Kuman and Kober 2011, and Sanderson and Striesznig 2009. These contributions typically and appropriately come out of extensive empirical analyses of development processes, especially of economic growth. Our study breaks new ground in its use of such insights within an integrated development model to forecast the impact of policies across multiple aspects of the development process.

1. THE INTERNATIONAL FUTURES TOOL

The central tool for this study is the IFs simulation model, whose home is the Frederick S. Pardee Center for International Futures (Box 2). IFs facilitates exploration of country-specific, regional and global futures through alternative scenarios. Although IFs is increasingly used in policy analysis, it began as an educational tool. Even in analysis applications, the primary strengths of the system are in framing investigation and analysis. Users of computer simulations should always treat forecasts as highly contingent and exploratory scenarios, not as predictions.

IFs aids exploration of the long-term future of closely interacting policy-related issues, including human development (temporally and substantively looking well beyond the MDGs), social change (including instability and risk) and environmental sustainability. It is a large-scale, long-term, fully integrated global modelling system—no subsystems are

exogenous to the others. It represents demographic, health, education, economic, infrastructure, energy, agricultural, sociopolitical and environmental subsystems for 183 countries interacting in the global system. The model is integrated with a large database for its many foundational data series and other variables of interest to users. Series begin in 1960 and even earlier when available. The easy-to-use interface facilitates data analysis, forecast presentation and scenario analysis, and the system is freely available on the Web and in standalone versions.[1]

IFs is a structure-based, agent-class driven, dynamic modelling system. Several important features aid exploration of the impact of a set of policy initiatives with potential to enhance human development. Two core features include:

- The use of a social accounting matrix (SAM) structure for tracking and balancing intersectoral flows, and the broader financial exchanges among domestic agent classes (governments, households and firms) and across countries.[2] This is important for analysis of multiple policies because it ensures that financial constraints are present and trade-offs addressed. The economic model structure in which this SAM structure is embedded is equilibrium-seeking, with a recursive treatment of time across annual time steps.
- A production function that endogenizes multifactor productivity, driving it by four major categories of input: human capital, social capital, physical capital and knowledge. Dynamic productivity contributions in each of the four categories are responsive to variables determined in other models of the larger IFs system.[3]

Figure 1 shows the major models in the system, all of which are linked in many ways that the figure cannot show. Very brief information about the major models follows; for extended documentation of the system, see Hughes and Hillebrand (2006), and the Help system accompanying IFs.

The *population model* represents 22 age-sex cohorts to age 100+ in a standard cohort-component structure; it endogenously represents changes in fertility rates, and uses an extensive health model to compute mortality (and morbidity) across 13 cause categories. The *economic model* is an equilibrium-seeking model across six sectors; it does not assume exact equilibrium will exist in any given year, but rather it uses inventories as buffer stocks and provides price signals so that the model chases equilibrium over time. As indicated above, it uses both a SAM structure and represents

Box 2 The Frederick S. Pardee Center for International Futures

The Frederick S. Pardee Center for International Futures is housed within the Josef Korbel School of International Studies of the University of Denver. Foundational funding was provided through a generous gift from Frederick S. Pardee. The Center's flagship publication is the annual Patterns of Potential Human Progress.

Development of the IFs modelling system in 2000-2003 was funded in substantial part by the European Commission's TERRA project. In 2009, TERRA also funded a Pardee Center project examining the impact of information and computing technology on sustainability.

The Pardee Center has also received assistance from the Strategic Assessments Group of the US Central Intelligence Agency and the US National Intelligence Council (NIC), which drew on IFs global trends analyses in *Project 2020: Mapping the Global Future* (2004), *Global Trends 2025: A Transformed World* (2008) and *Global Trends 2030: Alternative Worlds* (2012). The IFs system also provided the UN Environment Programme (UNEP) with driver forecasts for *Global Environment Outlook 4* (2007).

More recently, IFs has contributed to the joint African Futures project in partnership with pan-African think tank the South Africa based Institute for Security Studies. African Futures is sponsored by the British High Commission, the Western Cape Provincial Government and the Hanns-Seidel Foundation, and has contributed background papers for the UNDP Human Development Reports of 2011 and 2012 (Hughes et al., 2011; Hughes 2012).

Earlier generations of IFs have benefitted from generous funding assistance provided by the US National Science Foundation, the Cleveland Foundation, the Exxon Education Foundation, the Kettering Family Foundation, the Pacific Cultural Foundation, the US Institute of Peace, the General Motors Foundation and the RAND Pardee Center.

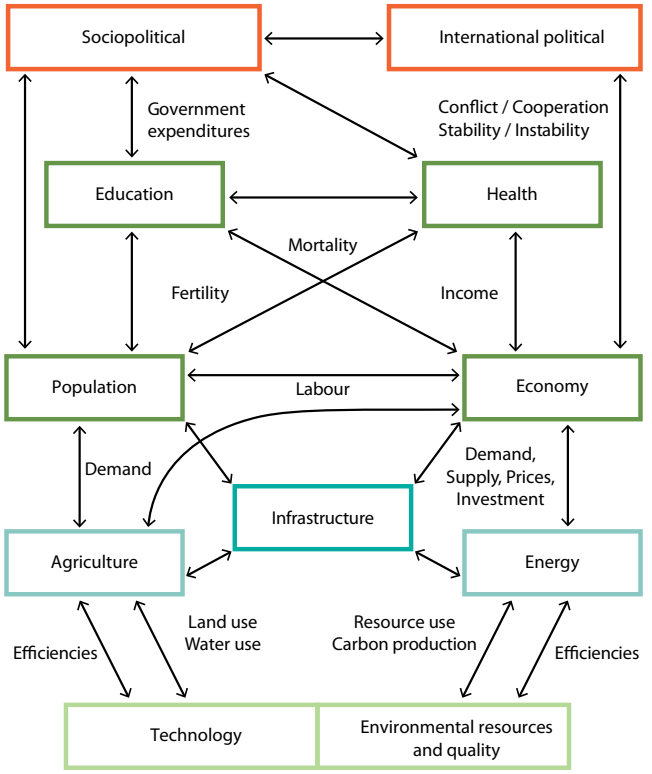
IFs also owes much to the large number of students, instructors and analysts who have used the system over many years and provided much appreciated advice for enhancement.

1 IFs is available to download or use online without cost at www.ifs.du.edu/ifs. Please access documentation on the website or other IFs publications for more detail on the model structure and assumptions.

2 The IFs system uses the type of universal SAM structure recommended by Jansen and Vos 1997. For information on the SAM structure in IFs, see Hughes and Hossain 2003.

3 For description of the IFs approach to multifactor productivity, see Hughes 2008.

Figure 1: The major modules of the IFs modelling system



Note: Links shown are examples from a much larger set.

productivity endogenously. The *education model* represents formal education across primary, secondary (separating lower and upper secondary levels) and tertiary levels. The *health model* builds on the distal driver foundation of the World Health Organization's (WHO) Global Burden of Disease formulations for major causes of death and disability (thanks to Colin Mathers), but looks to the WHO's Comparative Risk Assessment approach on relative risk to represent key proximate drivers of health such as undernutrition, obesity and smoking. The *sociopolitical model* represents fiscal policy through taxing and spending decisions, and represents the general evolution of other governance variables, including corruption level and regime type. The *agricultural and energy models* are partial equilibrium systems at the physical level, and their dynamics shape the respective financial sector representations in the economic model. There are also *models for international politics, infrastructure* (focusing on level of access to major infrastructure systems) and the *environment*. Technology variables can be found across the models.

The system facilitates scenario development and policy analysis via a 'scenario-tree' that allows users to change framing assumptions, agent-class interventions, initial conditions and many of the relationships within the model. Scenarios can be saved for development and refinement over time. The easy-to-use interface also facilitates the analysis of historical data and display of forecasting results.

2. IDENTIFYING THE INTERVENTIONS

A huge range of policies affects the course of development. Even with the broad issue coverage of IFs, analysis will consequently be incomplete in many respects. However, the Frederick S. Pardee Center for International Futures has been undertaking increasingly broad analysis over the last several years in the context of its series of volumes called Patterns of Potential Human Progress (PPHP). The foundations developed through the series help to explore policy levers that may be of interest to the development policy community.

This section discusses three important elements in thinking about interventions. The first is the character of the policy lever of interest. In reality, many of the levers or interventions discussed below are actually policy targets with respect to specific variables. For instance, achieving specific fertility rates, primary education enrolment rates or even a specific level of spending on health are all policy targets that can be reached by countries in many ways with policy initiatives that one could specify with much more detail. Only the most highly elaborated models of individual issue areas are likely truly to allow manipulation of specific policy interventions.

The second element is the force applied to any policy lever. Just as in the real world, where that is a matter of political art and compromise, modeled policy interventions can be very arbitrary. There are, however, some steps towards making the magnitude of modeled interventions somewhat less arbitrary. The approach here is to focus on aggressive but reasonable interventions, to be elaborated below.

Third, realistically, countries are not immediately able to move from current policy configurations to the magnitudes of the targeted interventions. The analyses here generally assume that it takes at least 10 years to do so.

POLICY INTERVENTION OPTIONS AND TARGETS

The volumes in the PPHP series help organize identification of policy levers, their magnitudes and the timing of their introduction. The first PPHP volume focused on poverty reduction. This was intentional, because poverty reduction is

Table 1: Internal and external levers explored in IFs poverty reduction analysis

Primarily domestic levers	Primarily international levers
Factors of Production	*Trade*
Fertility Reduction	High Trade
High Female Labour	Export Promotion
High Investment	*Foreign Investment*
Human Capital	High FDI
High Education Spending	High Portfolio Flows
High Health Spending	*Household Transfers*
Social Capital/Governance	High Remittances
High Govt Effectiveness	*Government Transfers*
Low Corruption	High Foreign Aid
High Economic Freedom	High IFI flows
Infrastructure Capital	*Technology*
High Infrastructure	High Technology
Natural Capital	
High Renewable Energy	
Knowledge Capital	
High R&D	
Low Protection	
Domestic Transfers	
High Transfers	

Source: Hughes et al. 2008, p. 101.

foundational to human development, as indicated also by its prime position among the MDGs. The analysis of poverty and the levers that might reduce it was broad ranging (see Hughes, Irfan, Khan, Kumar, Rothman and Solórzano 2008), and this paper begins by identifying those policy access points.

