Long-term economic growth and environmental pressure: reference scenarios for future global projections

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Abstract

As a wide range of possible factors can affect economic growth projections, it is useful to identify a set of possible future socio-economic development pathways. This paper describes a consistent methodology to derive (per capita) GDP trend pathways on a country basis. The methodology is based on a convergence process and places emphasis on the key drivers of economic growth in the long run: population, total factor productivity, physical capital, employment and human capital, and energy and natural resources (specifically oil and gas). The paper also compares economic growth projections for a set of Shared Socioeconomic Pathways (SSP) storylines. The per capita GDP growth is projected for more than 175 countries. Given the long-term nature of some of the major environmental challenges, including climate change, the time horizon for the projections is 2100. Finally, the paper investigates the influence of short-term growth rate estimates on the long-term levels of per capita income in various countries. It does so by comparing long-term projections based on short-term forecasts from 2010 with the projections based on the latest forecasts. In this way, the effects of the recent economic crisis, and uncertainty in short term developments, on longer term growth trends are highlighted.

Keywords: Baselines; Growth; Convergence; Climate change

JEL classifications: O41, O44, Q32, Q43

1. Introduction

Future projections of the impact of international environmental policies, such as those related to climate change, are usually presented against a "business as usual" (BAU) baseline or a reference scenario.[1] For instance, the OECD Environmental Outlook to 2050 (OECD, 2012a) describes in detail a set of socioeconomic developments and the related pressures on the environment, and highlights the consequences of policy inaction for key environmental themes. Greenhouse gas emissions pathways resulting from economic reference scenarios are also sometimes used for setting mitigation actions, e.g. by defining pledges in relation to a BAU emission level. However, as a wide range of possible factors can affect economic projections, it is useful to consider different possible developments. This paper presents and compares a range of GDP projections based on different perspectives on future socio-economic developments. The scenarios are based on the Shared Socioeconomic Pathways (SSPs). The SSP storylines have been developed by the climate change research community for the Intergovernmental Panel on Climate Change (IPCC) (O'Neill et al., 2012). They are part of a framework, described in Moss et al. (2010), and van Vuuren et al. (2012), that combines the socio-economic developments defined by the SSPs with Representative Concentration Pathways (RCPs) to assess future climatic changes.

The purpose of this paper is to introduce and apply a detailed methodology for making consistent long-term economic projections for most countries in the world, building on a methodology developed by the OECD Economics Department (OECD, 2012b). The methodology forms the basis of the present *ENV-Growth* model, which starts by mimicking short-term (2012-2016) economic projections of the OECD and the International Monetary Fund (IMF), and then projects a gradual process of convergence towards a balanced growth path along the lines of an augmented Solow growth model (Barro and Sala-i-Martin, 2004). The model follows a so-called *conditional convergence* hypothesis: country income levels (e.g. GDP per capita) will converge towards those of most developed economies based on convergence hypotheses for the key drivers of per capita economic growth. Specific attention is paid to the development of income generated from the exploitation of natural resources, especially crude oil and natural gas.

The methodology is applied to construct pathways of GDP and per capita income levels for more than 175 countries, collectively representing 98.5% of global GDP in 2010. Trend projections are made for each of the SSP scenarios by translating SSP storylines into assumptions on the various drivers of growth. Together, this set of scenarios provides a range of future projections of GDP and per capita income for the rest of the 21st century. The SSP scenarios do not cover the full spectrum of plausible economic projections, but they do illustrate a substantial variance in global GDP levels by the end of the century. The methodology can therefore also serve as a basis for different quantitative assessments that involve economic baselines. The analysis produces long-term trend projections; they are not predictions of future developments. Accordingly, the results should be interpreted with some degree of caution.

The paper is structured as follows. Section 2 describes the main elements of the SSP scenarios. Section 3 introduces the *ENV-Growth* model that is used for making the economic projections. Section 4 discusses the data sources for calibrating the model and the interpretation of the different SSP storylines for the drivers of economic growth. Section 5 presents the resulting income projections for the SSP scenarios. An analysis of the implications of these projections for between-country income

[1] Note that baseline or reference scenarios do not have to be set at BAU levels. For instance, it is not uncommon to set baselines for CDM credits below the BAU emission level (Clapp and Prag, 2012).

inequality is presented in Section 6, while Section 7 investigates the influence that forecasts of short=-term growth rates play in the long-term projections. Section 8 concludes.

2. A brief introduction to SSP scenarios

To date, emissions projections for the future have often been based on the Special Report on Emission Scenarios (SRES) (Nakicenovic and Swart, 2000), developed by the IPCC. As time progresses, projections become outdated, and many of the assumptions underlying the SRES scenarios need to be revisited. For the 5th Assessment Report, the IPCC has asked the international research community to develop new and updated scenarios. This has been done through a collaborative process involving modelling groups and researchers working on i) the climate system; ii) vulnerability impacts, and adaptation (VIA); and iii) Integrated Assessment Modelling (IAM). A broad group of stakeholders, including governments and NGOs, reviews the scenario development process (as laid out in IPCC, 2008), providing a foundation for international credibility and acceptance.

This new scenario framework for the integrated analysis of future climate change comprises two main elements (see Moss et al., 2010, and Van Vuuren et al., 2012): (i) Representative Concentration Pathways (RCPs) reflecting projections for greenhouse gas concentrations and radiative forcing, and (ii) Shared Socioeconomic Pathways (SSPs) describing different combinations of socio-economic developments and their associated levels of greenhouse gases emissions. The SSPs combine both qualitative and quantitative information on possible future developments of emissions and their main socio-economic drivers, and include projections for population and per capita income. They do not contain estimated impacts of climate policies and can therefore all be considered as reference (or baseline) scenarios, reflecting different views on “no climate policy” developments for the 21st century. The SSPs are linked to the RCPs through the specification of a climate policy scenario: a specific SSP without policy would lead to a certain radiative forcing level and in combination with a specific climate policy scenario would bring the forcing levels down to be in line with a specific RCP. [2]

The different SSP storylines are described in O’Neill et al. (2012) and summarised in Annex II. These storylines are constructed around two axes: challenges to mitigation and challenges to adaptation, as illustrated in Figure 1.

In SSP1 (or ‘’Sustainability’’), the challenges for both adaptation and mitigation are low, as relatively rapid income growth is combined with substantially reduced reliance on natural resources. This is achieved at least in part through quick technological change and through high levels of international cooperation. Also, following KC et al. (2010), high levels of education induce lower fertility rates and therefore smaller populations.[3] Consequently, global emission levels are relatively low compared to most of the other scenarios.

In SSP2 (or ‘’Middle of the Road’’), current trends more or less continue, with moderate progress made in terms of income convergence. This implies some emerging economies catch up relatively quickly whereas growth is much slower in the least-developed countries, at least in the first decades.

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[2] Note that not all SSPs can be linked to all RCPs, either because the SSP without policy leads to lower forcing levels than described in the RCP (e.g. if an SSP without mitigation action leads to a radiative forcing level of 7 W/m2, it is incompatible with RCP8.5), or because the required stringency of climate policy involved makes it infeasible to reach very low forcing levels (i.e. if the required mitigation efforts are insufficient to reduce radiative forcing to the desired level).

[3] These demographic elements of the SSPs are made operational in Lutz and KC (2012), and used as exogenous input in the ENV-Growth projections.

Global emissions are projected to more or less follow business-as-usual trends. There are substantial challenges for mitigation and adaptation, but neither is particularly severe.

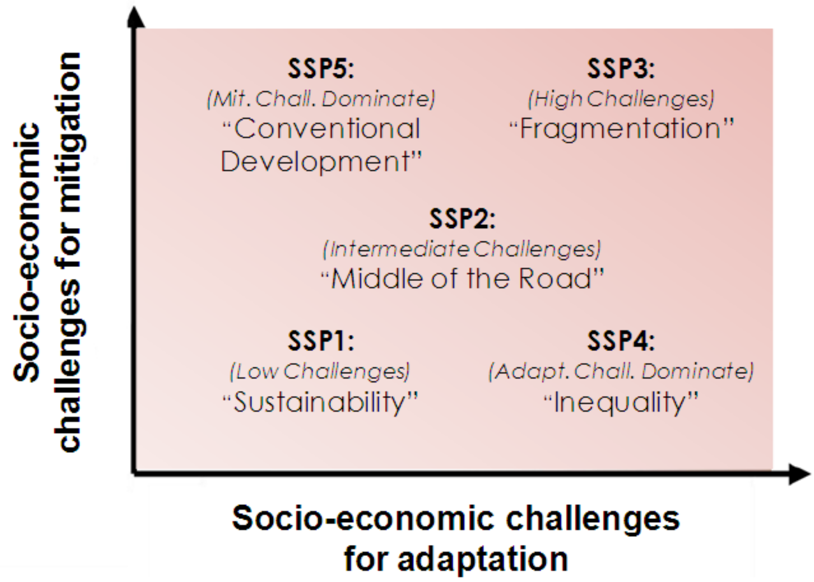
In SSP3 (or "Fragmentation''), economic growth is assumed to be much slower as a combination of multiple causes: lack of international cooperation, slow technological progress, low education levels and high population growth. A lack of development of clean technologies implies high global emission levels and thus severe mitigation challenges. The low income levels in developing countries, in turn, imply severe challenges to adaptation.

SSP4 (or "Inequality'') depicts a world where high-income countries use technological advances to stimulate economic growth; leading to a high capacity to mitigate. In contrast, developments in low-income countries are hampered by very low education levels and international barriers to trade. These limit economic growth rates to rather low levels, implying low levels of per capita income and high challenges for adaptation. As global growth is less rapid than in SSP1, the long-run growth prospects for high-income countries diminish over time, and by the end of the century global emissions are lower than in e.g. SSP3.

Finally, SSP5 (or "Conventional Development'') represents a scenario where countries put full focus on economic development, regardless of the environmental consequences. For high-income countries this means an emphasis on advanced technologies, whereas many developing countries 'fuel' their rapid economic growth with high demand for fossil energy sources. In addition, strong improvements in education levels imply reduced fertility rates and thus relatively small, well-educated populations. This leads to high global emissions and high challenges to mitigation, but the increased income levels in the most vulnerable regions allow for relatively low adaptation challenges.

The narratives for these five scenarios guide the choice of assumptions made in the economic model (e.g. the rate at which total factor productivity will develop over the period), as described in Section 4.

Figure 1. Schematic representation of the SSPs



Source: O'Neill et al. (2012)

3. The ENV-Growth modelling framework

The OECD *ENV-Growth* modelling framework for projecting future global and country-specific GDP levels is based on the assumption that each country gradually catches up to its own frontier level of per capita income that is consistent with its endowments and institutions (Barro and Sala-i-Martin, 2004). This does not necessarily imply that absolute income levels of developing countries will gradually converge towards the income level of the most developed economies, as local circumstances matter. Future GDP projections are then generated using an augmented Solow growth model that includes accumulation of human capital (Mankiw et al., 1992).

The model is based on the "conditional growth" methodology of the OECD Economics Department (Duval and De la Maisonneuve, 2010; OECD, 2012b), which is used to project GDP for OECD countries to 2050. Recently, the OECD Economics Department (OECD, 2012b) has updated this work and refined its methodology. The *ENV-Growth* model starts from this latter work and applies this methodology to a longer timeframe, until the end of the century, and to a larger set of countries, including most non-OECD countries. On one hand the model has also been enhanced to include energy both as productive input as in Fouré et al. (2012) and as a generator of resource revenues for oil and gas producing countries (World Bank, 2011). On the other hand some elements of the Economics Department module are defined exogenously for each scenario since they are part of the SSP storylines.

The model is based on long-term projections of five key drivers of economic growth: (i) physical capital; (ii) employment as driven by demographic trends, labour participation rates and unemployment scenarios; (iii) human capital, as driven by education; (iv) energy demand, as driven by energy efficiency; (v) the patterns of extraction and processing of natural resources (oil and gas); and (vi) total factor productivity (TFP) as an indicator of exogenous technical progress. Gradual convergence of regions towards their technology frontier is projected at a speed of 1-5 percent per year, depending on the driver. Figure 2 depicts the relationships between the key determinants of the model; the main underlying equations are presented in the Annex. The following describes some of the modelling features for each of the key drivers, including details on the convergence mechanisms at play in the model.

Physical capital follows the standard capital accumulation formulation with a fixed depreciation rate. The investment rate per unit of GDP is assumed to slowly converge towards a balanced growth path, mimicking the *golden rule* for savings (which maximises balanced growth consumption levels; Barro and Sala-i-Martin, 2004). The investment rate thus depends on the structural parameters of the production function. An alternative methodology would be to endogenise the dynamics between savings/investments and current accounts as done by Fouré et al. (2012) or by OECD (2012b). However, if the saving-investment relationship were fully endogenised, the capital accumulation process could not be consistent with the storylines underlying the five SSP scenarios without explicitly defining the drivers of changes in savings behaviour (which is only available for OECD countries and a selected set of emerging economies in OECD, 2012b).

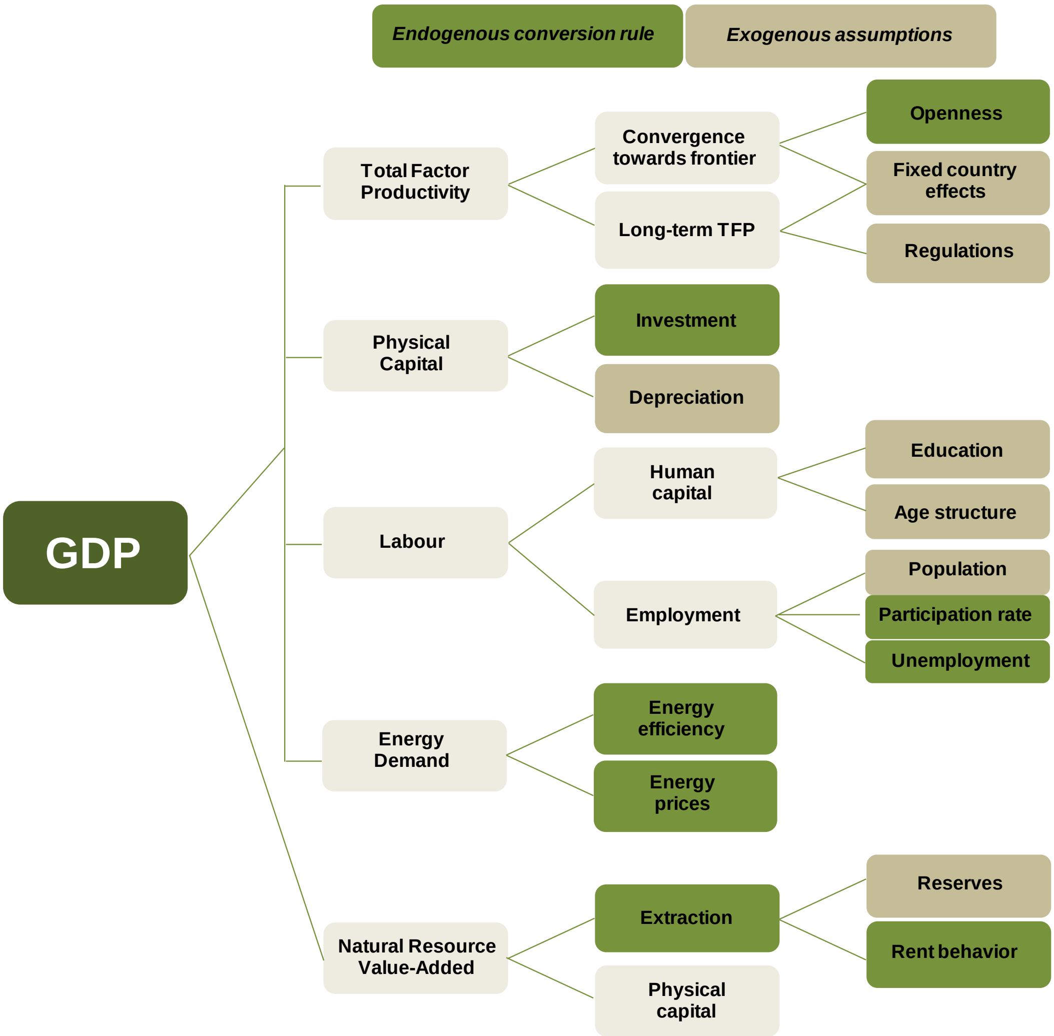
Employment follows detailed demographic trends. Total employment results from the combination of time-dependent trends in population and labour participation rates, which are specific to each age cohort and gender, and with aggregate unemployment levels.[4] The convergence process applies to participation rates by age cohorts and gender, based on various relevant variables such as ratio of

[4] Note that the population and education projections underlying this analysis are constructed simultaneously and capture feedback effects between the two, as in KC et al. (2010).

dependency and education levels[5]. Unemployment levels are assumed to converge very slowly to a common structural level. For most countries, this convergence process is still ongoing by the end of the century.

Human capital improvements are linked to age- and gender-specific education levels. These are converted into a human capital index using mean years of schooling as an intermediate variable, following the formulation of Hall and Jones (1999) as well as estimates from Morisson and Murtin (2010). Increases in the human capital index are reflected in the model through improvements in labour productivity.

Figure 2. Schematic overview of the OECD *ENV-Growth* model



Natural Resources are considered through two channels. First, value added is created by extracting and processing natural resources. The contribution to the GDP of countries that have resources is derived from country-specific resource depletion modules, focusing on oil and gas sectors, inspired by fossil-fuel supply modules used by the IEA. These modules describe the interplay between oil and gas resources, together with parameters reflecting the time evolution of marginal production costs, and are

[5] The methodology on convergence of future participation rates have been simplified compared to OECD (2012b) in order to keep consistency between projections for both OECD and non-OECD countries.

used to project prices and production levels. Second, these natural resources are used as input in production for energy consumers: gains in energy efficiency at the user side therefore act as a driver of economic growth (as more output can be generated by using the same energy inputs). The projection of gains in energy efficiency is based on the law of motion for autonomous energy efficiency improvements as estimated by Fouré et al. (2012), which describes a U-shaped relation between economic development and energy productivity.[6]

As in Solow's (1956) seminal work, the continuous improvement in *TFP* leads to more efficient production as more output can be created with the same combination of primary factors: capital and labour, and, in the case of the ENV-Growth model, natural resources. Specifically, the *ENV-Growth* model features additional input-specific factor productivity for labour (as in OECD, 2012b) and energy demand (as in Fouré et al., 2012). That is, human capital developments (through education) increase labour productivity, while autonomous energy efficiency increases the productivity of energy inputs.

TFP growth is assumed to be a combination of two elements: (i) countries gradually grow towards their long-term TFP frontier (driven by the speed of convergence); (ii) the long-term TFP frontier itself shifts over time. As the long term TFP frontier is country-specific, all countries will grow through both channels (which are often termed "technological catch up" and "technological passthrough", respectively). In that sense, there is no group of "frontier countries" that achieve full convergence. More technologically advanced countries, however, are closer to their frontier and therefore, *ceteris paribus*, grow less rapidly than countries which are less technologically advanced (i.e. whose distance to their long-term TFP frontier is longer).

Following the Economics Department methodology (OECD, 2012b), the speed of convergence towards the frontier is influenced by fixed country effects reflecting a wide variety of country-specific factors, and an international trade openness indicator. For the latter, countries that are more open will have easier access to advanced technologies and learning. Greater country openness can thus boost domestic productivity (Leamer and Levinsohn, 1995; Edwards, 1998) via diffusion of new technologies. The amount of trade between countries is likely to increase with increases in domestic and trading partners' income. Conversely, *ceteris paribus*, larger countries are likely to trade less as they have access to a larger domestic market.

Finally, the country-specific long-term frontier itself depends on a fixed country effect, a global frontier growth rate, and a country-specific product indicator that measures the extent of regulatory barriers to market access and competition (i.e. countries that have less such barriers have more incentives to innovate and can access frontier technologies more easily).[7]

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[6] The logic of the U-shape relation is as follows. Commercial energy consumption is low for low-income countries and then rises rapidly with industrialisation (associated with increased incomes). As countries become richer, access to advanced technologies and further structural shifts towards the services sector imply higher energy productivity.

[7] A useful summary of the link between competition and innovation is in Aghion and Griffith (2005). Empirically, a positive effect of easing anticompetitive regulation on TFP has recently been found at the aggregate level by OECD (2012b) and at the industry level by Nicoletti and Scarpetta (2003), Barone and Cingano (2011) and Bourlès et al. (2012).

4. Model calibration

4.1 Data sources

The first step of the calibration process consists in compiling an historical database for the 176 countries considered. The OECD *Economic Outlook* database (December, 2011 release) is used for OECD countries for the period 1960-2013, while the data for non-OECD countries for the period 1960-2010 draws upon the World Bank *World Development Indicators* (WDI) database (December, 2011 release). All variables in real value terms (GDP, government expenditures) are converted to 2005 USD in PPP using the World Bank International Comparison Program (ICP) exchange rates.

As in OECD (2012b), data and historical trends are extrapolated until 2016 whenever short-term projections are available from either the OECD (2011) or the IMF (World Economic Outlook database – September 2011). The model projections effectively start in 2017. In the few remaining countries that are not covered by these databases, the model projection is directly applied as of 2010.

The labour force database (participation rates and employment rates by cohort and gender) is extracted from ILO (2011) active population prospects (up to 2020) and OECD *Labour Force Statistics and Projections* (2011). The long-term structural unemployment level is assumed to be 2% for all countries. Population and education data were taken from the contribution by Lutz and KC (2012) to the SSP framework; see the Section 4.2.

Historical energy demands were extracted from IEA *Extended Energy Balance* (2011) while the projections of energy efficiency improvements up to 2016 rely on IEA *World Energy Outlook* (2011), and then follow a rule of convergence toward leader economies in terms of energy efficiency. Natural resource rents in the base year 2010 are derived with a methodology similar to World Bank (2011), albeit with updated oil and gas production costs, respectively taken from IEA World Energy Outlooks (2009, 2011). Oil and gas reserves for 2010 are taken from BP (2011). The estimates for conventional resources are extracted from BGR (2010). Unconventional oil resources estimates (including Canada tar sands, Venezuela extra heavy oil and shale oil) are extracted from WEC (2007) while shale gas resources estimates are based on EIA (2011a).

Physical capital stock was built-up from historical investment data series, assuming a 5% annual depreciation rate. The historical total factor productivity and autonomous energy efficiency were derived by inverting the law of motion for GDP and energy demand equations, following Fouré et al. (2012). Following the methodology of OECD (2012b), TFP growth is calibrated to an empirical error-correction model specification, drawing on recent work by Bourlès et al. (2010) and Bouis et al. (2011).

4.2 Interpretation of the economic dimension of the SSP storylines

The GDP projections for the various SSPs can be differentiated by the factors influencing growth, including exogenous demographic trends, education levels, the speed of convergence of income of less developed countries, technological progress, trade openness and long-term savings and investment. The detailed specific assumptions on these factors for each SSP scenario are provided in Table 1.

The assumptions in Table 1 aim to reflect the challenges in climate change adaptation and mitigation as outlined in the SSP storylines. For example, low population growth and high education levels in SSP1, reflect a world in which there are lower challenges for adaptation, while high population growth and low education levels reflect a world with high challenges for adaptation. Similarly, a high technological development in SSP1 reflects a more sustainable world with low challenges for climate change mitigation. The exploitation of natural resources is higher in a scenario with high growth as SSP5, reflecting high challenges for climate mitigation that follow from the intensive use of natural resources.

Table 1. SSP scenario-specific assumptions for key growth drivers

	SSP1	SSP2	SSP3	SSP4	SSP5
TFP-related drivers					
TFP frontier growth	Medium high	Medium	Low	Medium	High
Convergence speed	High	Medium	Low	LI: Medium low MI: Medium HI: Medium	Very high
Openness	Medium	Medium	Low	LI: Low MI: Medium HI: Medium	High
Natural resource-related drivers					
Resources[1]	Conv: Medium Unconv: Low	Medium	Conv: Medium Unconv: High	Low	Oil: Low Gas: High
Fossil-Fuel Prices	Low	Medium	High	Oil: High Gas: Medium	High
Demographic drivers[2]					
Population growth	Low – medium depending on country	Medium	Low - high depending on country	Low - high depending on country	Low - high depending on country
Education	High	Medium	Low	Very low - medium depending on country	High

1. "Conv" stands for conventional; "Unconv" stands for unconventional (shale gas, shale oil, tar oil).
2. Demographic projections are summarised from Lutz and KC (2012).

While assumptions on demographic drivers have been taken from Lutz and KC (2012), those on technological development and natural resources have been adapted to reflect the SPPs storylines. Drivers related to technological development are generally assumed to be greater in scenarios with higher international collaboration and more attention to sustainability. The long-term growth rate at the technology (TFP) frontier is the key driver of growth in high income countries, as these are closer to their frontier and depend less on convergence. This rate is set highest in SSP5 (which focuses on "conventional" economic development), followed by SSP1 (focused on "sustainable" growth), and set at a low value for SSP3 (where technological progress is much less rapid). Similarly, the speed of convergence and trade openness are (very) high in the SSP5, and low in the fragmented scenario SSP3. Assumptions related to TFP drivers in SSP4 (focused on ''unequal'' economic development paths) are differentiated between income groups, namely low-income (LI) countries, Middle-Income (MI) countries, and High-Income (HI) countries, to reflect the regional inequalities and high barriers to international cooperation.[8]

[8] High income countries are based on the World Bank classification of countries (http://data.worldbank.org/about/countryclassifications; for 2010, the threshold for the high income group is 12,275 USD/capita). Middle income countries combine all World Bank upper-middle income countries, and those lower-middle

The exploitation of natural resources, similarly to technological development, is more effective in scenarios in which there is a higher focus on sustainable development. Country-specific natural resource depletion modules are inspired by IEA fossil-fuel supply models; they are calibrated for oil and gas using SSP-specific assumptions on energy prices and extraction rates. These assumptions are based on the energy-related storylines of the SSPs and summarised in Table 1. Energy demand is in principle higher in scenarios with high mitigation challenges (SSP3 and SSP5), and in scenarios with high income growth (SSP1 and SSP5). Unconventional resources are mobilized in SSP3 and SSP5, thereby partially alleviating the mid-term effects of conventional resource depletion.[9] In SSP1, the focus is much more on clean energy sources, rather than oil and gas.

The assumed development of oil and gas prices reflects the degree of scarcity and the underlying switch towards alternative fuels (although these are not explicitly modelled). The short-term trends in oil and gas price are consistent with the IEA Current Policies Scenario (IEA, 2011) and diverge as of 2020. The channels for longer price development are twofold: production costs increase with depletion reflecting technical challenges to access lower grade resources; a Hotelling-like rent follows an exponential increase in the Medium case. In the case of high oil price, the US Department of Energy (DOE) high assumption serves as a calibration basis (EIA, 2011b) and exhibits faster increase to 2050 before levelling off. In the longer run, high and medium prices are capped by the production costs of substitutes for oil and because of ultimate depletion of accessible resources. Alternatively, the lower price time path projects a moderate increase to 2100, reflecting fast uptake of oil substitutes. The long term development of gas prices follows similar patterns to oil prices.

5. Resulting income projections

5.1 A comparison across the SSPs of GDP and income levels

This section presents the main results from the SSP projections, analysing key indicators and growth drivers at global level and for selected regions. These projections provide a basis for quantitative analysis of environmental impacts associated with economic activity, but by themselves ignore the feedbacks from such environmental impacts to the economy. GDP and income (per capita GDP) levels are presented in 2005USD using constant PPPs. Over the century, it is likely that PPP exchange rates would also gradually converge, as productivity gains affect the structure of domestic economies. Projecting such PPP changes over time requires, however, specification of an underlying sectoral model.