Subsequent PPHP volumes turned to advancing education (Dickson, Hughes and Irfan 2009) and improving health (Hughes et al. 2011; see also Hughes, Kuhn, Peterson, Rothman, Solórzano, Mathers and Dickson 2011). There the policy handles became more specific, and the paper turns to those next. In all cases, these variables (poverty reduction, education and health) are directly related to the HDI and to common categories of human capabilities, important in and of themselves.

The fourth and fifth volumes in the PPHP series are completed and in final production (Rothman et al., forthcoming 2013; Hughes et al., 2014), and turn attention more to means rather than direct ends of development efforts. The fourth looks at building infrastructure, where access to roads, water and sanitation, electricity and telecommunications have some important direct human impacts (certainly transport and communications increase human well-being in and of themselves), but are especially important for their secondary effects, such as improving economic growth or reducing the ill-health effects of unsafe water. The fifth volume turns to governance, which again provides secondary benefits (e.g., physical security) as well as some primary ones, such as the satisfaction of participation in decisions that affect one's life.

Reducing poverty: a broad approach to human development

Table 1 summarizes the levers selected for use in *Reducing Global Poverty*, the first PPHP volume. The levers were divided into two groups: first, those primarily used within countries (although many of them clearly have international ramifications); and second, those for use primarily across countries (although they all have domestic ramifications for developing countries).[4] Many of the levers were chosen because they anticipated work to follow in the subsequent volumes of the series. In addition, those later volumes identified increasingly more extensive and detailed sets of levers.

Having identified the leverage points of interest, the next issue was to determine the appropriate magnitude of intervention. All the PPHP volumes have attempted to make those magnitudes aggressive but reasonable. This is in part a reaction to approaches such as the MDGs, in which targets are set for outcomes that, while most would agree are desirable, are not always attainable. That said, the specification of aggressive but reasonable interventions requires difficult decisions. For poverty analysis, we relied simply on our best (hopefully reasonably expert) judgement. Choices for intervention magnitudes are listed below; the approach is fundamentally one of 'brute force' through the application of multipliers in which, with relatively few exceptions (such as the movement of foreign aid donations to at least 0.5 percent of gross domestic product or GDP), changes are relative to the underlying values for each individual country in the IFs base case,[5] and

4 Hughes et al. (2008) provided much more detail on the specification of these levers than we can here. For example, an appendix to Chapter 7 of *Reducing Global Poverty* further elaborates the levers and their specification for the analysis. See also that volume's Table 3.1, which extracted a more complete potential list from the development literature. As that comparison will quickly illustrate, the levers available within IFs by no means exhaust the possible points of intervention in order to accelerate reductions in poverty rates. They do, however, touch on large numbers of those that development experts have identified.

5 Although interventions are 'relative to the base case', that is not strictly accurate. Strictly speaking, the interventions are relative to underlying computations that, all else being equal, would be those of the base case. The interventions themselves can alter dynamics over time, however, so that the underlying computations drift away from the base case.

therefore take very different country starting points and patterns into account.

- **World as a whole**: Over 20 years relative to the base case, global increase of foreign direct investment (FDI) by 30%, portfolio investment flows by 50%, research and development (R&D) expenditures by 20% and global migration by 50%.
- **Developed countries**: Foreign aid donations of at least 0.5% of GDP in 10 years.
- **International financial institutions**: Doubling of lending over 10 years relative to the base case.
- **World Bank developing countries as a whole**: Health spending, governance effectiveness (World Bank scale) and economic freedom (Fraser Institute scale) increase by about 20% over 10 years, along with technologically based productivity growth by 0.2%. Over 20 years, corruption decreases by about 30% (Transparency International scale), and infrastructure improves by about 20%. Renewable energy production grows to 50% above the base case by 2050.

- **Africa**
  - ***Eastern***: Relative to the base case, education spending increases 20% over 10 years, while savings/investment rates double over 25 years. Transfers to unskilled households are up by 50% over 20 years. By 2050, exports grow 25-30%.
  - ***Middle***: Movement to replacement fertility over 45 years (45% change relative to the base case). Increases in savings/investment rates by 50% over 25 years (e.g., 18-27%), education spending by 35% over 10 years, and transfers to unskilled households by 50% over 20 years. Corruption decreases by about 40% (Transparency International scale) over 20 years; infrastructure improves by about 80% over 30 years. By 2050, exports grow 25-30% relative to the base case.
  - ***Western***: Movement to replacement fertility over 30 years (33% change relative to the base case). Increases in savings/investment rates by 30% over 25 years (e.g., 18-27%), education spending by 80% over 10 years, and transfers to unskilled households by 50% over 20 years. By 2050, exports grow 25-30% relative to the base case.
  - ***Southern***: Movement to replacement fertility over 30 years (33% change relative to the base case). Savings/investment rates increase by 50% over 25 years (e.g., 18-27%), while exports grow 25-30% by 2050 relative to the base case.
  - ***Northern***: Movement to equal female labour force participation over 45 years; education spending up 20% over 10 years.

- **Asia**
  - ***South central***: Movement to equal female labour force participation over 45 years. Education spending increases by 20% over 10 years, and savings/investment rates by 20% over 25 years. Reduced protectionism lowers import costs by 20% over 20 years. Exports grow 25-30% by 2050 relative to the base case.
  - ***South-east***: Education spending rises 35% over 10 years.
  - ***East poor***: Education spending soars 80% over 10 years, and transfers to unskilled households are up 25% over 20 years.
  - ***West (Middle East)***: Movement to equal female labour force participation over 45 years. Savings/investment rates increase by 30% over 25 years (e.g., 18-24%).

- **Americas**
  - ***Caribbean***: A 50% rise in savings/investment rates over 25 years (e.g., 18-27%). Transfers to unskilled households grow 25% over 20 years.
  - ***Central***: Movement to equal female labour force participation over 45 years. Savings/investment rates rise 50% over 25 years (e.g., 18-27%), and education spending increases 35% over 10 years. Transfers to unskilled households double over 20 years.
  - ***South***: Movement to equal female labour force participation over 45 years. Increases in savings/investments rates of 50% over 25 years (e.g., 18-27%), and in education spending of 20% over 10 years. Over 20 years, reduced protectionism lowers import costs by 20%; transfers to unskilled households double.

- ***Oceania (poor)***: Movement to replacement fertility over 30 years (33% change relative to the base case). Savings/

Table 2: Summary of target rates in IFs normative scenario to advance global education

	Intake/transition	Survival	Gender parity
Primary	2.2 percentage points annual increase	1.2 percentage points annual increase (2 percentage points could be reasonable for some countries in catch-up mode, especially above 65 percent survival)	1.2 percentage points annual increase (2 percentage points could be reasonable for some countries in catch-up mode, especially above 65 percent survival)
Lower secondary	1.0 percentage points annual increase (has compounding affect on top of primary growth)	0.8 percentage points annual increase	0.8 percentage points annual increase
Upper secondary	0.5 percentage points annual increase (historically this would ramp up with increased lower secondary enrolment)	0.3 percentage points annual increase (country or regional catch-up specifications could be as much as 2 points, e.g. in South and West Asia)	0.3 percentage points annual increase (country or regional catch-up specifications could be as much as 2 points, e.g. in South and West Asia)
Tertiary	Normative scenario does not change this (2 percentage points growth in gross enrolment would be aggressive)	Normative scenario does not change this (2 percentage points growth in gross enrolment would be aggressive)	Normative scenario does not change this (2 percentage points growth in gross enrolment would be aggressive)

Note: Maximum values are at 50 percent intake/transition and 65 percent survival with relative slowing at higher and lower levels, generating an S-shape curve of growth.
Source: Dickson, Hughes and Irfan 2009: 113.

investment rates double over 25 years, as do transfers to unskilled households over 20 years.

- ***Europe (eastern)***: Savings/investment rates climb 20 percent over 25 years (e.g., 18-22%), while education spending increases 20% over 10 years. Corruption decreases by about 60% (Transparency International scale) over 20 years.

Advancing education: a targeted intervention

In the policy analysis of the PPHP education volume (see Dickson, Hughes and Irfan 2009), the approach was somewhat different. Table 2 shows the intervention points identified across each level of formal education—intake rates or, at levels above primary, transition rates from lower levels; survival rates to the end of education levels (an approximation of completion of those levels); and gender parity ratios.

Each cell within Table 2 indicates the magnitude of the targeted intervention in what, as a whole, constitutes a 'normative scenario' for the aggressive but reasonable advance in formal education participation rates. Despite efforts to use data heavily, the process of creating the normative scenario was a significantly qualitative one. Development of it had an iterative character, beginning with some initial estimates for reasonable targets that were gradually adjusted in light of new evidence streams, including analysis of countries demonstrating best practices and suggestions of subject-matter experts. The scenario does not include target specifications at the tertiary level (except for slow reductions of gender imbalances), because the basis for them was not yet strong enough.[6] The approach again recognized very different initial starting points and dynamics across countries.

Looking beyond rates of increase in education participation, we also established a context for thinking about spending on education by exploring how public spending per student varies around the world and by level of education. As UNESCO (2007, p. 19) pointed out:

By expressing expenditure [per student] as a percentage of GDP per capita, education budgets can be compared in relation to national income level, which is a proxy for a country's ability to generate education financing.

At the primary and lower secondary levels, low-income and lower middle-income countries, on the whole, spend considerably less per student as a percentage of GDP per capita than upper-middle- and high-income countries. It may be reasonable to speculate that such levels for lower income countries represent inadequate spending as a result of resource constraints and high child dependency ratios. In contrast, however, low-income countries spend (relative to GDP per capita) much more per student at the upper secondary, and especially at the tertiary level, than do richer countries. That almost certainly reflects the great difficulty that the poorest countries have in

6 The target values specify maximum growth rates that occur near the mid-range of intake/transition and survival. Because of constraints on growth of those variables at the low end of ranges (related to difficulty scaling up systems) and at the high end of ranges (related to complications bringing in the last portions of populations), we apply S-curve patterns of growth around those maximum values.

obtaining educated faculty and other professionals to staff higher education, and may also represent the start-up costs of developing facilities for universities and professional schools, and the absence of economies of scale when enrolment rates are low. In addition, on the basis of limited available data, it appears that in richer countries private expenditures at the tertiary level facilitate lower public expenditure rates.[7] Also, education at the tertiary level is a more tradable good than education at lower levels (large numbers of students do study abroad), a fact that could lead to some degree of global convergence in actual costs and prices, and therefore to continued disparity in spending relative to GDP per capita.