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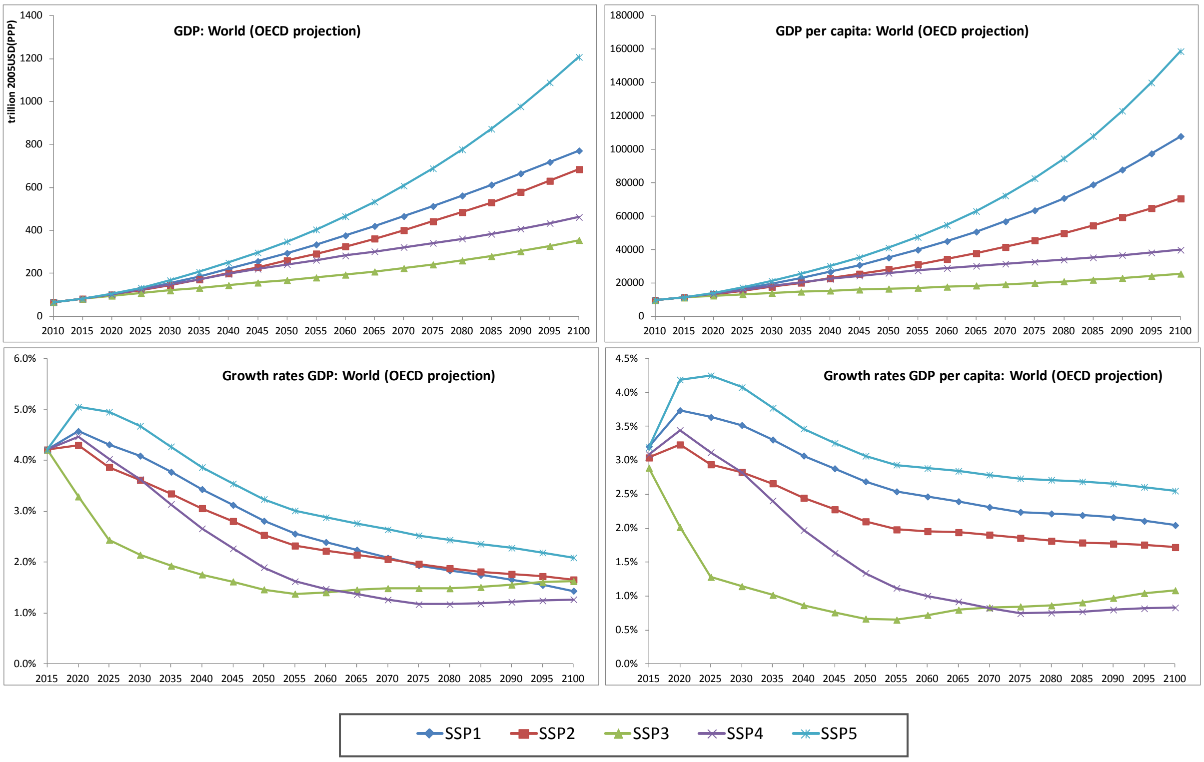
income countries that have (i) at least 2,500 USD/cap income in 2010 (excluding the poorest countries in this group), plus (ii) at least 2% growth projected for 2010-2015 (excluding stagnant countries), and (iii) income above 4,000 USD p.c. or growth above 4% (i.e. identify the high achievers in the group in terms of either income or growth). Low income countries are all other lower-middle income countries plus all low income countries from the World Bank classification. This classification of countries, and especially the thresholds for the middle income country group, is chosen to highlight the elements in the SSP storylines that differentiate between developing countries that have good opportunities to catch up to higher income countries, and countries that are in a more challenging situation.

[9] Following the SSP narratives, the assumption is made that there is no reluctance to use unconventional fossils in SSP3, while there would be constraints to development of unconventional oil, but not unconventional gas, in the SSP5 scenario.

Figure 3. Global GDP (bln 2005USD) and per capita income levels (2005USD) for the 5 SSPs and associated annual growth rates (%/year)



As illustrated in Figure 3, global GDP levels by the end of the century vary substantially across SSPs.[10] The range of global GDP levels at the end of the century varies from just over 355 trillion USD to more than 1200 trillion USD, with SSP3 at the bottom of the range, and SSP5 at the top. This pattern is similar for per capita income levels, even though the population projections vary across scenarios.

SSP5, with its narrative focus on ''conventional'' economic development, projects a global GDP increase by 2100 of more than 18-fold the 2010 level. In this scenario growth rates of per capita income remain well above 2% per annum throughout the century, leading to a 16-fold increase of per capita income by 2100.[11]

SSPs 3 and 4, which represent the scenarios with lowest levels of international co-operation and trade, are at the bottom of the range. They both see marked reductions in global growth of per capita income to around 1% per annum. The drop in global growth occurs almost immediately in SSP3, and around mid-century in SSP4. SSP3 in particular shows very low growth in income (less than a three-fold increase over the century), following the assumptions of low growth rates for the economic drivers in this particular SSP.

SSP1 and SSP2 both have intermediate growth rates. SSP1 presents nevertheless a little higher growth at global level as it assumes a quicker convergence. Further, given the higher population projections in SSP2, per capita income levels diverge more than absolute GDP levels between SSP1 and SSP2.

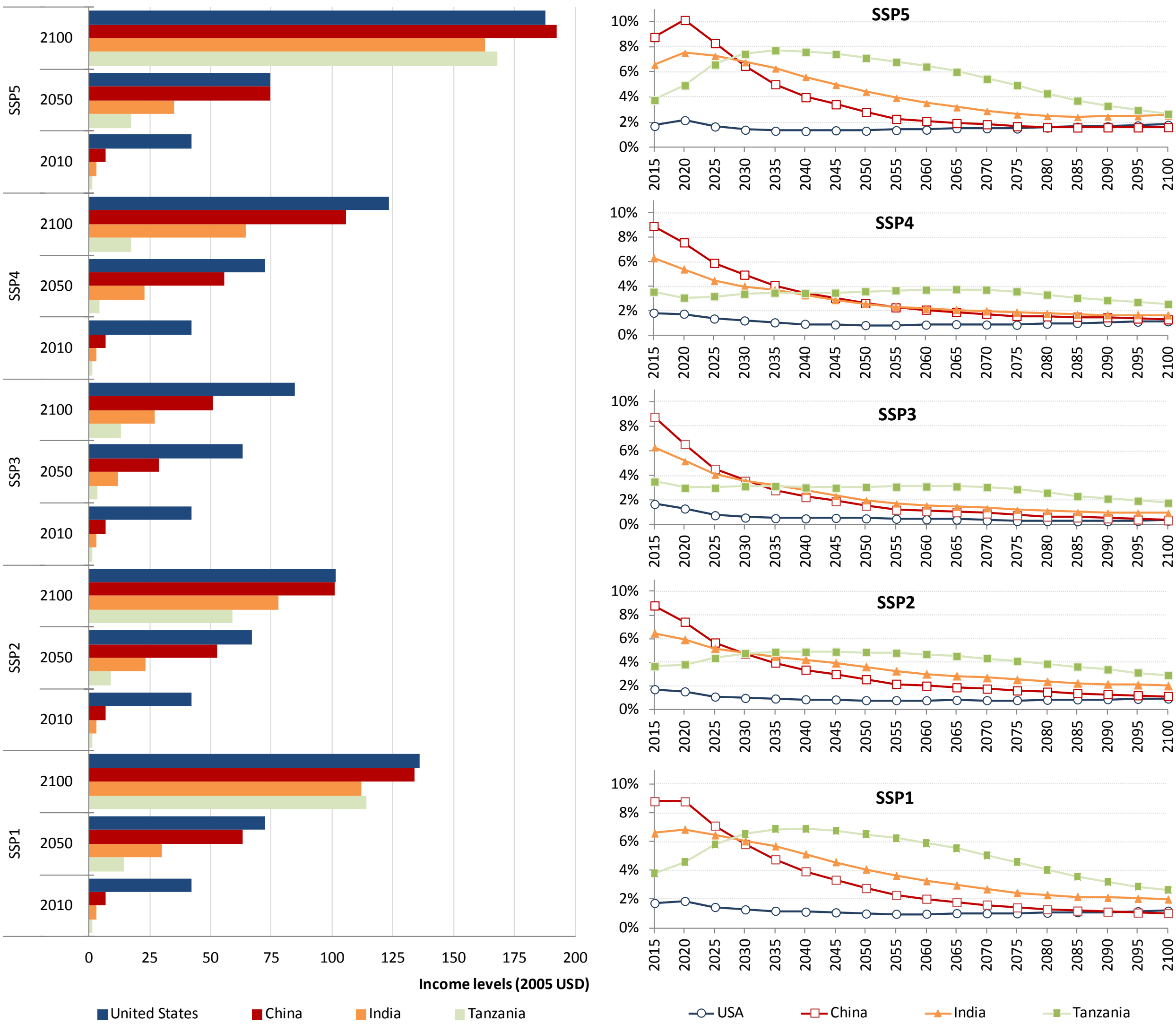
[10] The full set of projections is publicly available at https://secure.iiasa.ac.at/web-apps/ene/SspDb; overview tables of the results are provided in Annex III.

[11] The presented growth rates are average annual growth rates over a 5-year period.

The global ranking between the different SSPs does not hold for all countries. As it is impossible to graphically show the results for all countries, Figure 4, panel A illustrates the income levels in the different SSPs for a few selected countries: USA (an example of a technologically advanced, high-income economy), China (an example of a middle-income emerging economy), India (an example of an emerging economy that currently still has relatively low income) and Tanzania (an example of a low-income developing country). While SSPs 3 and 5 are respectively at the bottom and top of the range for all countries considered, there are substantial differences for the other SSPs. In particular, SSP4 is lower than SSP2 in countries at lower stages of development, such as India and Tanzania, because the development barriers inherent in the SSP4 narrative prevent these countries from converging rapidly. The two SSPs are very similar in the case of China. The figure also illustrates that income convergence is a slow process, as by 2050, Tanzania and India still have substantially lower income levels than China and especially the USA. By 2100, per capita GDP convergence is almost completed in SSP1 and SSP5; the inequalities remain much sharper in SSP3 and SSP4.

Figure 4. Income levels and growth rates in selected countries across the 5 SSPs

A. Income levels (2005 USD) **B. Income growth rates**



The graphs in Figure 4, panel B illustrate how the timing of income growth also differs across countries. For the SSPs with at least medium convergence speed (SSPs 1, 2 and 5), the income growth rates follow a typical convergence pattern. High income economies, illustrated here using the USA as an example, follow a relatively stable growth path, with annual growth declining in the coming decades due primarily to an aging society (which among other things leads to lower overall labour participation rates and hence less employment). Emerging economies such as China and India grow much faster at the beginning of the century, but over time their growth rates diminish as their TFP levels get closer to high-income country levels. The faster they converge (SSP5), the quicker their growth rates diminish.

For China the decline in growth rates is accelerated by the population age structure: unlike India they do not have a large pool of young people that will sustain a large future labour supply to enhance economic development in the coming decades. For the lower income countries like Tanzania the process of convergence is still in its infancy: capital inflows into the economy are still scarce (although the short-term forecast is that capital grows at around 7% per annum in this decade), and returns to capital investments are high. This triggers increasing growth rates and a gradual catch-up in productivity (TFP), which eventually declines again as capital becomes more abundant and TFP levels converge. Thus, a typical hump-shaped growth pathway emerges for most developing countries.

5.2 Details about the drivers of growth

To better understand the differences in results between the SSPs, Figure 5 illustrates the drivers of GDP per capita growth for selected countries; total GDP per capita growth equals the sum of all drivers. Population growth plays a dual role in these projections: on the one hand it can increase labour supply levels (although with aging populations and age-specific participation rates labour supply trends do not strictly follow population trends), and on the other hand it implies that total income has to be divided over more individuals. The "Population" bars in the graph reflect the second role.

The results show that capital is a main driver of growth, together with increases in TFP. Labour supply and human capital also plays an important role especially in the context of low income countries like Tanzania, and countries with relatively young populations such as India.[12] It is also fundamental to consider the reliance on natural resources. In China there is a decreasing reliance on natural resources, especially in SSP1, which reflects a more sustainable future development, although the overall impact on economic growth is not large (and hence the effect is barely visible in Figure 5)[13].

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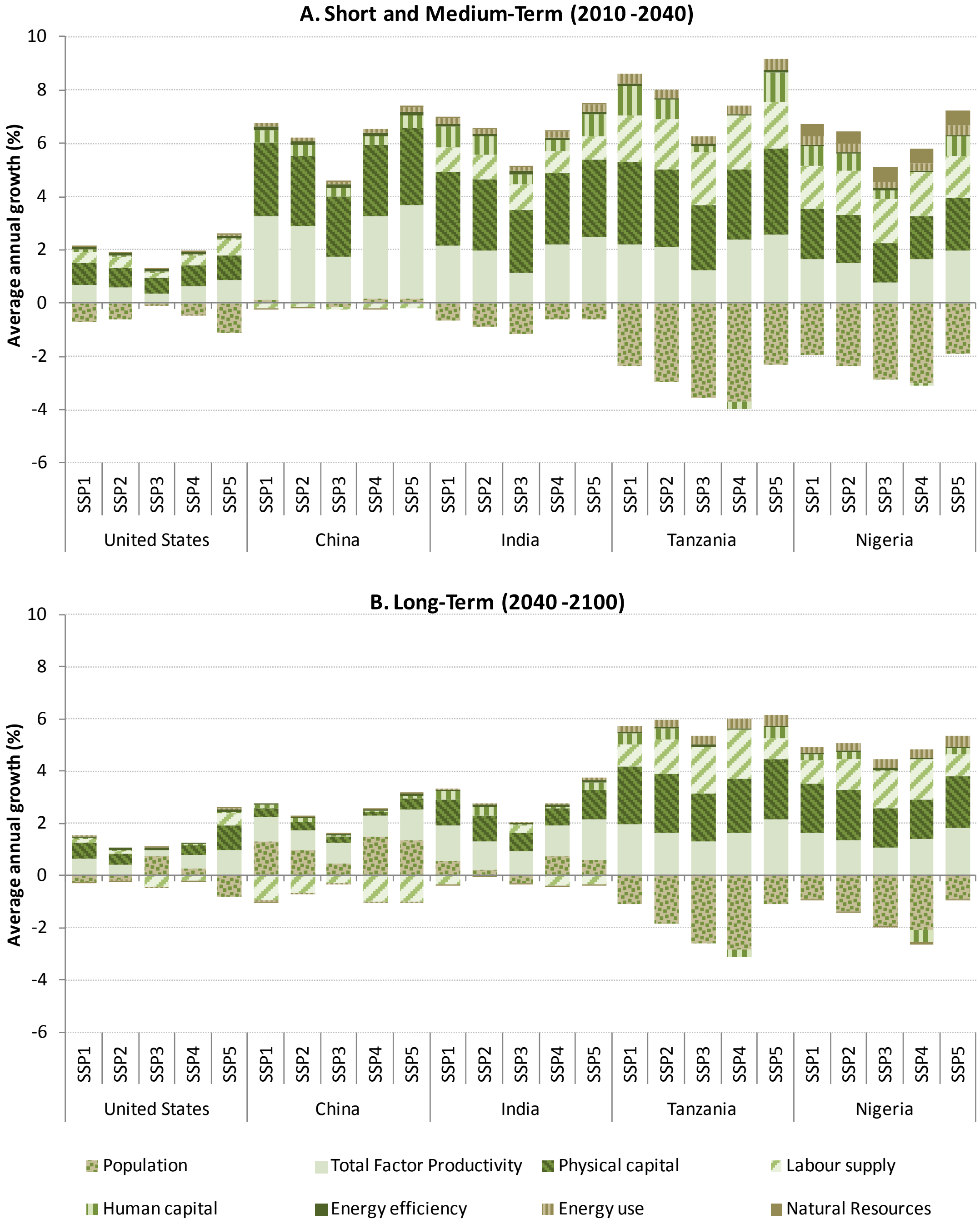
[12] The Constant Enrolment Numbers assumption for education in low income countries adopted in SSP4 imply that a decreasing share of the population has access to proper schooling, and hence human capital levels are falling over time in this scenario.