There is, however, tremendous variation in spending rates per student across countries within income categories, especially those at lower incomes. In order to determine 'reasonable' spending rates for a normative scenario, we established benchmarks for per-student costs, appropriate to the economic development level of each country and variable across levels of education, relative to GDP per capita. That involved both bottom-up analysis of specific costs within developing countries that illustrate good practices in expanding education participation and attainment; and aggregate, top-down analysis, looking comparatively at total spending across countries around the world to understand how patterns relate to quantity and quality of performance. In the normative scenario, we set the convergence time in moving education expenditures as a percentage of GDP per capita for primary, lower secondary, upper secondary and tertiary education from initial levels to those of the benchmarks at 20 years.

Improving health: focusing on proximate drivers

The third volume of the series focused on health policy (see Hughes, Kuhn, Peterson, Rothman and Solórzano 2011) and entailed another set of challenges. To begin, there are two quite different approaches to thinking about alternative health futures. WHO's Global Burden of Disease analyses (Mathers and Loncar 2006, undated) focused on distal (or distant) drivers, which are variables that affect health through their impacts on variables much closer to actual changes in mortality and morbidity. In particular, the Global Burden of Disease work identifies three such drivers: GDP per capita, formal education years attained by adults and the advance of technology. This set is quite distant from health-oriented policy variables. It overlaps heavily with foundational variables in the PPHP poverty and education analyses.

Instead of focusing on such distal drivers alone, the PPHP analysis included proximate drivers, the intermediate variables between the distal drivers and health outcomes. WHO's ongoing Comparative Risk Assessment (CRA) project provided a starting point for considering health outcomes associated with proximate risk factors (Ezzati et al. 2004a, 2006). The project has used two guiding criteria for including specific risks in its analysis by selecting risks for which sufficient data and scientific understanding exist in order to assess the exposure and health effects associated with them, and "for which intervention strategies are available or might be envisioned to modify their impact on disease burden" (Ezzati et al. 2004b). Within this framework, the project has tried to provide conceptual and methodological consistency and comparability across the risk factors. Table 3 shows the 28 risk factors covered in the most recent Comparative Risk Assessment report (WHO 2009).

Table 3: Proximate health risk factors included in the WHO Comparative Risk Assessment project

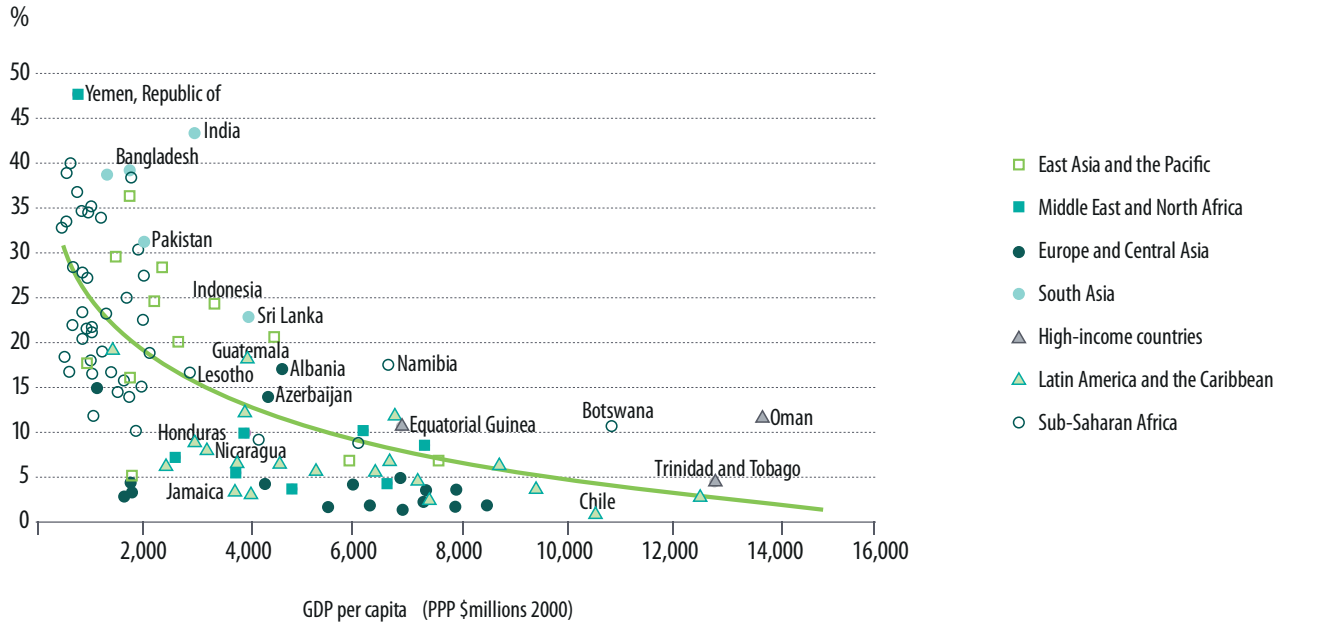
Health category	Risk factor
Childhood and maternal undernutrition	Underweight* Iron deficiency Vitamin A deficiency Zinc deficiency Suboptimal breastfeeding
Other nutrition-related risk factors and physical activity	High blood pressure High cholesterol High blood glucose Overweight and obesity* Low fruit and vegetable intake Physical inactivity
Sexual and reproductive health	Unsafe sex Unmet contraceptive need
Addictive substances	Tobacco use* Alcohol use Illicit drug use Unsafe water, sanitation, hygiene* Urban outdoor air pollution* Indoor smoke from solid fuels* Lead exposure Global climate change*
Occupational risks	Risk factors for injuries Carcinogens Airborne particulates Ergonomic stressors Noise
Other selected risk factors	Unsafe health-care injections Child sexual abuse

Note: Risk factors marked with an asterisk (*) are included as proximate drivers in the IFs health model.

Source: Hughes et al. 2011.

7 Costs per student at higher levels of education have come down over time for countries at all income levels, including the high-income category. In 1970, high-income countries spent 50.4 percent of GDP per capita on each tertiary student (see also Coombs 1985, p. 158). Our own analysis shows that their spending per student has stabilized at around 28 percent of GDP per capita since about 1990.

Figure 2: Underweight children as a function of GDP per capita (percent)



Note: Equation: y = 86.2833 – 8.8428 * ln(x); R-squared = 0.5075; standard error = 8.4
Source: IFs Version 6.57 using World Development Indicators data (most recent by country).

In summary, the CRA project and other studies (e.g., Laxminarayan, Chow and Shahid-Salles 2006; Prüss-Üstün and Corvalán 2006) have now provided guidance for identifying links between selected risk factors and specific health outcomes, making possible their inclusion in forecasts of future health. For example, childhood undernutrition is associated with a range of communicable diseases, and obesity with certain chronic diseases (Gaziano et al. 2006, Narayan et al. 2006).

However, a number of factors complicate quantitative analysis of proximate risk factors. First, the risk factors vary with respect to the size of their impact on health outcomes, their susceptibility to human intervention and the degree to which they change independently of the distal drivers. Second, existing risk assessment analyses have not fully taken into account competing risks (the possibility that those saved from one cause of death will simply die from another) in their estimated relationships (Laxminarayan, Chow and Shahid-Salles 2006). And finally, data for some factors are very limited. For these reasons, and because all modelling is time and other-resource limited, we currently incorporate only a subset of Comparative Risk Assessment proximate risk factors in our forecasts, as indicated by the asterisks in Table 3.

The effort to determine the magnitude of intervention, again trying to be aggressive but reasonable, led to an approach with great potential in long-term analysis across many countries and many development domains, not just health. The approach looks to the information gained by cross-sectional analysis across countries that are widely disparate in their development levels, as indicated (albeit crudely) by level of GDP per capita.

Figure 2 illustrates the approach. Risk factor estimates often vary quite dramatically across countries at the same general level of development. The figure shows the percentage of children who are underweight relative to GDP per capita. In 2005, both Honduras and India had GDP per capita of just over US $3,000 at purchasing power parity (PPP). Yet the most recent WHO estimates of childhood undernutrition differ strikingly for the two countries—8.6 percent in Honduras compared to 43.5 percent in India in 2006. The reasons for unexpectedly high or low undernutrition rates in relation to per capita income in particular regions or countries often remain unclear; historically South Asia has been a particular outlier.

One way to quickly summarize the extent of cross-country variation for a risk factor is the standard error relative to the regression line (the equivalent of the standard deviation relative to a mean) in a relationship like that of Figure 2. The standard error of 8.50 compared to a mean underweight percentage of 16.1 suggests that values for undernutrition

frequently vary by about 50 percent above or below the values expected based on GDP per capita. In contrast, relative to income-based expectations, the variation around female smoking, where the relationship with income is extremely weak, is nearly 80 percent.

Determining aggressive but reasonable target values for any policy lever or target can draw on such understandings of cross-national variation. In the PPHP health volume, for example, the high and low scenarios for undernutrition are 50 percent, or roughly one standard error above and below the cross-sectionally estimated function, and the range of variation for other health interventions is similarly linked to the magnitude of the standard errors for those risk factors. Although in rather traditional counterfactual analysis we explored near-immediate movement of proximate drivers to theoretical minimum levels, our focus was on phased-in human action at aggressive but reasonable levels.[8] The primary health policy scenario package developed for that volume and used in this analysis involved such interventions on eight proximate drivers, combined with a comparable acceleration of overall technological advance at the distal driver level.[9]

We have subsequently developed procedures for specifically targeting interventions to reach levels at or above a value tied to the cross-sectional function. For instance, the target value could be set at or above the function for 'good practices' (that is, at least average for countries at a given level of income) or 1.0 standard errors above the function for 'very good practices' (roughly falling into the top third of countries). In fact, we typically use the 1.0 standard error level for analyses of aggressive but reasonable interventions.