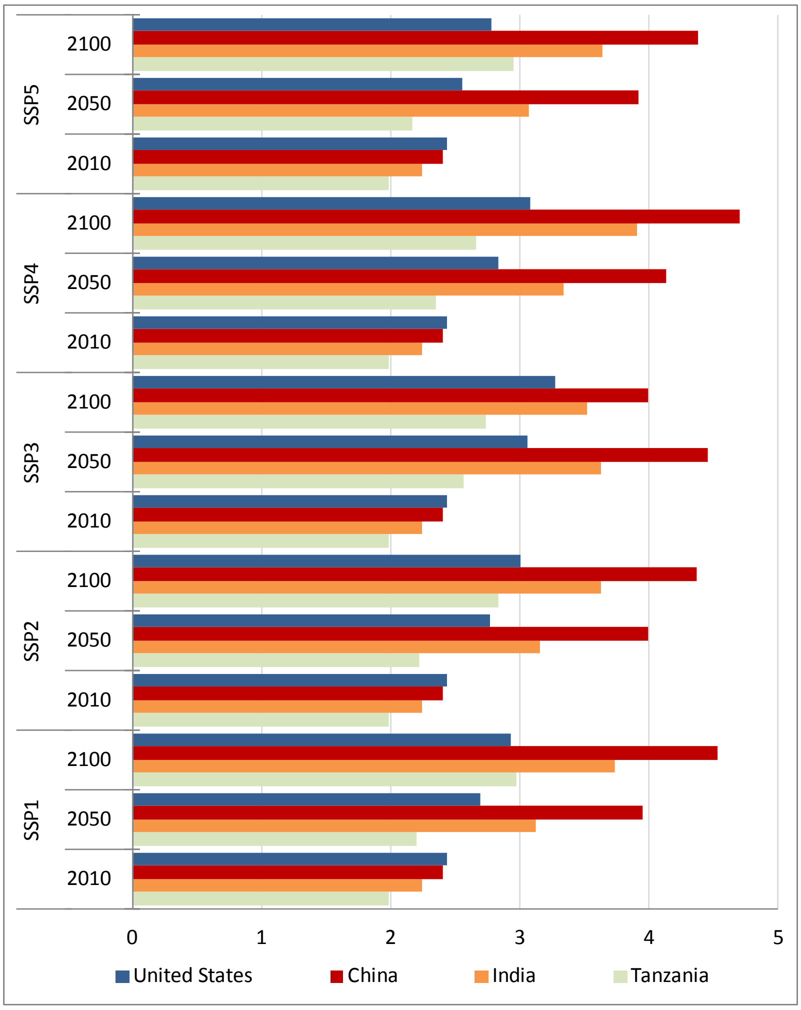
[13] In the case of Nigeria, an oil producer and OPEC member, oil rents currently account for about 20% of their GDP (World Bank, 2011). For all SSPs, it is projected that the contribution of oil extraction to GDP growth will diminish sharply by mid-century, once their oil resource base approaches exhaustion (Nigeria does not have large amounts of unconventional resources).

Figure 5. Contributions to economic (GDP per capita) growth in selected countries for the five SSPs (annual growth rates)



Finally, Figure 6 shows capital intensity (i.e. capital stock to GDP ratio) of the economies. In all countries, capital intensities increase over time, reflecting that none of the economies are fully on a balanced growth path yet. India and China are above the USA in terms of capital intensity, to support their high growth rates. Tanzania also boosts its capital intensity, but as it starts from a much lower level it remains the least capital intensive of this set of countries.

Figure 6. Capital intensity (capital stock/GDP) in selected countries for the five SSPs



6. Income inequality across countries in the SSPs

One of the major elements in the SSPs is the degree to which there is a convergence in incomes across countries, or reversely, to what extent inequality between countries persist.[14] The ENV-Growth model is based on an assumption that technological developments will at least partially spill over from the more developed to less developed economies. This implies that countries that currently have relatively low productivity levels will – ceteris paribus – have a higher economic growth rate than more developed countries. Other factors complicate this trend: for instance aging populations will affect labour supply and thus limit growth in some countries more than others. More importantly, the SSPs have different assumptions on education levels, which implies that labour productivity is not identical across the SSPs. Thus, complex patterns of interactions affect growth rates of countries, and the resulting patterns of income convergence is not a priori clear. In this section we investigate income inequality in the draft (per capita) income projections for the different SSPs. Only countries for which data is available from 1980 onwards are included (126 countries).

[14] We use the term 'income' loosely here and quantify it as the average level of GDP per capita in a country.

An important observation is that there are many different indicators that can be used to show income inequality. Using different indicators can lead to substantially different qualitative insights. Furthermore, as the model uses fixed PPP exchange rates to express all incomes in constant 2005USD; projections using different exchange rates, such as MER or a different base year, or evolving rates over time can crucially affect the calculations.[15]

We start by comparing the income distribution that emerges in 2050 and 2100, and then focus on two well-known indicators: the (between-country) Gini-coefficient, and the income ratio of the top and bottom deciles. In all cases, we ignore within-country income inequality, as the macroeconomic framework cannot assess this. This does not mean that within-country inequality is not important or not part of the SSP narratives.

6.1 Income distribution

The SSPs lead to very different results in terms of convergence. Figure 7 illustrates the distribution of countries ranked by per capita income in 2010, 2050 and 2100, and highlights the role of emerging economies by indicating the positions of China and India in these distributions.[16] The line for 2010 indicates a high degree of income inequality, with income levels in the majority of countries below 7,500 USD, and less than 10% of countries with an income level above 35 thousand USD.

By 2050 (panel A), the various SSPs exhibit limited discrepancies in the general distribution of per capita income; the median per capita income lies between 15 (SSP3) and 35 (SSP5) thousand USD. Although the chart shows relatively similar distributions of income across scenarios, the relative position of countries for a given scenario changes significantly. For example, Chinese per capita income is close to 30 thousand USD in SSP3 (the fragmented scenario with low convergence rates) and is positioned right before the third quartile of the distribution, while other scenarios (esp. SSP2) induce much faster growth in China and place the country amongst the 10% highest income countries in the world.[17] India also grows relatively fast in the first half of the century and sees average per capita income reaching medium income level by 2050 in most scenarios.

The resulting spread in income distribution across countries is a lot wider in 2100 (panel B) than in 2050 (panel A). By 2100, in all scenarios but SSP3, per capita income levels of more than half of the countries covered by the analysis will exceed (sometimes by far) the current level of USA income, which is about 42 thousand USD. The degree of inequality and concentration of income in SSP4 is highlighted in the figure by the sizeable gap between first and third quartiles (i.e. the poorest countries and the relatively rich, respectively) and by how it crosses SSP2 (indicating a much smaller variation in income levels in the middle range). The other SSPs show more relative convergence in per capita income levels in 2100 across countries.

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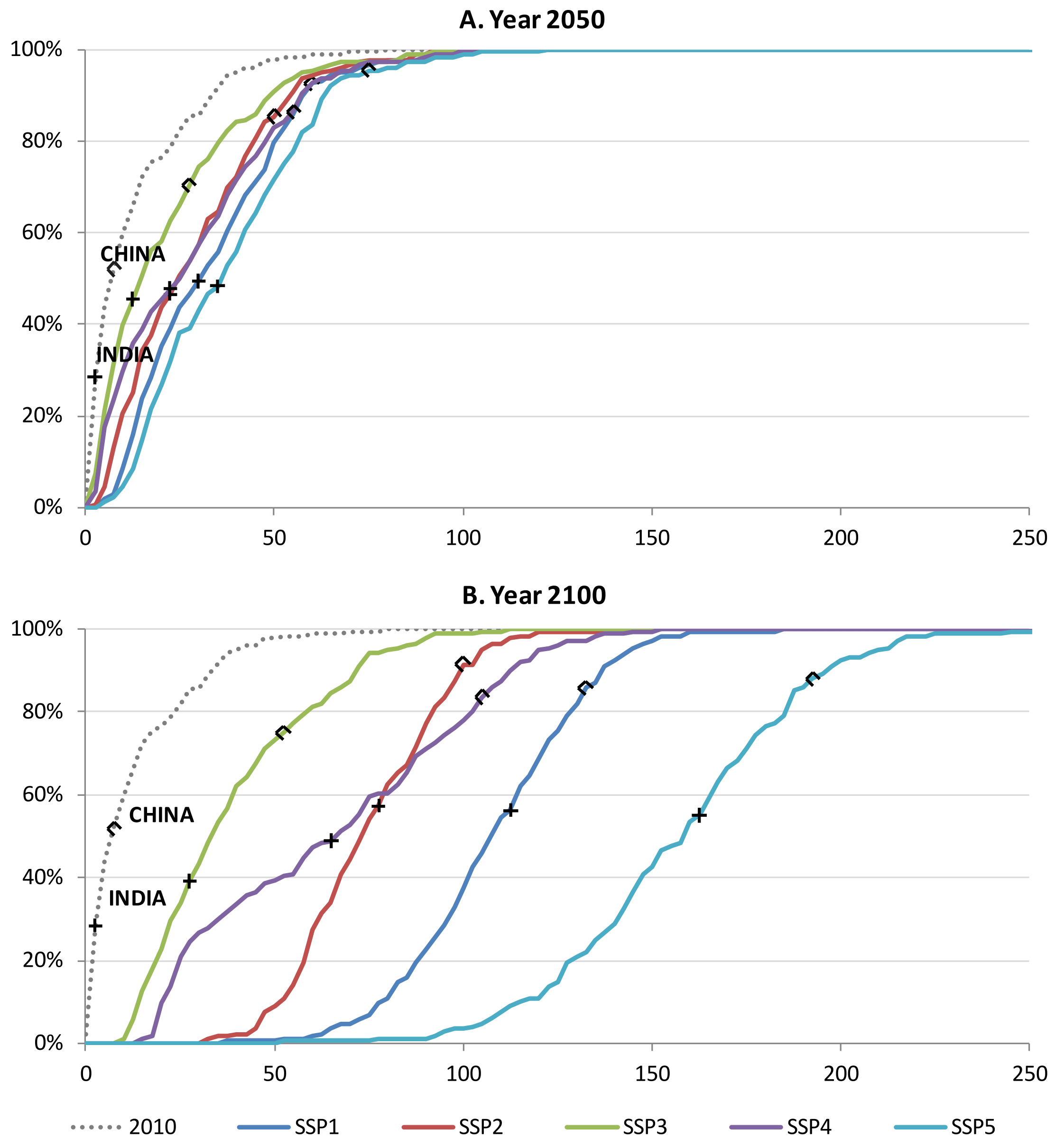
[15] See for instance B. Milanovic, 2010, 'Global inequality recalculated and updated: the effect of new PPP estimates on global inequality and 2005 estimates', *Journal of Economic Inequality*.

[16] Distributions are at the country level, and not adjusted for differences in population size. As we do not calculate income distributions within countries, it is impossible to make a per person distribution function.

[17] The position of China in the scenarios with fastest global growth, SSP1 and SSP5, is less high than in SSP2, as in SSP2 China overtakes more countries that currently have higher income levels but that grow slower.

Figure 7. Distribution of income levels (Per capita GDP PPP (thousand USD 2005 per person)



6.2 The Gini coefficient

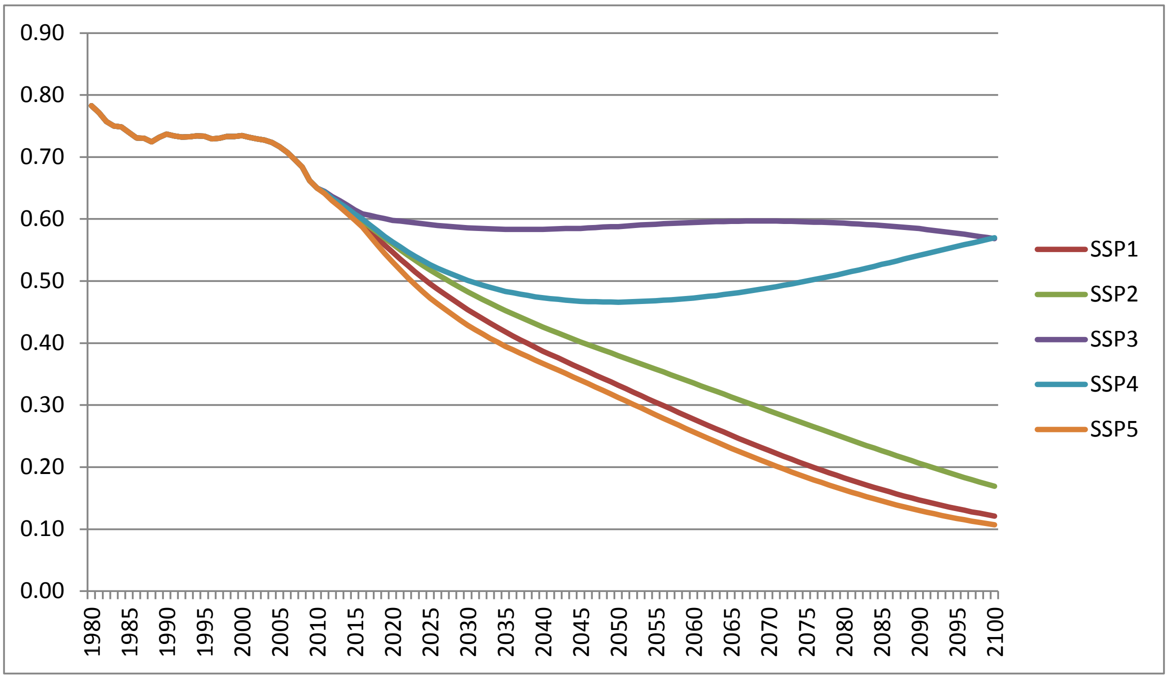
We follow Bourguignon & Morrison (2002) and Bouguignon (2011) and calculate the between-country Gini coefficient as the population-weighted Gini coefficient of average income between countries.[18] The population weighting is important, as the size of countries varies widely and many

[18] Bourguignon, F. and Morrison, C. (2002) 'Inequality among world citizens: 1890–1992', American Economic Review, vol. 92, no. 4, pp. 727–744.

Bourguignon (2011), 'A turning point in global inequality…and beyond', in: "Research on Responsibility. Reflections on our Common Future". Ed. By Krull Wilhem. CEPEuropaische Verlagsanstalp. Leipzig.

poorer countries have relatively large populations. The alternative (in the terminology of Bourguignon, 2011, the inter-country Gini coefficient) would give all countries equal weights and would provide a different perspective. We feel the population-weigthed alternative is the most informative for our purposes. Figure 8 shows the results.

Figure 8. Historical trends and projections by the different teams for the between-country Gini coefficient

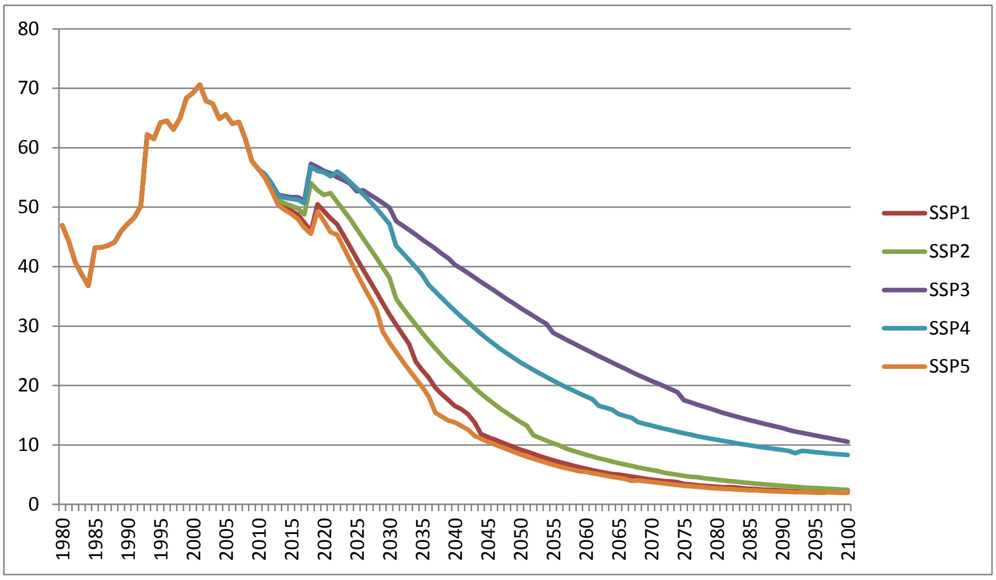


The population-weighted Gini coefficient measures the degree of inequality as an index, with 0 indicating a perfectly equal distribution and higher values indicating higher degrees of inequality. As shown in Figure 8, global income inequality (currently equal to 0.64 for the sample of countries considered and for the USD2005PPP exchange rates, down from almost 0.8 in 1980) reduces particularly in SSPs 1, 2 and 5, reaching the values of 0.12, 0.15 and 0.11, respectively, by the end of the century. In SSPs 3 and 4, international income inequality differences are much more persistent. This is not surprising given that these two scenarios are based on storylines reflecting a persistent inequality and a lower economic convergence. For SSP3, the Gini coefficient is rather stable over time: while all countries are projected to grow slowly, there is some convergence, but the dispersion remains substantial. SSP4 is an interesting case. In the first decades, when the emerging economies largely catch up with the advanced economies, the Gini coefficient falls considerably. But a large group of least developed countries remains behind, andis projected to observe a much slower convergence process. This implies that over time, the Gini coefficient starts growing again and eventually gets back to current levels.

6.3 The top-bottom decile income ratio

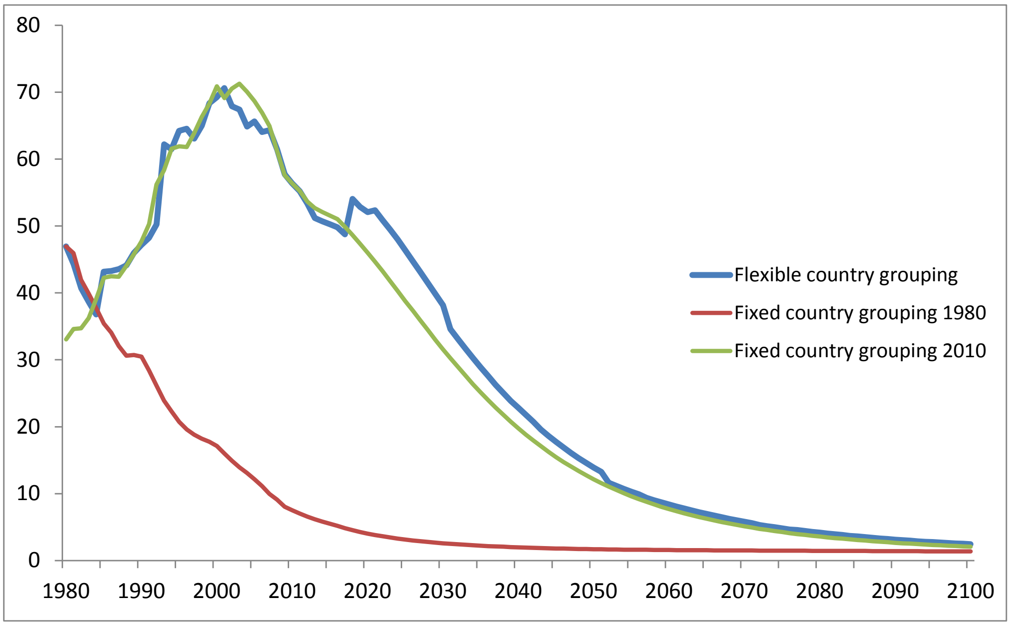
For the top-to-bottom decile income ratio, we use a dynamic method. This implies that in each year, the top and bottom decile countries are re-evaluated, and different countries belong to these groups over time. This can result in shocks in the ratio indicator over time, as important countries leave or enter the group. The results for historical trends and SSP projections are given in Figure 9.

Figure 9. Historical trends and projections by the different teams for the top-bottom decile income ratio



The alternative of using a fixed group of countries can lead to substantially different results. This is illustrated in Figure 10 for SSP2, where the flexible country grouping is compared to fixed country groupings based on income distributions in 1980 and 2010, respectively. The fixed grouping based on 1980 values includes India in the bottom decile; in the flexible grouping it leaves after 1985. Keeping this large emerging economy in the grouping implies that inequality has steadily declined, and will continue to decline. This puts a different perspective on the insights above that income inequality has substantially increased in recent decades.

Figure 10. Historical trends and projections by the different teams for the top-bottom decile income ratio



7. The influence of changes in short-term growth rates on long-term income levels

[This section will investigate how changes in forecasts of short-term income growth rates affect long-term income levels. It does so by comparing long-term projections based on short-term forecasts from 2010 with the projections based on the latest forecasts. Given the large uncertainties in recent short-term forecasts, as shown by the larger-than-usual changes in forecasts by IMF and OECD, this analysis is highly topical. In this way, the effects of the recent economic crisis, and uncertainty in short term developments, on longer term growth trends are highlighted. The interaction between the short and long run entails a direct level effect from the difference in short-term income levels, plus an array of indirect effects through capital accumulation, changes in the istance from the long-term technology frontier (and hence convergence speed), changes in the long-term frontier itself, and energy resource scarcity.]

8. Final remarks

This paper presented a methodology, directly building on OECD (2012b), for making consistent long-term economic projections for most countries in the world. The *ENV-Growth* model, based on a gradual process of conditional convergence towards a balanced growth path, was introduced and used to project different scenarios to be used as a reference for future projections of the impact of international climate change (and other) policies. The methodology goes beyond the usual drivers of economic growth in Solow growth models (total factor productivity, labour, physical capital and human capital) to explicitly account for efficiency improvements in energy use and the exploitation of natural resources (oil and gas). The model is calibrated for 176 countries, and provides projections for the entire century. The model has been applied to construct illustrative pathways of GDP and per capita income levels for each of the five SSP scenarios.

Global and regional per capita income levels (in 2005 USD) differ widely across the different SSPs. Globally, the range of global income levels at the end of the century varies from just over 25 thousand USD (a less than 3-fold increase over current levels) in SSP3 to more than 150 thousand USD in SSP5 (a 16-fold increase). In 2050 the range is smaller, but still substantial, at 16-41 thousand USD. In SSPs 1, 2 and 5 there is substantial income convergence, but global income inequalities are much more persistent in SSPs 3 and 4, with income in the poorest countries limited to around 10 thousand USD. Such a variation of income levels across scenarios, illustrates the difference in challenges that the five SSPs imply for climate change mitigation and adaptation: the relatively low income levels in vulnerable developing countries in SSP3 and SSP4 suggest high challenges to adaptation, whereas the high level of energy-intensive economic activity in SSP3 and SSP5 indicate high mitigation challenges. Nonetheless, the link between economic activity and these challenges is complex, and more detailed analysis is needed to identify the adaptation and mitigation challenges that result from the income projections presented here.

Energy efficiency improvements, while vital to avoid major resource constraints, have in general only a moderate effect on economic growth, when compared to (total factor) productivity, physical capital accumulation and demographic developments. For resource-rich countries, reduced income from traditional resources will put a downward pressure on growth, although some countries can (partially) alleviate this by exploiting more non-conventional sources, especially in SSP3 and SSP5 (the scenarios with high fossil energy demand).

One should, however, be humble when projecting country income levels over an entire century, as the degree of uncertainty on future projections is large. Furthermore, major external shocks, for instance in the form of natural disasters or military conflict, can occur abruptly and affect projections severely for prolonged periods of time, and in some cases even affect economic growth trends permanently. Moreover, these projections ignore terms of trade effects, changes in PPPs and feedbacks from environment to the economy. Thus, the projections provided here are not predictions, and should be interpreted with some degree of caution. Nonetheless, by using five substantially differing scenario settings, a plausible set of potential future GDP and income growth projections has been constructed.

These caveats notwithstanding, the reference socioeconomic projections can be used in several ways. First, when making new baseline scenarios, modellers can choose an SSP and use the quantitative data available, together with some qualitative information that is given in the SSP storyline. Second, SSPs could also be used to categorise baselines that are produced using domestic or alternative data sources. Projection elements in common with the SSP storylines (e.g. per capita income or emissions) can be identified, thus mapping baselines to an SSP in the matrix provided in Figure 1. A combination of these two approaches is also possible, e.g. where domestic population projections are combined with income projections from the most closely related SSP. Third, while this set of scenarios is constructed specifically for future climate change research, the resulting projections can also be used for a wider range of studies as they are reflect different combinations of underlying growth drivers. The projections are suitable as a reference for any quantitative analysis that relies on long-term economic baselines.