Building infrastructure: improving access

The PPHP infrastructure volume combines two approaches to defining policy initiatives. The first looks to normative or aspirational targets. The MDGs, for instance, included such targets for water and sanitation through 2015. Dates for other infrastructure targets vary in the literature, but to impose some consistency we set the target date for the other goals at 2030. And, because it is effectively impossible for any country to meet truly universal targets, we used a level of 97.5 percent for those goals that specify universality of access (namely energy, water and sanitation, and ICT). That gave rise to the following set of global targets:

- **Transportation**
  - Reduce by half or to below 10 percent (whichever comes first) the percentage of the rural population living more than two kilometres from an all-season road between 2010 and 2030.
- **Energy**
  - Provide universal access to electricity by 2030.
  - Eliminate the use of solid fuels as the primary source for heating and cooking in the home by 2030.
- **Water and sanitation**
  - Reduce by half the percentage of the population without access to improved sources of water and sanitation between 1990 and 2015.
  - Provide universal access to improved sources of water and sanitation by 2030.
- **ICT**
  - Provide universal access to mobile telephones and broadband by 2030.

These goals proved, of course, to be unreasonably demanding for many countries, and we therefore turned also to the second approach, the standard error approach, discussed earlier, to create an aggressive but reasonable scenario, again looking for values one standard error above (or, in cases such as reducing the number of those without access to safe water, below) cross-sectionally estimated target functions.

Strengthening governance: security, capacity and inclusion

To this point, all interventions discussed deal with the actions of governments—in interaction, of course, with firms and households. But the character of governance itself is well understood to affect human development. The forthcoming fifth volume of the PPHP series conceptualizes governance in three dimensions—security, capacity and inclusion—and explores specific operationalizations of each. Security is operationalized with two different and generally complementary measures: the probability of domestic conflict and the vulnerability to conflict. Capacity is operationalized in terms of

8 See Chapters 5 and 6 of Hughes, Kuhn, Peterson, Rothman and Solórzano 2011 for analysis that concludes that such policies might avert approximately 203 million deaths over the horizon through 2060 and avoid about 4.2 billion discounted years of life lost compared to a base case. This is somewhat less than half the total with more static counterfactual analysis and is, we would argue, a more policy-relevant figure.

9 We focused that technological advance on chronic diseases and somewhat retarded advance in communicable disease mortality reduction to limit its impact there.

governments' ability to mobilize revenues (up to 30 percent of GDP) and to use it effectively (looking especially to low levels of corruption). Inclusion is operationalized in terms of the democratic character of institutions and also broader inclusiveness, as represented by the Gender Empowerment Measure (GEM) of the UN Human Development Reports.

Within the voluminous literatures on how these three dimensions affect human development, we can point to Alesina et al. 1996; Bozzoli, Brück and de Groot 2010; Collier 1999; Gates et al. 2010; and Polacheck and Sevastianova 2010 with respect to the costs of insecurity for economic growth and broader development; to Aidt 2009, Knack and Keefer 1995, North 1990, de Soto 2000, and Tanzi and Davoodi 2002 on measures of capacity (such as corruption and rule of law) and development; and to Barro 1996, Doucouliagos and Ulubaşoğlu 2008, Lijphart 1999, Olson 1993, Przeworski and Limongi 1997, and Przeworski et al. 2000 for different perspectives within the contentious debate around the impact of democracy (as a key element of inclusion) on development.

For interventions in this area, we created a strengthened governance scenario by combining 'brute force' and standard error approaches to specify the following changes relative to the base case scenario.

- **Security**: Probability of internal conflict reduced to zero over 20 years.
- **Capacity**: Government revenues increased in non-Organisation for Economic Co-operation and Development (OECD) countries by 10 percent (about three percentage points of GDP) over 20 years relative to the base case. Over 10 years, corruption reduced and governance effectiveness and regulatory quality increased globally to one standard error above values typical for each country's level of per capita GDP.
- **Inclusion**: Measures of democracy and gender empowerment moved, over 10 years, to one standard error above values typical for each country's level of per capita GDP.

POLICY INTERVENTION: GOOD PRACTICE AND AGGRESSIVE BUT REASONABLE POLICY

As indicated earlier, it is unusual to undertake policy analysis across many countries and issue areas. The preceding section of this paper has identified some of the difficulties in doing so and indicated approaches for dealing with them. The challenges include the fact that, even in a model as large and broad in scale as the IFs system, there are unlikely to be policy levers as specific as those policy makers actually attempt to use; more likely we will find variables in the system that represent the general targets of those much more specific levers. Many of those variables are identified above, drawing upon experience in the PPHP series.

Another challenge is determining appropriate magnitudes for policy interventions. We have attempted to identify aggressive but reasonable target values whenever possible, rather than relying on absolute normative targets that generally fail to take into account the starting points of countries and the possible dynamics of the systems on which they act. One approach we developed for this purpose relies on cross-sectional functions relating the target variable to development level, and using the function itself, or some number of standard deviations above it, as such a reasonable target.

Such an approach will not, however, work well for all policy interventions. For instance, the prevalence of diseases such as HIV/AIDS and malaria is linked as much or more to historical path dependencies and geographic factors, favourable or unfavourable to specific disease vectors, than to development levels. In such instances, informed 'brute force' multipliers on variables we wish to move remains the logical approach to setting intervention magnitudes.

Timing of phase-in for interventions remains a largely subjective judgement. Much policy analysis consists of comparative static approaches in which an intervention is made and a new equilibrium is considered by effectively ignoring other changes that would occur over time in a real-world system. The approach here is to represent the temporal dimension somewhat more realistically across all the interacting systems of IFs.

Work across the five PPHP volumes has gradually refined and extended thinking about, and the ability to create, aggressive but reasonable policy interventions. The set of leverage points in the poverty volume (see Table 1) has not changed dramatically, but interventions have become more refined in terms of the detail of policy level and the specification of magnitude. Table 4 identifies 12 clusters across leverage points, some primarily domestic and others primarily international, explored in the rest of this paper. The next section will consider the separate impact on human development of each cluster, as well as some of the more powerful individual intervention points, and the implications of broader development strategies across the clusters.

Most important for this analysis is the fact that the effort to consistently identify aggressive but reasonable interventions across policy sectors, regardless of the specific mechanism(s) for doing so, begins to move policy analysis from a comparison of apples and oranges to a comparison of apples and apples. If all policy interventions in Table 4 were government expenditures, comparative analysis would be simple—but large numbers are not, hence the need for careful attention to some other metric for comparison.

3. ALTERNATIVE HUMAN DEVELOPMENT FUTURES

Because development policy requires much lead-time to implement effectively, and even more to have real impact, the time horizon of the PPHP series has been 2060. Similarly, we believe that the next generation of global development goals should look out to at least 2040 and probably to 2050, although the target year almost certainly will be 2030. The analysis here, because of the interests of the UNDP Human Development Report Office, will use a time horizon of 2050.

Assessing the impact of policy interventions requires a base case scenario for comparison. This is described first, followed by a consideration of the relative implications of each policy cluster and of some of the individual interventions. The paper then looks at how much impact large packages of development-oriented interventions, at more limited levels and also at high levels, might have. It also considers the manner in which the interventions might affect the individual dimensions of the HDI (a long and healthy life, knowledge and a decent standard of living). In each case, we will consider patterns for countries at different income levels or in different regions.

THE BASE CASE SCENARIO

A range of global transitions drives our base case forecasts of ongoing improvements in human development. Incomes continue to rise, driven in part by technological advances and diffusion globally. Education and health levels increase as incomes improve and reinforce economic growth. Advances in infrastructure and improved governance further propel productivity gains in mostly virtuous cycles.

Table 5 outlines some important characteristics of the base case by issue area and variable. Although the IFs base case changes somewhat over time as data and the IFs system of models evolve, there is considerable stability in its overall behaviour. Thus, the base case generally demonstrates continuity with historical patterns (including the development policies that have been pursued in recent decades). Even so, its complex dynamics—including a wide range of nonlinear relationships—provide a structure that can also generate nonlinear future patterns that differ considerably from historical trajectories. The base case of this paper is very close to that presented in previous Human Development Report research (Hughes, Irfan, Moyer, Rothman and Solórzano 2011).

The IFs base case scenario shows steady growth of the HDI across countries at all current levels of the index (see Figure 3), with the greatest growth, in both absolute and relative change, likely to be for those countries now at what the UN Human Development Reports characterize as low HDI levels.

Table 4: Clusters of policy intervention levers for comparative analysis in IFs

Primarily domestic levers	Primarily international levers
1. Demographics	*8. Trade*
Fertility Reduction	Low Protectionism
High Female Labour	Export Promotion
2. Savings/Investment	*9. Foreign Investment*
High Investment	High FDI
3. Domestic Transfers	High Portfolio Flows
High Transfers	*10. Household Transfers*
4. Human Capital	High Remittances
High Education Spending and Targets	*11. Intergovernmental Transfers*
High Health Spending and Targets	High Foreign Aid
5. Infrastructure Capital	High international financial institution flows
High Infrastructure Access	*12. Technology*
6. Knowledge Capital	High Technology
High R&D	
7. Social Capital/Governance	
Low Internal Conflict	
High Govt Revenues/Low Corruption	
High Democracy and Inclusion	

Note: The intervention levels for the levers in the clusters are those from the PPHP volumes, as reviewed in the text.

Figure 4 shows HDI progression in the base case scenario by regional groupings defined by the Human Development Report Office (consisting mostly of countries with low, medium and high HDI levels, and excluding almost all very high HDI countries)[10] and displaying also the very high HDI countries as a separate grouping. In part because of the saturation effects built into the structure of the index, there is less growth potential in countries with currently very high HDI levels, and there is almost certain to be ongoing catch-up of countries currently at lower levels. See Hughes, Irfan, Moyer, Rothman and Solórzano (2011) for discussion of these saturation elements in the index structure and also for forecasts of its individual component elements.

10 The UNDP Human Development Report Office categorization places a few countries, such as Argentina and Chile, in both regional groupings and the very high HDI category.