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ANNEX I. MAIN EQUATIONS IN THE ENV-GROWTH MODEL

In the model, GDP (Y) is calculated as a function of capital (K), labour (a combination of human capital h and the labour force L), energy (E) and the value added of the natural resource exploitation sector (VA^{NR}):[19]

$$(1)\quad Y_{r,t} = \left[\alpha_{VA} \left(A_{r,t} \cdot \left(K_{r,t}\right)^{\alpha_{r,t}} \cdot \left(h_{r,t} \cdot L_{r,t}\right)^{1-\alpha_{r,t}} \right)^{\frac{\sigma_E - 1}{\sigma_E}} + (1-\alpha_{VA}) \cdot \left(\lambda^E_{r,t} \cdot E_{r,t}\right)^{\frac{\sigma_E - 1}{\sigma_E}} \right]^{\frac{\sigma_E}{\sigma_E - 1}} + VA^{NR}_{r,t} - P^E_{r,t} \cdot E_{r,t}$$

TFP (*A*) depends on the existing TFP levels and on the long-term TFP frontier:

$$(2)\quad A_{r,t} = A_{r,t-1} \cdot \left[\frac{A^{LT}_{r,t}}{A_{r,t-1}} \right]^{\rho_{r,t}}$$

The convergence rate (ρ) in turn is a function of the openness of the economy (Open):

$$(3)\quad \rho_{r,t} = \frac{\rho^0 + \rho^{open} \cdot \left(Open_{r,t} - c^{open\_\rho}\right)}{1 + \rho^0 + \rho^{open} \cdot \left(Open_{r,t} - c^{open\_\rho}\right)}$$

$$(4)\quad open_{r,t} = fe^{open}_{r,t} \cdot \left(open_{r,t-1}\right)^{c^{open}}$$

$$(5)\quad A^{LT}_{r,t} = Exp\left\{ fe^{TFP}_{r,t} + e0 + g \cdot (t - t0) + a^{pmr} \cdot \left(pmr_{r,t} - c^{pmr}\right) \right\}$$

Capital input (K) equals the sum of the discounted cumulated capital and the new capital investment (I):

$$(6)\quad K_{r,t} = \left(1 - \delta_r\right) \cdot K_{r,t-1} + I_{r,t-1}$$

$$(7)\quad \frac{I_{r,t}}{Y_{r,t}} = \gamma^I_r \cdot \frac{I_{r,t-1}}{Y_{r,t-1}} + \left(1 - \gamma^I_r\right) \cdot i\_y^{LT}_{r,t}, \qquad with \qquad i\_y^{LT}_{r,t} \equiv \left(g^Y_r + \delta\right) \cdot \frac{\alpha_{r,t}}{MPC^{LT}_r}$$

$$(8)\quad \alpha_{r,t} = \gamma^\alpha_r \cdot \alpha_{r,t-1} + \left(1 - \gamma^\alpha_r\right) \cdot \alpha^{struct}_r$$

Human capital (h) is calculated as:

$$(9)\quad h_{r,t} = \overline{h_{r,t}}$$

Labour input (L) is a function of the unemployment rate (unr), the labour participation rate (pr) by age and gender (respectively indexed with a and g) and the population (Pop):

[19] The natural resource exploitation sector includes oil and gas extraction.

$$(10)\quad L_{r,t} = \left(1 - unr_{r,t}\right) \cdot \sum_{a>15,g} pr_{a,g,r,t} \cdot Pop_{a,g,r,t}$$

$$(11)\quad unr_{r,t} = \gamma_r^{unr} \cdot unr_{r,t-1} + \left(1 - \gamma_r^{unr}\right) \cdot unr_{r,t}^{struct}$$

Total value added of the natural resource exploitation sectors depends on the prices of natural resources (PNR), the natural resource-specific capital inputs (KNR) and extraction levels (NR) for each type of resource (indexed by j):

$$(12)\quad VA_{r,t}^{NR} = \sum_j P_{j,r,t}^{NR} \cdot \left[(1-\alpha_j^{NR}) \cdot K_{j,r,t}^{NR\;\frac{\sigma_j^{NR}-1}{\sigma_j^{NR}}} + \alpha_j^{NR} \cdot NR_{j,r,t}^{\frac{\sigma_j^{NR}-1}{\sigma_j^{NR}}} \right]^{\frac{\sigma_j^{NR}}{\sigma_j^{NR}-1}}$$

ANNEX II. BRIEF DESCRIPTION OF THE SSP STORYLINES[20]

The SSP storylines served as the starting point for the development of the quantitative SSP elements. Each storyline provides a brief narrative of the main characteristics of the future development path of an SSP. The storylines were identified at the joint Impacts, Adaptation and Vulnerability (IAV) and Integrated Assessment Models (IAM) workshop in Boulder, November 2011. A brief summary of the storylines are provided here for comprehensiveness. For further details and extended descriptions of the storylines, see O'Neill et al. (2012).

1.1 SSP1 - Sustainability

This is a world making relatively good progress towards sustainability, with sustained efforts to achieve development goals, while reducing resource intensity and fossil fuel dependency. Elements that contribute to this are: a rapid development of low-income countries, a reduction of inequality (globally and within economies), rapid technology development, and a high level of awareness regarding environmental degradation. Rapid economic growth in low-income countries reduces the number of people below the poverty line. The world is characterized by an open, globalized economy, with relatively rapid technological change directed toward environmentally friendly processes, including clean energy technologies and yield-enhancing technologies for land. Consumption is oriented towards low material growth and energy intensity, with a relatively low level of consumption of animal products. Investments in high levels of education coincide with low population growth. Concurrently, governance and institutions facilitate achieving development goals and problem solving. The Millennium Development Goals are achieved within the next decade or two, resulting in educated populations with access to safe water, improved sanitation and medical care. Other factors that reduce vulnerability to climate and other global changes include, for example, the successful implementation of stringent policies to control air pollutants and rapid shifts toward universal access to clean and modern energy in the developing world.

1.2 SSP 2 - Middle of the Road

In this world, trends typical of recent decades continue, with some progress towards achieving development goals, reductions in resource and energy intensity at historic rates, and slowly decreasing fossil fuel dependency. Development of low-income countries proceeds unevenly, with some countries making relatively good progress while others are left behind. Most economies are politically stable with partially functioning and globally connected markets. A limited number of comparatively weak global institutions exist. Per-capita income levels grow at a medium pace on the global average, with slowly converging income levels between developing and industrialized countries. Intra-regional income distributions improve slightly with increasing national income, but disparities remain high in some regions. Educational investments are not high enough to rapidly slow population growth, particularly in low-income countries. Achievement of the Millennium Development Goals is delayed by several decades, leaving populations without access to safe water, improved sanitation, medical care. Similarly, there is only intermediate success in addressing air pollution or improving energy access for the poor as well as other factors that reduce vulnerability to climate and other global changes.

1.3 SSP 3 - Fragmentation

The world is separated into regions characterized by extreme poverty, pockets of moderate wealth and a bulk of countries that struggle to maintain living standards for a strongly growing population.

[20] Copied from the supporting note on the SSP database, Available at https://secure.iiasa.ac.at/web-apps/ene/SspDb.

Regional blocks of countries have re-emerged with little coordination between them. This is a world failing to achieve global development goals, and with little progress in reducing resource intensity, fossil fuel dependency, or addressing local environmental concerns such as air pollution. Countries focus on achieving energy and food security goals within their own region. The world has de-globalized, and international trade, including energy resource and agricultural markets, is severely restricted. Little international cooperation and low investments in technology development and education slow down economic growth in high-, middle-, and low-income regions. Population growth in this scenario is high as a result of the education and economic trends. Growth in urban areas in low-income countries is often in unplanned settlements. Unmitigated emissions are relatively high, driven by high population growth, use of local energy resources and slow technological change in the energy sector. Governance and institutions show weakness and a lack of cooperation and consensus; effective leadership and capacities for problem solving are lacking. Investments in human capital are low and inequality is high. A regionalized world leads to reduced trade flows, and institutional development is unfavorable, leaving large numbers of people vulnerable to climate change and many parts of the world with low adaptive capacity. Policies are oriented towards security, including barriers to trade.

1.4 SSP 4 - Inequality

This pathway envisions a highly unequal world both within and across countries. A relatively small, rich global elite is responsible for much of the emissions, while a larger, poorer group contributes little to emissions and is vulnerable to impacts of climate change, in industrialized as well as in developing countries. In this world, global energy corporations use investments in R&D as hedging strategy against potential resource scarcity or climate policy, developing (and applying) low-cost alternative technologies. Mitigation challenges are therefore low, due to some combination of low reference emissions and/or high latent capacity to mitigate. Governance and globalization are effective for and controlled by the elite, but are ineffective for most of the population. Challenges to adaptation are high due to relatively low income and low human capital among the poorer population, and ineffective institutions.

1.5 SSP 5 - Conventional Development

This world stresses conventional development oriented toward economic growth as the solution to social and economic problems through the pursuit of enlightened self interest. The preference for rapid conventional development leads to an energy system dominated by fossil fuels, resulting in high GHG emissions and challenges to mitigation. Lower socio-environmental challenges to adaptation result from attainment of human development goals, robust economic growth, highly engineered infrastructure with redundancy to minimize disruptions from extreme events, and highly managed ecosystems.

ANNEX III. SUMMARY OF THE PROJECTIONS (next 3 pages)

Country	GDP per capita (thousand USD 2005 per person)											GDP per capita growth rate (average annual percentage										
	2010	2050					2100					2010-2050					2050-2100				
		SSP1	SSP2	SSP3	SSP4	SSP5	SSP1	SSP2	SSP3	SSP4	SSP5	SSP1	SSP2	SSP3	SSP4	SSP5	SSP1	SSP2	SSP3	SSP4	SSP5
Qatar	77.6	98.2	91.0	84.8	97.6	121.4	182.1	134.4	86.0	149.5	275.8	0.7	0.4	0.2	0.6	1.4	1.7	1.0	0.0	1.1	2.5
Luxembourg	68.7	91.6	90.0	90.8	91.8	91.9	146.1	112.2	101.8	130.2	196.9	0.8	0.8	0.8	0.8	0.8	1.2	0.5	0.2	0.8	2.3
Macao SAR_ China	58.2	88.7	86.3	83.9	85.5	90.5	123.5	101.2	88.8	99.9	182.9	1.3	1.2	1.1	1.2	1.4	0.8	0.3	0.1	0.3	2.0
Singapore	51.9	94.2	86.1	81.8	88.9	98.6	143.9	104.7	86.2	121.5	195.8	2.0	1.7	1.4	1.8	2.2	1.1	0.4	0.1	0.7	2.0
Norway	46.7	64.8	59.9	56.0	66.1	67.4	128.5	92.9	71.1	113.9	172.6	1.0	0.7	0.5	1.0	1.1	2.0	1.1	0.5	1.4	3.1
Kuwait	45.6	75.7	73.4	95.4	97.8	102.7	137.1	117.0	81.7	134.6	211.6	1.6	1.5	2.7	2.9	3.1	1.6	1.2	-0.3	0.8	2.1
Brunei Darussalam	45.5	72.3	62.8	54.4	65.3	82.5	139.2	103.8	71.0	117.4	206.0	1.5	0.9	0.5	1.1	2.0	1.9	1.3	0.6	1.6	3.0
United States	42.2	72.3	66.9	63.4	72.4	74.8	136.2	101.6	84.9	123.3	187.6	1.8	1.5	1.3	1.8	1.9	1.8	1.0	0.7	1.4	3.0
Hong Kong SAR_ China	41.8	78.1	70.8	66.1	70.7	84.4	134.8	96.1	75.7	102.2	190.9	2.2	1.7	1.5	1.7	2.5	1.5	0.7	0.3	0.9	2.5
Switzerland	38.4	60.0	55.0	47.8	58.3	63.5	133.5	96.7	68.0	116.4	182.0	1.4	1.1	0.6	1.3	1.6	2.5	1.5	0.8	2.0	3.7
Netherlands	37.0	59.5	55.1	50.4	58.9	62.8	126.1	93.1	69.1	112.4	174.5	1.5	1.2	0.9	1.5	1.7	2.2	1.4	0.7	1.8	3.6
Ireland	36.0	55.3	51.2	49.7	54.3	57.4	117.1	85.4	70.4	102.1	160.1	1.3	1.1	0.9	1.3	1.5	2.2	1.3	0.8	1.8	3.6
Australia	35.7	65.8	60.7	56.0	65.8	68.8	147.6	108.6	78.5	131.6	204.7	2.1	1.7	1.4	2.1	2.3	2.5	1.6	0.8	2.0	3.9
Austria	35.4	58.7	54.2	49.2	57.3	61.7	118.4	86.6	68.1	103.4	162.7	1.6	1.3	1.0	1.6	1.9	2.0	1.2	0.8	1.6	3.3
Canada	35.3	52.2	55.3	61.0	54.9	63.0	119.1	103.9	108.4	108.1	180.5	1.2	1.4	1.8	1.4	2.0	2.6	1.8	1.6	1.9	3.7
Sweden	33.8	59.9	55.3	51.1	59.1	61.9	119.2	86.4	68.5	104.5	160.6	1.9	1.6	1.3	1.9	2.1	2.0	1.1	0.7	1.5	3.2
Belgium	33.4	57.5	53.2	50.5	56.9	60.2	119.9	88.9	70.5	107.2	165.5	1.8	1.5	1.3	1.8	2.0	2.2	1.3	0.8	1.8	3.5
Germany	33.1	56.9	52.9	47.0	56.3	60.5	125.1	92.1	68.7	110.5	174.0	1.8	1.5	1.0	1.7	2.1	2.4	1.5	0.9	1.9	3.8
United Arab Emirates	33.1	52.3	48.8	54.1	58.7	63.2	128.6	97.1	55.3	109.3	196.6	1.4	1.2	1.6	1.9	2.3	2.9	2.0	0.0	1.7	4.2
Iceland	32.6	55.5	50.9	45.5	54.7	57.3	127.8	92.1	66.2	111.8	172.9	1.8	1.4	1.0	1.7	1.9	2.6	1.6	0.9	2.1	4.0
United Kingdom	32.5	56.8	52.3	46.8	56.3	59.4	132.9	97.3	68.8	117.2	183.4	1.9	1.5	1.1	1.8	2.1	2.7	1.7	0.9	2.2	4.2
Denmark	32.5	49.5	45.6	41.8	49.0	51.7	108.5	79.5	60.6	96.7	148.6	1.3	1.0	0.7	1.3	1.5	2.4	1.5	0.9	1.9	3.8
Finland	31.7	56.2	51.9	46.6	55.9	58.9	113.7	83.6	65.2	101.4	155.4	1.9	1.6	1.2	1.9	2.1	2.0	1.2	0.8	1.6	3.3
Equatorial Guinea	31.2	50.8	42.9	35.5	27.4	53.9	125.9	87.7	49.1	41.8	184.0	1.6	0.9	0.3	-0.3	1.8	3.0	2.1	0.8	1.1	4.8
Japan	30.8	61.8	56.9	45.9	61.0	67.1	128.0	93.2	67.2	111.4	177.5	2.5	2.1	1.2	2.4	2.9	2.1	1.3	0.9	1.7	3.3
France	29.7	52.4	48.3	42.8	51.5	54.6	116.0	83.9	60.8	100.8	157.7	1.9	1.6	1.1	1.8	2.1	2.4	1.5	0.8	1.9	3.8
Korea_ Rep.	27.4	73.5	67.7	58.3	72.7	79.5	155.7	115.4	88.7	140.5	213.8	4.2	3.7	2.8	4.1	4.8	2.2	1.4	1.0	1.9	3.4
Italy	27.1	44.5	40.5	36.2	42.8	47.1	115.3	83.0	56.5	98.8	160.6	1.6	1.2	0.8	1.4	1.8	3.2	2.1	1.1	2.6	4.8
Spain	27.0	41.2	38.0	34.3	40.0	43.3	107.2	77.6	54.0	92.5	147.6	1.3	1.0	0.7	1.2	1.5	3.2	2.1	1.2	2.6	4.8
Israel	26.7	59.9	54.6	47.5	60.5	61.4	137.6	100.8	70.7	124.4	184.6	3.1	2.6	1.9	3.2	3.2	2.6	1.7	1.0	2.1	4.0
New Zealand	25.4	47.8	43.7	37.7	47.5	50.3	120.9	88.1	59.7	107.6	167.1	2.2	1.8	1.2	2.2	2.5	3.1	2.0	1.2	2.5	4.6
Slovenia	25.3	45.3	41.5	37.2	44.2	48.2	97.1	70.9	56.0	85.3	133.5	2.0	1.6	1.2	1.9	2.3	2.3	1.4	1.0	1.9	3.5
Oman	24.6	53.7	46.6	33.9	49.8	62.2	142.3	108.9	62.1	116.8	207.9	3.0	2.2	0.9	2.6	3.8	3.3	2.7	1.7	2.7	4.7
Greece	24.1	48.9	44.7	36.7	47.9	52.3	121.7	89.8	60.8	107.7	168.1	2.6	2.1	1.3	2.5	2.9	3.0	2.0	1.3	2.5	4.4
Czech Republic	23.7	57.1	51.6	44.8	55.8	61.1	132.7	97.4	72.1	119.2	184.4	3.5	2.9	2.2	3.4	4.0	2.6	1.8	1.2	2.3	4.0
Trinidad and Tobago	23.1	53.1	45.5	34.5	47.0	60.5	123.8	91.4	52.9	95.1	182.6	3.3	2.4	1.2	2.6	4.1	2.7	2.0	1.1	2.1	4.0
Bahamas_ The	22.8	42.6	37.2	29.9	39.0	48.2	104.0	77.0	42.1	83.8	154.6	2.2	1.6	0.8	1.8	2.8	2.9	2.1	0.8	2.3	4.4
Malta	22.6	52.5	47.2	38.1	49.4	58.2	120.1	86.7	60.1	100.7	171.7	3.3	2.7	1.7	3.0	3.9	2.6	1.7	1.2	2.1	3.9
Portugal	21.6	37.7	34.3	29.3	36.6	40.0	95.2	69.1	47.4	83.8	130.9	1.9	1.5	0.9	1.7	2.1	3.0	2.0	1.2	2.6	4.6
Bahrain	21.3	48.9	42.7	32.9	43.8	54.7	120.0	89.9	52.1	93.9	175.7	3.2	2.5	1.4	2.6	3.9	2.9	2.2	1.2	2.3	4.4
Saudi Arabia	20.4	35.2	31.4	30.5	31.3	47.4	92.6	70.7	37.3	54.2	142.3	1.8	1.4	1.2	1.3	3.3	3.3	2.5	0.4	1.5	4.0
Slovak Republic	20.0	49.0	44.5	39.1	47.6	52.8	108.7	81.7	62.7	98.9	151.2	3.6	3.0	2.4	3.4	4.1	2.4	1.7	1.2	2.2	3.7
Cyprus	18.9	37.6	33.2	26.5	35.3	42.0	97.3	70.9	42.6	80.0	141.3	2.5	1.9	1.0	2.2	3.1	3.2	2.3	1.2	2.5	4.7
Barbados	17.6	53.0	46.3	34.5	49.7	61.6	115.9	86.5	50.8	97.4	171.0	5.0	4.1	2.4	4.6	6.3	2.4	1.7	0.9	1.9	3.5
Poland	17.3	44.3	40.5	34.2	43.5	48.1	97.7	74.0	54.6	89.3	136.4	3.9	3.4	2.5	3.8	4.5	2.4	1.6	1.2	2.1	3.7
Hungary	17.0	40.2	36.1	31.6	38.7	43.1	100.7	74.6	54.6	90.2	141.9	3.4	2.8	2.1	3.2	3.8	3.0	2.1	1.5	2.7	4.6
Estonia	16.6	47.3	43.1	37.4	47.1	51.0	113.5	85.5	64.7	105.4	158.3	4.6	4.0	3.1	4.6	5.2	2.8	2.0	1.5	2.5	4.2
Croatia	16.2	40.3	35.6	27.6	37.4	44.7	84.0	61.8	40.1	71.6	118.8	3.7	3.0	1.8	3.3	4.4	2.2	1.5	0.9	1.8	3.3
Libya	15.8	20.0	18.1	15.4	17.1	20.2	34.4	27.8	19.0	25.3	48.1	0.7	0.4	-0.1	0.2	0.7	1.4	1.1	0.5	1.0	2.8
Lithuania	15.4	39.2	34.4	25.9	36.5	44.0	91.6	66.2	39.8	78.6	131.3	3.9	3.1	1.7	3.4	4.7	2.7	1.8	1.1	2.3	4.0
Argentina	14.4	49.1	40.9	26.8	40.6	55.4	123.8	88.3	42.8	84.4	178.2	6.1	4.6	2.2	4.6	7.1	3.0	2.3	1.2	2.2	4.4
Russian Federation	14.1	53.8	46.6	31.4	52.9	63.8	112.0	82.6	46.6	98.5	162.9	7.1	5.8	3.1	6.9	8.8	2.2	1.5	1.0	1.7	3.1
Chile	13.6	43.7	36.8	25.5	37.6	49.0	122.6	87.1	43.1	89.2	176.5	5.5	4.3	2.2	4.4	6.5	3.6	2.7	1.4	2.7	5.2
Gabon	13.5	32.6	25.3	16.5	16.3	35.8	110.3	69.7	28.3	24.2	156.9	3.5	2.2	0.6	0.5	4.1	4.8	3.5	1.4	1.0	6.8
Malaysia	13.2	46.3	39.1	27.6	41.3	52.6	130.0	93.5	50.1	103.3	189.4	6.3	4.9	2.7	5.3	7.5	3.6	2.8	1.6	3.0	5.2
Latvia	12.9	41.2	35.8	24.8	38.3	46.8	99.1	71.0	40.5	84.5	141.9	5.5	4.5	2.3	4.9	6.6	2.8	2.0	1.3	2.4	4.1
Uruguay	12.9	50.4	40.7	25.5	40.0	57.3	136.0	93.6	42.3	83.1	193.2	7.3	5.4	2.5	5.3	8.6	3.4	2.6	1.3	2.2	4.7
Belarus	12.7	48.4	41.9	27.9	45.6	56.1	117.7	87.1	48.5	103.3	171.1	7.1	5.8	3.0	6.5	8.6	2.9	2.2	1.5	2.5	4.1
Lebanon	12.6	41.8	35.9	25.7	36.4	47.1	111.6	83.3	45.8	84.4	160.2	5.8	4.6	2.6	4.7	6.8	3.3	2.6	1.6	2.6	4.8

(...continued) **Country**	**GDP per capita (thousand USD 2005 per person)**											**GDP per capita growth rate (average annual percentage**									
	2010	**2050**					**2100**					**2010-2050**					**2050-2100**				
		SSP1	**SSP2**	**SSP3**	**SSP4**	**SSP5**	**SSP1**	**SSP2**	**SSP3**	**SSP4**	**SSP5**	**SSP1**	**SSP2**	**SSP3**	**SSP4**	**SSP5**	**SSP1**	**SSP2**	**SSP3**	**SSP4**	**SSP5**
Turkey	12.5	37.4	31.7	23.0	30.9	41.6	105.5	76.9	37.9	68.5	151.1	5.0	3.8	2.1	3.7	5.8	3.6	2.8	1.3	2.4	5.3
Panama	12.5	49.6	41.6	27.3	41.5	55.2	132.1	94.0	47.5	92.3	186.8	7.4	5.8	2.9	5.8	8.5	3.3	2.5	1.5	2.4	4.8
Botswana	12.5	46.9	36.5	22.6	37.3	51.8	101.7	68.4	37.2	68.3	141.6	6.9	4.8	2.0	5.0	7.9	2.3	1.8	1.3	1.7	3.5
Mexico	12.4	38.7	32.2	21.1	32.5	44.5	119.1	83.8	38.1	79.1	172.5	5.3	4.0	1.7	4.0	6.5	4.1	3.2	1.6	2.9	5.8
Mauritius	12.1	48.0	38.9	26.2	39.8	56.4	148.3	101.6	43.3	88.3	221.4	7.4	5.5	2.9	5.7	9.2	4.2	3.2	1.3	2.4	5.8
Bulgaria	11.6	40.8	35.6	24.1	37.4	46.7	104.1	77.3	42.7	84.0	149.3	6.3	5.2	2.7	5.6	7.6	3.1	2.3	1.5	2.5	4.4
Kazakhstan	11.1	48.0	41.0	29.5	50.5	61.0	91.3	67.0	37.1	81.4	134.4	8.3	6.8	4.2	8.9	11.3	1.8	1.3	0.5	1.2	2.4
Romania	10.9	45.1	38.3	24.7	40.5	51.8	127.7	90.6	44.5	101.5	183.8	7.8	6.3	3.2	6.8	9.4	3.7	2.7	1.6	3.0	5.1
Venezuela_ RB	10.8	18.8	18.5	14.8	17.8	25.7	72.8	62.0	28.6	53.5	126.1	1.9	1.8	0.9	1.6	3.5	5.7	4.7	1.9	4.0	7.8
Iran_ Islamic Rep.	10.7	31.5	27.7	21.2	29.5	37.7	95.9	73.3	35.3	70.3	142.7	4.9	4.0	2.5	4.4	6.3	4.1	3.3	1.3	2.8	5.6
Costa Rica	10.3	32.6	27.7	18.2	27.5	36.4	97.9	68.9	32.4	64.4	139.2	5.4	4.3	1.9	4.2	6.4	4.0	3.0	1.6	2.7	5.7
Brazil	10.1	35.8	28.8	17.3	28.6	40.7	117.1	79.8	32.3	71.2	168.0	6.4	4.7	1.8	4.6	7.6	4.6	3.5	1.7	3.0	6.3
Montenegro	10.0	35.5	30.6	21.7	33.4	41.9	83.0	62.9	37.1	71.6	123.5	6.3	5.1	2.9	5.8	7.9	2.7	2.1	1.4	2.3	3.9
South Africa	9.4	39.9	32.3	22.2	32.6	45.3	103.0	72.2	36.8	70.7	149.9	8.1	6.0	3.4	6.1	9.5	3.2	2.5	1.3	2.3	4.6
Azerbaijan	8.8	14.8	12.5	8.5	13.8	17.8	72.9	52.1	19.7	57.7	111.2	1.7	1.0	-0.1	1.4	2.6	7.8	6.3	2.6	6.3	10.5
Macedonia FYR	8.7	35.2	30.4	21.4	31.8	39.8	86.2	63.9	39.4	70.2	123.2	7.6	6.2	3.6	6.6	8.9	2.9	2.2	1.7	2.4	4.2
Ukraine	8.7	50.1	41.8	24.4	43.7	58.8	119.1	86.9	41.6	86.7	172.4	11.9	9.5	4.5	10.1	14.4	2.8	2.2	1.4	2.0	3.9
Peru	8.6	42.7	35.5	20.2	36.0	49.8	134.3	93.7	41.6	94.9	193.2	10.0	7.9	3.4	8.0	12.1	4.3	3.3	2.1	3.3	5.8
Colombia	8.5	27.3	22.7	13.9	22.6	31.0	99.2	68.5	28.3	66.1	143.1	5.5	4.2	1.6	4.2	6.6	5.3	4.0	2.1	3.9	7.2
Dominican Republic	8.4	35.7	29.2	17.4	29.1	40.8	100.5	72.2	35.4	66.9	144.0	8.1	6.2	2.7	6.2	9.7	3.6	3.0	2.1	2.6	5.1
St. Lucia	8.4	25.8	21.6	14.0	22.9	31.0	106.4	76.8	31.6	78.5	163.6	5.2	4.0	1.7	4.4	6.8	6.3	5.1	2.5	4.8	8.5
Suriname	8.0	53.5	42.7	23.2	45.1	65.1	129.6	95.3	46.3	92.7	191.8	14.2	10.8	4.7	11.6	17.8	2.8	2.5	2.0	2.1	3.9
St. Vincent & Grenadines	7.8	30.9	25.5	15.0	26.7	38.7	113.5	82.2	31.7	80.9	174.8	7.4	5.7	2.3	6.1	9.9	5.4	4.4	2.2	4.1	7.0
Tunisia	7.8	37.3	30.0	19.6	28.8	42.1	109.3	75.3	34.3	62.6	155.1	9.5	7.2	3.8	6.8	11.1	3.9	3.0	1.5	2.3	5.4
Thailand	7.7	37.7	31.2	18.7	32.2	43.5	124.6	88.0	37.4	86.5	183.4	9.8	7.7	3.6	8.0	11.7	4.6	3.6	2.0	3.4	6.4
Albania	7.7	30.2	25.5	16.3	26.2	34.9	78.8	57.1	30.0	49.7	109.9	7.3	5.8	2.8	6.0	8.9	3.2	2.5	1.7	1.8	4.3
Serbia	7.5	28.9	24.9	17.5	26.5	33.0	74.2	55.0	31.6	62.5	107.7	7.1	5.8	3.3	6.3	8.5	3.1	2.4	1.6	2.7	4.5
Algeria	7.5	21.5	17.4	11.3	17.5	24.8	87.5	61.2	25.0	58.5	129.0	4.6	3.3	1.2	3.3	5.7	6.1	5.0	2.4	4.7	8.4
Bosnia and Herzegovina	7.3	31.0	27.2	20.1	28.7	35.2	78.6	59.2	37.0	66.0	113.2	8.1	6.8	4.4	7.3	9.5	3.1	2.3	1.7	2.6	4.4
Algeria	7.3	26.7	22.0	12.5	22.0	31.2	107.3	75.0	30.0	71.6	158.1	6.6	5.0	1.8	5.0	8.1	6.0	4.8	2.8	4.5	8.1
Turkmenistan	7.1	35.6	29.9	22.1	32.7	40.5	74.4	55.0	41.3	63.8	107.3	10.1	8.1	5.3	9.1	11.8	2.2	1.7	1.7	1.9	3.3
Jamaica	7.0	23.3	18.8	10.7	20.3	29.1	82.4	57.5	25.9	57.3	121.1	5.8	4.2	1.3	4.7	7.9	5.1	4.1	2.8	3.7	6.3
China	6.8	63.1	52.8	28.7	55.8	74.6	133.8	101.3	51.1	105.6	192.5	20.7	16.9	8.1	18.0	24.9	2.2	1.8	1.6	1.8	3.2
Belize	6.6	18.9	15.3	9.5	10.7	22.6	90.6	63.0	24.1	33.6	138.9	4.7	3.3	1.1	1.6	6.1	7.6	6.2	3.1	4.2	10.3
Ukraine	6.1	33.2	27.8	15.3	31.0	40.0	100.4	72.9	34.7	87.0	149.3	11.2	9.0	3.8	10.3	14.0	4.0	3.2	2.5	3.6	5.5
El Salvador	6.0	23.8	19.1	10.4	17.5	28.3	95.3	65.8	24.7	54.2	139.6	7.4	5.4	1.8	4.7	9.2	6.0	4.9	2.8	4.2	7.8
Namibia	5.8	29.3	22.8	14.5	16.6	35.4	92.7	63.7	29.5	36.4	142.8	10.1	7.3	3.7	4.7	12.7	4.3	3.6	2.1	2.4	6.1
Egypt_ Arab Rep.	5.7	29.4	24.2	14.1	24.2	34.2	102.4	75.6	32.3	68.3	149.4	10.4	8.2	3.7	8.2	12.5	5.0	4.2	2.6	3.6	6.7
Angola	5.5	20.0	14.1	7.2	6.2	22.4	95.3	54.7	20.0	15.6	131.6	6.7	3.9	0.8	0.4	7.8	7.5	5.8	3.6	3.0	9.7
Maldives	5.1	22.2	18.0	10.8	18.9	27.0	104.5	72.5	26.9	68.3	160.3	8.3	6.2	2.8	6.7	10.6	7.4	6.1	3.0	5.2	9.9
Jordan	5.0	21.1	17.5	11.1	12.7	24.6	97.9	71.3	33.8	44.3	146.2	8.0	6.2	3.0	3.8	9.7	7.3	6.1	4.1	5.0	9.9
Armenia	4.8	20.1	16.9	10.8	18.6	23.6	64.7	46.2	23.3	53.6	94.4	7.9	6.3	3.1	7.1	9.7	4.4	3.5	2.3	3.8	6.0
Bhutan	4.8	39.9	30.5	16.8	30.1	47.4	143.6	97.2	33.4	79.8	214.4	18.4	13.5	6.3	13.3	22.3	5.2	4.4	2.0	3.3	7.0
Syrian Arab Republic	4.8	20.1	16.1	9.8	11.6	23.8	103.8	71.0	27.5	38.4	156.2	8.1	6.0	2.6	3.6	10.0	8.3	6.8	3.6	4.6	11.1
Paraguay	4.7	24.9	19.7	10.2	12.5	29.0	111.5	74.8	27.4	28.6	162.2	10.9	8.1	3.0	4.2	13.1	7.0	5.6	3.4	2.6	9.2
Georgia	4.7	30.3	24.8	12.6	28.1	36.7	95.6	67.0	32.6	81.8	139.9	13.8	10.8	4.3	12.6	17.2	4.3	3.4	3.2	3.8	5.6
Sri Lanka	4.6	31.3	26.0	14.4	26.7	36.3	78.5	56.4	27.9	54.2	109.6	14.7	11.8	5.4	12.1	17.4	3.0	2.3	1.9	2.1	4.0
Swaziland	4.5	18.0	14.2	8.3	11.3	21.7	93.0	63.1	22.8	44.1	142.7	7.4	5.3	2.0	3.7	9.4	8.4	6.9	3.5	5.8	11.2
Bolivia	4.4	24.0	18.6	9.4	11.1	28.8	126.5	87.1	28.7	30.4	189.6	11.3	8.2	2.9	3.9	14.0	8.5	7.3	4.1	3.5	11.2
Morocco	4.3	27.0	21.2	11.9	19.7	31.5	121.1	77.6	25.0	54.2	175.5	13.2	9.8	4.5	9.0	15.8	7.0	5.3	2.2	3.5	9.2
Guatemala	4.3	18.2	13.5	6.7	6.4	21.1	110.4	69.3	21.0	20.9	161.8	8.1	5.4	1.4	1.3	9.8	10.2	8.2	4.2	4.5	13.3
Tonga	4.1	17.4	13.8	7.5	8.7	23.6	83.1	59.3	22.6	30.8	131.4	8.0	5.9	2.0	2.7	11.7	7.6	6.6	4.0	5.1	9.1
Vanuatu	4.1	20.0	15.0	8.2	9.0	24.3	130.7	83.1	22.3	21.7	203.6	9.6	6.6	2.4	2.9	12.2	11.1	9.1	3.4	2.8	14.8
Fiji	4.1	15.2	12.5	7.4	12.9	19.2	75.9	53.9	21.2	54.2	118.1	6.8	5.2	2.1	5.4	9.3	8.0	6.6	3.7	6.4	10.3
Samoa	3.9	17.5	13.9	7.1	8.0	23.8	76.6	56.3	19.9	27.9	118.0	8.6	6.3	2.0	2.6	12.6	6.7	6.1	3.6	5.0	7.9
Indonesia	3.9	32.9	26.3	13.2	27.0	39.2	125.3	86.3	30.8	80.0	183.9	18.7	14.4	6.0	14.9	22.8	5.6	4.6	2.7	3.9	7.4
Congo_ Rep.	3.8	24.8	18.0	9.2	9.9	28.8	113.3	66.9	23.2	22.2	162.9	13.8	9.3	3.5	4.0	16.4	7.2	5.4	3.1	2.5	9.3
Mongolia	3.6	40.5	31.7	16.1	33.2	48.3	99.0	69.8	32.5	70.1	144.2	25.5	19.4	8.6	20.4	30.9	2.9	2.4	2.0	2.2	4.0
Cape Verde	3.6	26.3	20.2	11.5	20.8	32.4	93.9	62.7	23.5	51.2	140.6	15.9	11.6	5.5	12.0	20.1	5.1	4.2	2.1	2.9	6.7