Table 5: International Futures, Base Case characteristics

Economy	Global GDP growth ranges from 3-3.5% annually	Economic production continues to diversify towards services and ICT	International trade as a percentage of GDP ticks up about 0.5 percentage points annually	Foreign Direct Investment as a percentage of GDP increases at nearly 0.04 percentage points annually	Foreign aid more than doubles in 40 years from $US 6 trillion to over $US 12 trillion
Population	Fertility rates decline in all regions	Life expectancy improves in all regions	Migration trends are extrapolated from historical patterns		
Education	Primary education gross enrollment rate is over 100% by 2025	Secondary gross enrollment levels reach 80% by 2025	Tertiary gross enrollment rate is over 35% by 2040	World literacy levels are over 90% by 2030	
Health	AIDS deaths fall to less than 1 million people annually by 2045	Communicable disease deaths decrease by half by 2040	Non-communicable disease deaths increase 1.5 times over 35 years	Global smoking rates decline to the level in 1980 in 25 years	
Governance	Political freedom increases at the global level	Economic freedom increases at the global level	Democracy advances	Corruption is reduced	Efficacy and rule of law are improved
Technology	Energy efficiency improves by 0.8% annually for first 15 years, then more quickly	Energy production costs decrease exogenously, differently for each type covered (coal, oil, gas, hydro, nuclear and other-renewable)	Global convergence of productivity to system leader in technology		
Agriculture	Cereal yields improve globally by about 0.03 tonnes per hectare per year	Overall crop land increases by about 1 million hectares per year	Overall grazing land increases by about 2 million hectares per year	Overall fish harvest remains constant	
Energy	Energy from oil, gas and coal dominate global production for the next two decades	Renewable energy production surpasses any single fossil fuel by 2045	Hydro and nuclear energy production stagnate		
Environment	Annual carbon emissions grow for the next 2-3 decades then decline	Carbon build-up in the atmosphere grows throughout the first half of the 21st century, going beyond 500 PPM by 2050	Percent of population with no access to safe water below 10% by 2050	Global fresh water use reaches 10% of annual renewable water resources by 2050, over 100% in North Africa by 2025	Indoor solid fuel use decreases below 20% of global population in 2050

Source: IFs Version 6.43

THE IMPACT OF AGGRESSIVE BUT REASONABLE POLICY INTERVENTIONS

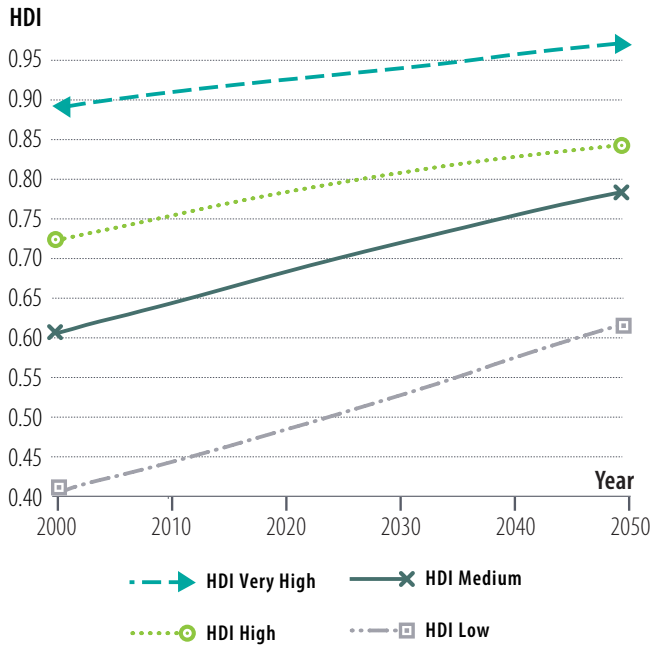
Using the base case scenario as a point of reference, Table 6 shows the implications for the HDI in the Human Development Report Office country groupings, and the world as a whole, of the 12 clusters of policy interventions that Table 4 and the supporting discussion identified. A number of conclusions can be drawn.

As Figures 3 and 4 showed, the momentum of HDI growth with current policy patterns in the base case scenario boosts HDI values (within the index's 0-1 range) considerably between 2010 and 2050. On a global basis, current policy patterns take it from 0.632 to 0.758. Most significantly, values for sub-Saharan Africa rise from 0.402 to 0.612, a remarkable 0.210 points in just 40 years. In many respects Africa is moving into a 'sweet spot' of development, where catch-up with more developed countries can occur on many dimensions (Hughes 2001; Cilliers, Hughes and Moyer 2011).

The momentum of HDI growth with current policy patterns adds considerably more to the value of the HDI between 2010 and 2050 than any single policy cluster can incrementally add to the base case value for 2050. For instance, human capital interventions in sub-Saharan Africa add more to its HDI value in 2050 (taking it from 0.612 in the base case to 0.651 with aggressive but reasonable human capital interventions) than does any other cluster of interventions in any other global region. Yet, sub-Saharan Africa's 0.210 point rise between 2010 and 2050 in the base case greatly outstrips that 0.039 point incremental increase.

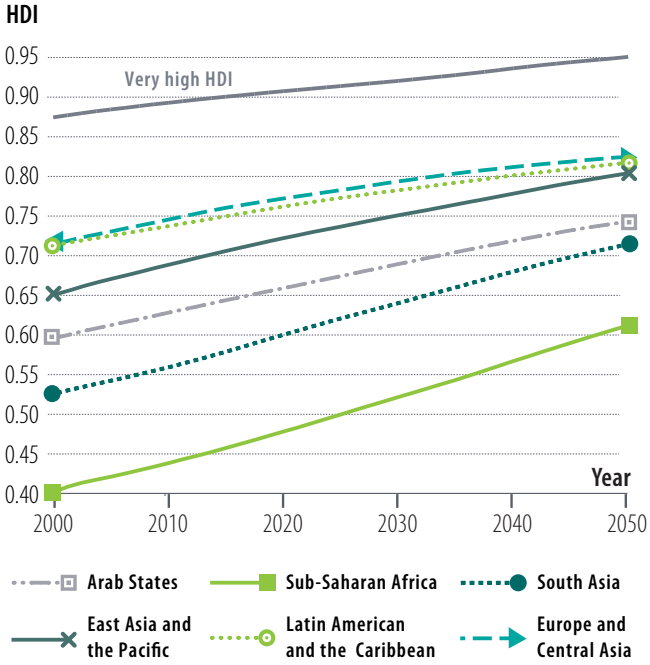
In fact, the fully integrated set of interventions across all 12 clusters adds less to values in 2050 relative to the base case than does normal base case growth from 2010 to 2050. For instance, for South Asia (the region of second largest growth anticipated in the base case), the HDI in the base case rises by 0.189 points (from 0.526 to 0.715), whereas the fully

Figure 3: HDI base case scenario forecasts by current HDI level



Note: HDI level categories from the Human Development Report Office, April 2012.
Source: IFs Version 6.57.

Figure 4: HDI base case scenario forecasts by Human Development Report Office country groupings



Note: HDI regional groupings from the Human Development Report Office, April 2012.
Source: IFs Version 6.57.

integrated intervention adds a further 0.074 points (and in sub-Saharan Africa it adds 0.094 points).

Although the incremental impacts of policy interventions may seem relatively small in comparison to base case growth over the period, those increments are more than 10 percent of the HDI values of sub-Saharan Africa and South Asia in 2050 (and 15 percent to 20 percent of their HDI values in 2010). They thus would have very significant impacts on human well-being, as will be seen in considering the individual components of the HDI.

The biggest contributions of the individual policy clusters are those made by human capital interventions. This is true in every global region. Moreover, the impacts of improvements in this area significantly outstrip the individual impacts of other clusters.

The second largest impact (especially in sub-Saharan Africa) comes from the demographic cluster, a combination of lower fertility rates and higher female formal labour force participation rates. The global impact of higher savings/investment rates follows, as do social/capital governance interventions and greater trade.

All other categories of intervention except domestic transfers make positive contributions to the global HDI relative to the base case scenario. The contributions (except for human capital) are, however, relatively modest, and they vary by region. Not surprisingly, for instance, intergovernmental transfers add 0.011 points to the HDI of sub-Saharan Africa and 0.001 to South Asia, but have no effect on very high HDI countries, which are donors rather than recipients.

The search for silver bullets in the effort to accelerate human development—that is, for those measures that can have great impact, ideally with low cost—is unending. Identification of prospective silver bullets changes over time and across philosophical viewpoints. In recent years, the two most prominent candidates, in addition to the classics of trade and financial flow liberalization, tend to be improved governance, by which is generally meant some combination of reduction of corruption, protection of property rights and liberalization of markets; and increased and more effective foreign aid, given considerable attention in the Millennium Project's recommendations for meeting the MDGs. However, the results reported here (see again Table 6) strongly suggest there is no silver bullet for development among the interventions examined. Almost all make some contributions to human development, but the increments associated with each cluster individually are fairly modest.

Table 6: HDI forecasts for 2050 comparing the base case scenario, individual clusters of policy interventions and combined ('fully integrated') interventions

	Arab States	East Asia and the Pacific	Europe and Central Asia	Latin America and the Caribbean	South Asia	Sub-Saharan Africa	Very High HDI	World
Base case scenario	0.742	0.804	0.825	0.817	0.715	0.612	0.951	0.758
Intervention clusters:								
1. Demographics	0.745	0.803	0.825	0.817	0.715	0.626	0.951	0.766
2. Savings/investments	0.746	0.804	0.830	0.823	0.721	0.625	0.952	0.764
3. Domestic transfers	0.742	0.804	0.825	0.817	0.715	0.612	0.951	0.758
4. Human capital	0.772	0.819	0.838	0.836	0.743	0.651	0.968	0.784
5. Infrastructure capital	0.742	0.806	0.829	0.821	0.723	0.609	0.953	0.761
6. Knowledge capital	0.742	0.805	0.825	0.817	0.716	0.612	0.951	0.759
7. Social capital/governance	0.762	0.815	0.837	0.833	0.725	0.613	0.955	0.763
8. Trade	0.742	0.808	0.826	0.821	0.725	0.613	0.955	0.763
9. Foreign investment	0.746	0.804	0.828	0.823	0.716	0.617	0.949	0.760
10. International remittances	0.743	0.804	0.826	0.818	0.715	0.612	0.951	0.760
11. Intergovernmental transfers	0.743	0.804	0.825	0.818	0.716	0.623	0.951	0.762
12. Technology	0.746	0.807	0.883	0.821	0.718	0.616	0.951	0.762
Fully integrated interventions	0.804	0.839	0.866	0.876	0.789	0.706	0.982	0.824
2010 for comparison	0.596	0.651	0.715	0.713	0.526	0.402	0.875	0.632

Note: Using Human Development Report Office country groupings.
Source: IFs Version 6.57.

At the same, time, however, the results clearly support the conclusion that, in combination, the interventions provide significant leverage for policies by 2050. For example, on a global basis, more than 300 million fewer people would live in extreme poverty at mid-century with a combined package of these interventions than in the base case scenario.

This finding provides some independent support for the approach advocated by the Millennium Project report. The plan proposed by the project's large team, led by Jeffrey Sachs, was not labeled a 'big push', but it is in fact an exemplar of that development strategy, and is an aggregation similar in many ways to our scenario with fully integrated interventions. Collier (2006, p. 121; 2007), while disagreeing with the emphasis Sachs put on aid, also suggested the need for a big push country by country. There appear to be synergies across individual interventions.

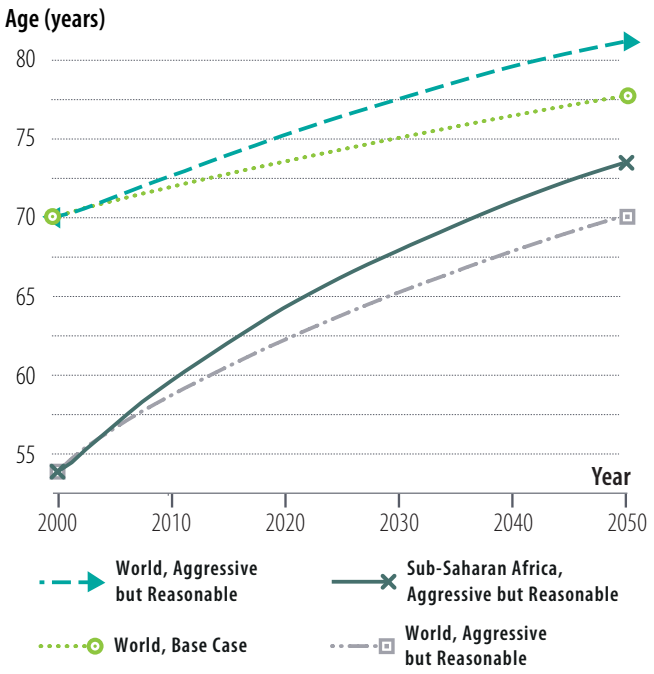
Why would there be such synergies and what are they? The most obvious and important synergy arises because many of the interventions support economic growth. When one intervention increases economic growth relative to the base case, almost all other interventions take place on a higher base of capabilities (both financial and sociopolitical). For instance, education and health expenditures rise with GDP, so an incremental percentage rise of them within a society already growing faster as a result of FDI or foreign aid will work from a higher base. There are also interacting positive feedback loops via broader human development variables, such as the impact of education on fertility and economic growth.[11]

The HDI is, of course, a composite representation of human development using the geometric mean of three sub-dimensions—long and healthy life (indicated by life expectancy), knowledge (as measured by mean years of schooling for adults age 25 and older and expected years of schooling for an elementary school entrant), and a decent standard of living (as measured by the log of GDP[12] per capita at PPP). In order to better understand the ways in which the policy interventions affect the HDI, it is important to look at the manners in which they affect each of the three sub-dimensions separately.

11 Mehrotra and Delamonica (2007, p. 5) argue that such positive feedback loops across multiple dimensions of social and economic development operate at both micro- and macro-levels.

12 Although the official measure uses gross national income (GNI), the IFs system uses the very nearly identical GDP.

Figure 5: Forecasts of life expectancy at birth in the base case and aggressive but reasonable scenarios for sub-Saharan Africa and the world



Source: IFs Version 6.57.

Aggressive but reasonable initiatives and life expectancy

Given the way it is constructed across policy clusters, the fully integrated intervention set can be the foundation for an aggressive but reasonable scenario to continue juxtaposing with the base case. Figure 5 shows that life expectancy improves quite significantly in the base case scenario itself, increasing globally from 70 years in 2010 to 81 years in 2050, and from 54 years to 69 years for sub-Saharan Africa, largely in response to a forecast of considerable progress against HIV/AIDS and other communicable diseases.

The combined intervention package of the aggressive but reasonable scenario adds about 3.5 more years for the world and for sub-Saharan Africa. Both the strong underlying growth of life expectancy captured by the base case and the inherent tendency for life expectancy advance to saturate as countries catch up with systemic leaders tend to reduce the incremental contribution of the fully integrated policy scenario to longer life. It is important to remember that huge efforts are currently being made around the world to improve health and life expectancy; were such efforts not represented in our base case, the aggressive but reasonable scenario would certainly have much greater absolute impact.

Aggressive but reasonable initiatives and completed education

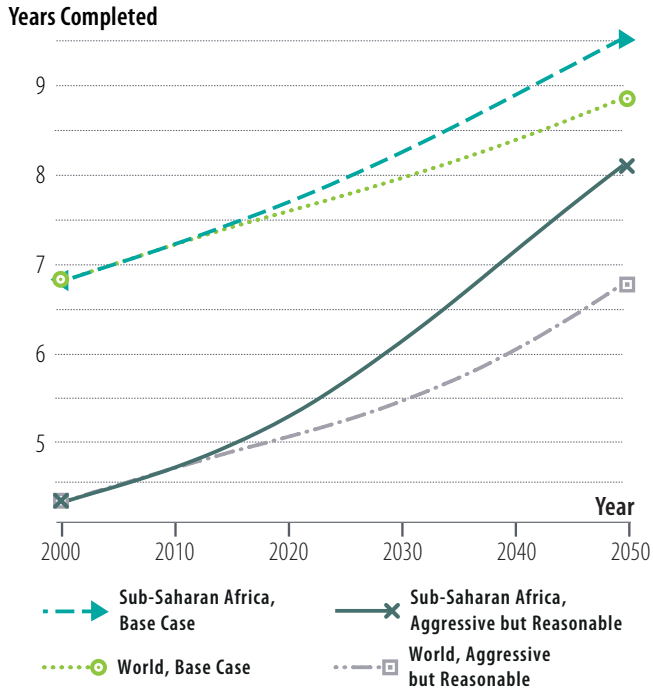
Figure 6 shows that years of formal education attained by adults are also advancing very rapidly in the base case. Globally, years of education attained by the average adult rises from 6.9 years in 2010 to 8.9 years in just over 40 years, and in sub-Saharan Africa climbs from 4.3 years to 6.7 years. Young adults are attaining so many more years of education than their elders that the momentum for such rise is extremely powerful; even if years of education acquired by the young ceased to increase further, the average across all adults would climb for several decades. The aggressive but reasonable scenario adds nearly 0.7 years to the world total in 2050 and about 1.3 additional years in sub-Saharan Africa. Although such increments are less than base case growth between 2010 and 2050, they would have very large impacts; analysis in the second volume of the PPHP series strongly suggested (and documented the pathways through which) additional productivity and economic growth alone would, in the long run, much more than pay for the costs of adding additional capacity in education systems to support such increased enrolments.

Aggressive but reasonable initiatives and GDP per capita

Both improved health and greater education have positive implications for economic growth (just as does economic growth for both of them through the dynamics of positive feedback loops). Moreover, most of the elements of our aggressive but reasonable scenario policy package would raise economic production. Therefore, it is not surprising that Figure 7 shows that the aggressive but reasonable scenario contributes more to GDP per capita in 2050 than does growth in the base case scenario. Globally, GDP per capita rises from $8,800 in 2010 to $17,900 in 2050 in the base case. The combined interventions raise that to $27,950 in IFs forecasts. Similarly, while GDP per capita in sub-Saharan Africa rises impressively in the base case, from $1,700 in 2010 to $5,700 in 2050, at average rates far above the historical rates of the previous five decades, the aggressive but reasonable scenario could more than double that mid-century value, taking it to $13,200.

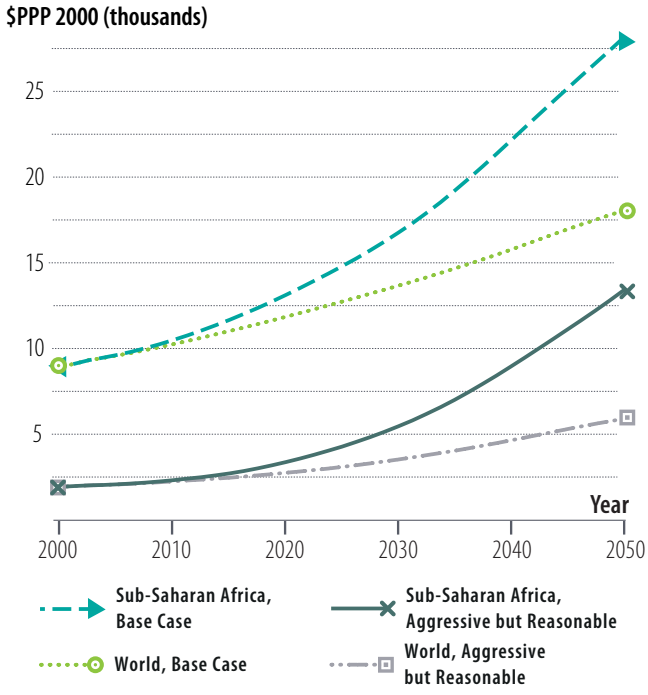
Because the HDI appropriately logs the contribution of income so as to represent the decreasing marginal utility of additional increments at high values, the additions to the base case made by the aggressive but reasonable scenario do not add as much to the index as the underlying rise of the base case. This phenomenon, too, is part of the explanation of seemingly lower impacts of the aggressive but reasonable

Figure 6: Forecasts of years of education completed in the base case and aggressive but reasonable scenarios for sub-Saharan Africa and the world



Note: Values are for adults age 25 and older.
Source: IFs Version 6.57.

Figure 7: Forecasts of GDP per capita at PPP in the base case and aggressive but reasonable scenarios for sub-Saharan Africa and the world



Source: IFs version 6.57.

scenario than of the ongoing base case climb in the HDI. Figures on the differential impact of the aggressive but reasonable scenario nonetheless show the very substantial leverage that its policies have to improve human well-being.

The aggressive but reasonable scenario and regional development

Table 7 extends the analysis to the regional and income-level groupings of the UNDP Human Development Report Office. Although the preceding discussion focused on sub-Saharan Africa, all groupings clearly benefit from the aggressive but reasonable scenario. With respect to education, sub-Saharan Africa benefits the most from the integrated aggressive but reasonable policy package, adding more years and showing a considerably higher percentage gain in 2060 relative to the base case. With respect to life expectancy, the gains are more comparable across regions, with each gaining at least 2.4 years. With respect to GDP per capita, South Asia, and Latin America and the Caribbean experience the largest dollar gains in the forecast, with sub-Saharan Africa showing the largest percentage gain.

The significant increases in GDP per capita in the aggressive but reasonable scenario mean that there also should be a considerable reduction in global poverty, and Table 8 confirms that. In the base case, we expect to see those living on less than $1.25 per day fall by two-thirds from about 1,200 million to about 430 million. It is, of course, harder to achieve incremental gains as numbers become smaller, yet the aggressive but reasonable scenario reduces that number to under 100 million. Because the HDI logs the contribution of GDP per capita, this additional and very important impact of higher incomes in the integrated policy scenario is not as clear in the index as when we look at poverty directly.

Because of the importance that demographic forecasts have to all else, Table 8 also shows population size in the base case and aggressive but reasonable scenarios. The latter reduces fertility more than mortality in sub-Saharan Africa and the Arab States, bringing their populations down somewhat in 2050 relative to the base case. Sub-Saharan Africa is, of course, the region of globally highest fertility, while the Arab States have often used oil revenues to greatly extend life expectancy, but are only more recently lowering fertility. In all other regions, the net impacts of aggressive but reasonable policies on mortality are greater than those on fertility.

Table 7: HDI elements compared in the base case and aggressive but reasonable scenarios: 2010 and forecasts for 2050

	2010	2050			
Life Expectancy (Years at Birth)	Base Case	Base Case	Aggressive but Reasonable	Gains relative to Base Case	
Arab States	69.9	76.7	80.1	3.4	4.43%
East Asia and the Pacific	73.2	80.1	82.5	2.4	3.00%
Europe and Central Asia	71.2	78.3	81.4	3.1	3.96%
Latin America and the Caribbean	74.6	81.1	83.8	2.7	3.33%
South Asia	65.9	76.9	80.6	3.7	4.81%
Sub-Saharan Africa	53.7	69.4	72.9	3.5	5.04%
Very High HDI Countries	80.5	84.9	87.8	2.9	3.42%
World	**70.0**	**77.5**	**80.9**	**3.4**	**4.39%**
Education Years (Age 25+)					
Arab States	5.6	9.0	9.7	0.7	7.78%
East Asia and the Pacific	7.1	9.6	9.8	0.2	2.08%
Europe and Central Asia	9.1	11.6	11.7	0.1	0.86%
Latin America and the Caribbean	7.7	10.5	10.9	0.4	3.81%
South Asia	4.6	6.9	7.6	0.7	10.14%
Sub-Saharan Africa	4.3	6.7	8.1	1.4	20.90%
Very High HDI Countries	11.2	13.5	13.6	0.1	0.74%
World	**6.9**	**8.9**	**9.6**	**0.7**	**7.87%**
GDP per Capita ($1,000 at 2000 PPP)					
Arab States	6.6	12.3	19.3	7.0	56.91%
East Asia and the Pacific	5.3	21.2	29.1	7.9	37.26%
Europe and Central Asia	10.5	19.9	27.8	7.9	39.70%
Latin America and the Caribbean	8.9	17.9	33.1	15.2	84.92%
South Asia	2.9	12.2	28.3	16.1	131.97%
Sub-Saharan Africa	1.8	5.7	14.6	8.9	156.14%
Very High HDI Countries	29.0	45.2	59.3	14.1	31.19%
World	**8.8**	**17.9**	**30.1**	**12.2**	**68.16%**

Note: Using Human Development Report Office country groupings.
Source: IFs Version 6.57.

OFFSETTING ENVIRONMENTAL PROBLEMS

In the research paper that the Pardee IFs Center prepared in support of the 2011 Human Development Report, the authors explored environmental challenge and disaster scenarios (Hughes, Irfan, Moyer, Rothman and Solórzano 2011). In the environmental disaster scenario, the potential environmental problems were so severe that the global HDI fundamentally stagnated between 2010 and 2050, and actually fell somewhat in the second half of the century.

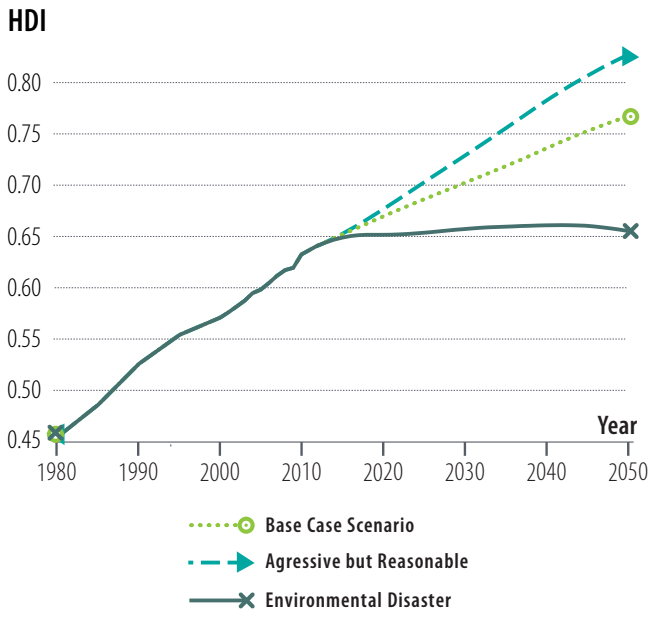
Might the aggressive but reasonable policy scenario offer some protection against such an outcome? Figure 8 suggests that it could. Aggressive but reasonable initiatives do not add as much HDI value to the base case as environmental disaster takes from it, but the package does create a considerably more optimistic scenario, one in which countries and the global system would presumably have much more adaptive capability for addressing environmental problems. One should not, however, make too much of this very preliminary forecast exercise. The specification of interventions for environmental disaster relied heavily on 'proxy' representations of possible systemic environmental impacts and not as much as desired on actual environmental impact pathways. Thus many of the interventions in the aggressive but reasonable scenario quite directly manipulate the same model levers

Table 8: Poverty compared in the base case and aggressive but reasonable scenarios: 2010 and 2050

	2010	2050			
Extreme Poverty (millions)	Base Case	Base Case	Aggressive but Reasonable	Gains relative to Base Case	
Arab States	25.3	17.4	0.8	-16.6	-95.40%
East Asia and the Pacific	211.2	28.7	8.5	-20.2	-70.38%
Europe and Central Asia	14.1	3.5	0.6	-2.9	-82.86%
Latin America and the Caribbean	33.8	32.5	12.7	-19.8	-60.92%
South Asia	557.3	80.7	13.3	-67.4	-83.52%
Sub-Saharan Africa	370.6	267.5	60.2	-207.3	-77.50%
Very High HDI Countries	0.1	0.0	0.0	0.0	NA
World	**1,212.4**	**430.2**	**96.1**	**-334.1**	**-77.66%**
Population (millions)					
Arab States	350.2	608.4	601.9	-6.5	-1.07%
East Asia and the Pacific	1,962.0	2,154.0	2,187.0	33.0	1.53%
Europe and Central Asia	476.0	459.5	472.8	13.3	2.89%
Latin America and the Caribbean	580.60	766.0	770.7	4.7	0.61%
South Asia	1,665.0	2,393.0	2,417.0	24.0	1.00%
Sub-Saharan Africa	808.2	1,869.0	1,570.0	-299.0	-16.00%
Very High HDI Countries	1,121.0	1,207.0	1,287.0	80.0	6.63%
World	**6,849.0**	**9,337.0**	**9,182.0**	**-155.0**	**-1.66%**

Note: Using Human Development Report Office country groupings.
Source: IFs Version 6.57.

Figure 8: Forecasts of the global HDI compared across three scenarios



Source: IFs Version 6.57.

that representation of environmental disaster used, making the obviously desirable combined analysis of elements in the two scenarios not yet possible. In future work we intend to elaborate and extend representation of those actual environmental impact pathways to facilitate more robust mitigation and adaptation analyses.

CONCLUSIONS

This paper has explored the potential for development-oriented policies to increase the pace of progress of human development. It has attempted to examine clusters of policy initiatives individually and comparatively, as well as considering all of them in combination.

Methodologically, the analysis combined use of the IFs modelling system with scenario development that built and explored 12 clusters of policy interventions as well as an integrated aggressive but reasonable policy scenario. The IFs system allowed the analysis of multiple interacting global subsystems, including demographic, economic, education, health, infrastructure and sociopolitical models. Some of its features—including the use of a universal SAM and the

extensive endogenous representation of multifactor productivity—facilitate such analysis of multiple leverage points and the trade-offs and synergies of policy. Our work in support of the PPHP series facilitated the determination of aggressive but reasonable magnitudes for the policies explored, thereby making the policy interventions more comparable.

Substantively, the IFs base case scenario suggests that substantial progress by mid-century is likely with or without the extra push of aggressive but reasonable policies. Much is underway already, and advances in life expectancy, educational attainment and income have great momentum. The gains of the global South relative to the global North are very notable, reinforcing the increasing recognition that after at least two centuries of global divergence in multidimensional development, a process of global convergence is now well underway.

Despite the momentum apparent in the base case, our analysis of potential impacts of more aggressive but reasonable policies suggests that most of the 12 clusters we explored would further enhance human development over time, especially those policies directed specifically at human development, governance and infrastructure. Although the increments that each cluster added to prospective HDI levels in 2050 were not typically very large (we find no silver bullet for development), the policies in combination have the potential to boost HDI levels in sub-Saharan Africa by 0.1 points and South Asia by 0.08 points (more than 20 percent and 15 percent, respectively, relative to today's values), with lesser impact in more developed regions. The clusters substantially enhanced gains already underway in all three sub-dimensions of the HDI; the largest proportional gains were in income, in part because of the saturating character of life expectancy and education. The aggressive but reasonable combined scenario resulted in reducing the global numbers of people in extreme poverty by more than 300 million by 2050 compared to the base case, the numbers living on less than $2 per day by nearly 730 million, and the number of undernourished children by 34 million.

In short, development polices currently in place and being quite aggressively pursued across most of the developing world have made, and are likely to continue to make, lives better in almost all of the world. There still is, however, very large room for improvement beyond the current pattern of initiatives, and aggressive but reasonable policies would greatly enhance the lives of hundreds of millions of people.

ADDENDUM: A CONSERVATIVE BASE CASE

In light of the on-going Great Recession and the apparently long-term nature of the problems it has created for the world economy (in interaction with high existing national debt levels and the growing impacts of ageing populations in large numbers of countries), we decided to explore a more conservative base case scenario. Among the benefits of doing that is understanding how sensitive the results of the paper's analysis are to alternative assumptions.

In the base case used for the analysis earlier in this paper, global economic growth from 2013 through 2040 is very near 3 percent annually, which happens also to be quite close to the long-term global average from the 1970s through today (and slower than that of the 1950s and 1960s). Global growth in our base case then declines somewhat in the 2040s, falling to about 2.5 percent by 2050, as a result of many factors including slowing population growth, peak oil and gas, and narrowing of gaps between much of the developing world and high-income countries. Figure 9a shows the regional picture behind that global average growth of the base case.

The base case growth forecasts in Figure 9 for South Asia and sub-Saharan Africa are, however, sufficiently high that many observers might question them as overly optimistic. And although growth in East Asia and the Pacific (dominated by China) declines over the forecast horizon, it remains quite rapid through 2050.

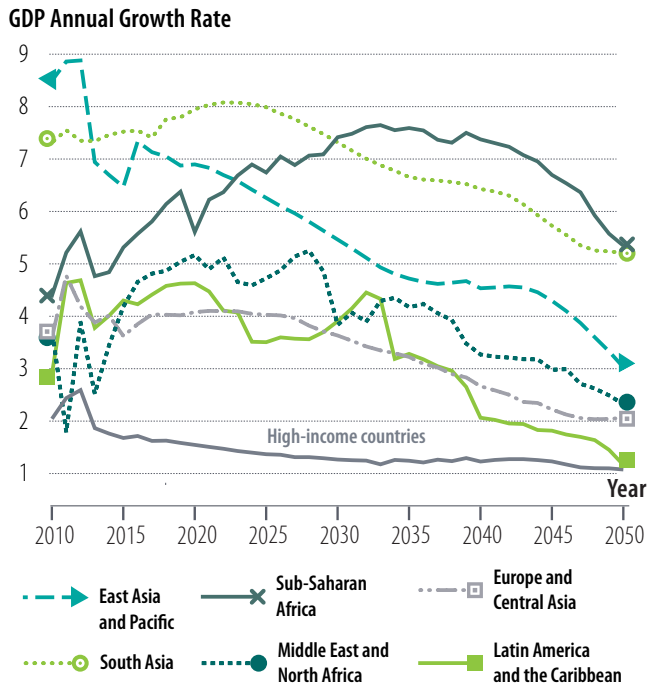
In contrast to the quite steady 3 percent growth of the base case, the global growth rate in the conservative base case begins to diverge from that of the base case in 2013, and steadily declines over the forecast horizon, dropping to 2.5 percent by 2020 and 1.5 percent before 2050. In addition, and with the same rationale in terms of challenging fiscal environments for states around the world, the conservative base case cuts back global educational expenditures by 20 percent relative to the base case and imposes a similar reduction for government expenditures more generally.

Figure 9b shows the regional growth picture of the conservative base case, and it is one of substantially more rapid decline of growth rates in East Asia and the Pacific, early if more moderate decline for South Asia (in contrast, the relative stability of high rates for 15 years in the base case), and fairly strong growth for Africa but without the mid-range acceleration of the base case.

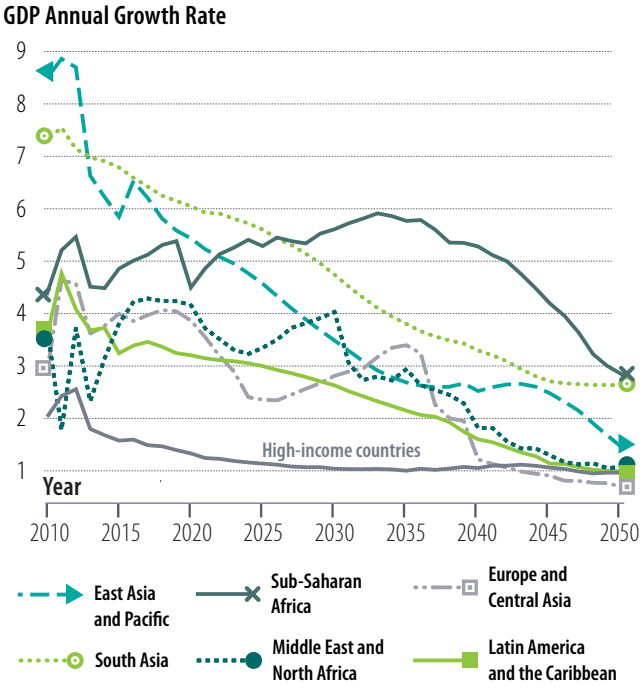
Figure 9c compares the global growth of the HDI in the conservative base case to that of the base case. Even in the base case, HDI growth slows relative to historical progress, in large part because of the saturation effects that this review has described. In the conservative base case, the slowing is considerably more pronounced, and the value in 2050 is 0.043

Figure 9: GDP and HDI under various scenarios

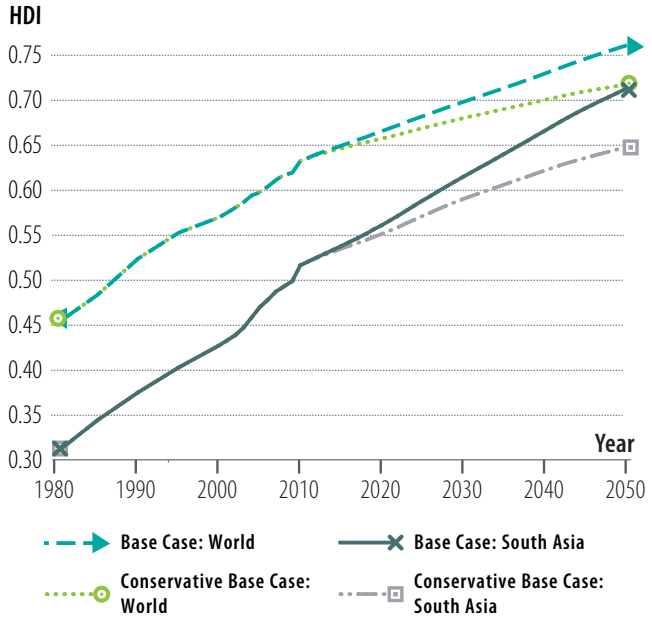
9a: GDP (at market exchange rates) growth in the 'normal' base case scenario



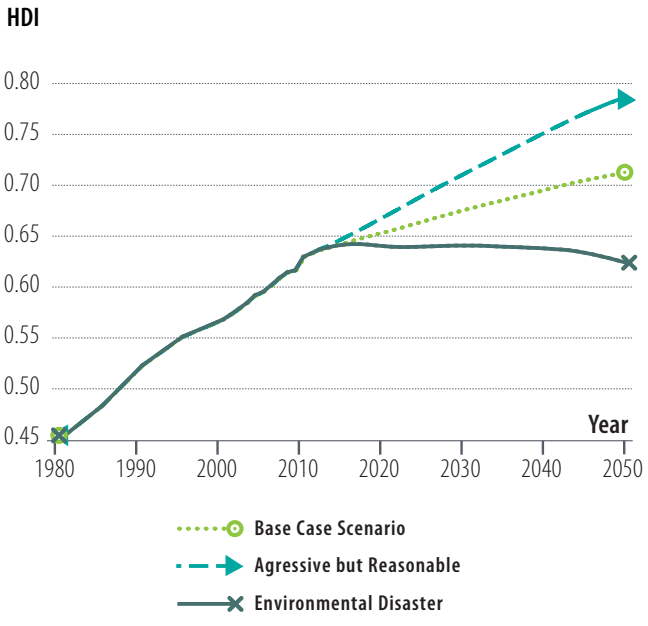
9b: GDP growth in the conservative base case scenario



9c: The HDI in base case and conservative base case scenarios



9d. The HDI in conservative versions of three scenarios



Notes:
1. Regions in these figures are those defined by the World Bank so as to show all high-income countries separately from developing countries of each geographic region.
2. Although this addendum uses Version 6.58 of the IFs system instead of 6.57 as in the main body of the paper, the model is all but identical, and the base case poverty numbers in 2050 are the same.

Source: IFs Version 6.58.

points (more than 5 percent) lower than that of the base case. The Figure also shows South Asia to illustrate the regional impact of this alternative scenario. Instead of clearly converging towards the global pattern as in the base case, the regional values rise much more, nearly in parallel with world values.

All components of the HDI rise less rapidly in the conservative base case. That is most pronounced for GDP per capita, which doubles (at PPP) from $8,770 in 2010 to $17,870 in 2050 in the base case, but rises only to $12,980 in the conservative base case. Whereas expected years of education for adults aged 25 and older climb globally by a full 2 years in the base case (from 6.9 years to 8.9 years), the increase in the conservative base case is 1.5 years. Similarly, years of life expectancy jump by more than 7 years in the base case, but only 6 years in the conservative base case.

Carrying the same changes made to create the conservative base case to the two other major scenarios of this research paper, namely the aggressive but reasonable policy scenario and the environmental disaster scenario, results in the HDI forecasts of Figure 9d. The reader should compare this with Figure 8. Although the differences between the 'normal' and conservative versions of the scenarios are not dramatic (as we have already seen in Figure 9c), they are both significant and important. For instance, in the conservative version of the environmental disaster scenario, the HDI actually declines before 2050, in contrast to the stagnation of the normal base. The normal base case leaves 430 million people in extreme poverty in 2050, but the conservative base case leaves 924 million there.

Some readers will ask why HDI differences are not greater between the two sets of scenarios, particularly given the rather dramatic differences in GDP per capita. The explanation is similar to analysis already provided in the paper. GDP per capita enters the HDI in logged form, and that formulation substantially dampens the impact of the conservative assumptions. Educational advance has huge momentum globally and lower GDP per capita slows that down somewhat, but does not fundamentally alter the forward course—remember that the biggest cost of education is salaries, and that the conservative assumptions lower that cost even as they also lower GDP per capita. Similarly, one large portion of health and life expectancy advances relates to technological progress; another large part to education. GDP per capita is important, but not dominant in the formulations of IFs or the Global Burden of Disease approach—consider the very substantial convergence in life expectancy seen in low-income countries towards that of high-income ones over the last five decades. In short, the results of this paper are quite robust in the face of alternative futures with respect to economic growth.

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