(...continued) Country	GDP per capita (thousand USD 2005 per person)											GDP per capita growth rate (average annual percentage									
	2010	2050					2100					2010-2050					2050-2100				
		SSP1	SSP2	SSP3	SSP4	SSP5	SSP1	SSP2	SSP3	SSP4	SSP5	SSP1	SSP2	SSP3	SSP4	SSP5	SSP1	SSP2	SSP3	SSP4	SSP5
Philippines	3.6	20.0	16.3	8.8	11.6	23.7	85.2	58.9	24.0	33.3	124.4	11.5	8.9	3.7	5.7	14.1	6.5	5.3	3.5	3.7	8.5
Honduras	3.5	18.0	13.3	6.5	7.5	21.3	112.1	68.5	19.0	21.6	165.6	10.3	7.0	2.1	2.8	12.6	10.4	8.3	3.9	3.8	13.6
Iraq	3.2	12.3	10.7	9.0	9.9	17.2	64.9	44.9	11.5	20.7	102.0	7.0	5.8	4.5	5.2	10.8	8.6	6.4	0.6	2.2	9.9
India	3.0	29.9	23.5	11.8	23.1	35.1	112.2	77.8	26.9	64.3	162.9	22.5	17.2	7.4	16.8	26.9	5.5	4.6	2.6	3.6	7.3
Uzbekistan	2.9	18.4	14.8	7.7	15.8	22.8	68.2	49.6	21.9	56.0	103.1	13.6	10.4	4.2	11.3	17.4	5.4	4.7	3.7	5.1	7.0
Vietnam	2.8	19.5	15.8	8.5	16.5	23.3	83.9	58.9	21.6	57.4	124.7	14.7	11.3	5.0	12.0	18.0	6.6	5.5	3.0	4.9	8.7
Guyana	2.8	15.0	11.8	6.3	12.5	19.8	78.5	56.2	19.9	55.3	123.0	10.9	8.1	3.1	8.7	15.2	8.5	7.5	4.3	6.8	10.4
Moldova	2.8	22.9	18.9	9.9	20.9	28.5	88.5	63.4	27.2	73.1	132.8	18.1	14.5	6.4	16.3	23.1	5.7	4.7	3.5	5.0	7.3
West Bank and Gaza	2.7	23.5	17.9	8.8	10.3	30.7	116.8	81.5	30.1	31.4	188.7	19.5	14.2	5.8	7.2	26.0	7.9	7.1	4.8	4.1	10.3
Nicaragua	2.5	15.6	11.8	5.3	10.2	18.8	94.7	62.9	18.8	44.6	140.8	13.1	9.3	2.8	7.8	16.3	10.2	8.7	5.1	6.7	13.0
Solomon Islands	2.4	17.7	13.0	6.7	7.4	21.6	118.0	76.1	21.9	23.1	182.8	15.7	10.8	4.4	5.1	19.8	11.3	9.7	4.5	4.2	14.9
Pakistan	2.4	16.7	12.5	6.1	8.5	19.8	86.3	57.0	17.9	26.6	127.2	14.7	10.4	3.9	6.3	18.0	8.4	7.1	3.8	4.2	10.8
Yemen_ Rep.	2.4	12.9	7.6	4.1	4.5	15.0	87.2	46.8	12.7	17.4	130.0	11.1	5.5	1.8	2.3	13.3	11.5	10.2	4.2	5.7	15.3
Lao PDR	2.3	16.3	12.7	6.4	10.0	20.5	94.6	64.6	18.8	37.6	147.0	15.3	11.3	4.4	8.4	19.8	9.6	8.2	3.9	5.5	12.4
Papua New Guinea	2.2	29.0	21.2	8.6	12.6	36.6	156.6	100.3	27.6	30.8	240.6	30.2	21.4	7.2	11.7	38.8	8.8	7.5	4.4	2.9	11.1
Nigeria	2.1	14.0	10.6	4.8	5.4	16.4	88.9	57.0	16.6	16.2	128.2	13.8	9.9	3.1	3.9	16.7	10.7	8.7	4.9	3.9	13.6
Djibouti	2.1	16.4	12.5	7.2	8.6	19.5	80.0	55.2	19.8	24.6	121.5	16.8	12.3	5.9	7.6	20.5	7.8	6.8	3.5	3.8	10.4
Kyrgyz Republic	2.1	13.1	10.3	5.4	10.9	16.2	60.7	43.1	17.8	47.4	91.6	13.4	10.1	4.0	10.8	17.3	7.3	6.3	4.6	6.7	9.3
Cameroon	2.0	13.6	9.8	4.7	5.7	16.0	97.1	57.2	16.7	21.3	142.6	14.1	9.5	3.3	4.5	17.0	12.3	9.7	5.1	5.5	15.9
Sudan	2.0	10.3	7.0	3.5	4.3	11.9	80.7	47.3	11.3	17.9	118.9	10.2	6.1	1.8	2.8	12.2	13.7	11.6	4.5	6.4	18.0
Cambodia	1.9	15.8	11.5	5.6	10.5	18.9	111.5	64.3	16.6	47.6	165.5	17.9	12.3	4.7	11.0	21.8	12.1	9.2	3.9	7.1	15.5
Tajikistan	1.9	16.9	13.0	5.6	9.7	21.1	70.8	49.7	19.3	35.5	104.0	19.3	14.2	4.7	10.0	24.7	6.4	5.7	4.9	5.3	7.8
Mauritania	1.7	13.4	9.8	4.8	6.0	16.4	78.4	49.6	14.0	17.7	119.7	16.7	11.6	4.4	6.1	21.0	9.7	8.1	3.8	3.9	12.6
Senegal	1.7	13.4	8.3	3.6	4.7	16.1	105.3	58.6	12.2	20.1	155.7	16.9	9.4	2.6	4.3	20.7	13.7	12.2	4.9	6.5	17.4
Côte d'Ivoire	1.7	18.8	12.6	5.2	7.2	22.2	124.6	72.9	17.8	25.8	181.3	25.1	16.0	5.1	8.0	30.1	11.2	9.6	4.9	5.2	14.3
Sao Tomé and Principe	1.7	33.1	23.2	9.0	15.4	42.4	140.5	82.9	26.6	39.1	212.1	46.2	31.6	10.7	20.2	59.9	6.5	5.2	3.9	3.1	8.0
Bangladesh	1.5	14.8	11.4	5.2	10.6	18.0	83.0	56.1	16.0	43.5	123.0	22.4	16.7	6.2	15.3	27.8	9.2	7.8	4.2	6.3	11.7
Kenya	1.5	11.4	8.3	3.6	4.0	13.7	85.1	53.3	15.5	15.7	125.9	16.9	11.5	3.7	4.3	20.6	12.9	10.8	6.5	5.8	16.4
Ghana	1.5	11.4	8.3	3.7	4.7	13.6	82.8	53.6	14.3	18.3	122.9	16.9	11.7	3.8	5.4	20.6	12.6	10.9	5.7	5.9	16.1
Myanmar	1.4	9.8	7.8	3.8	7.6	11.8	59.5	40.4	13.2	36.6	88.4	14.4	11.0	4.1	10.6	17.9	10.2	8.4	4.9	7.7	13.0
Benin	1.4	11.1	7.2	3.1	4.1	13.3	98.9	54.6	12.1	18.6	148.1	17.0	10.1	3.0	4.7	20.9	15.8	13.2	5.7	7.1	20.2
Lesotho	1.4	12.6	9.1	4.1	7.0	16.2	99.3	60.3	15.6	37.6	156.2	20.3	14.0	5.0	10.1	26.7	13.7	11.2	5.5	8.8	17.3
Zambia	1.4	14.2	9.6	3.6	4.2	17.3	95.0	54.4	13.4	12.9	139.1	23.2	14.9	3.9	5.0	28.7	11.3	9.3	5.5	4.2	14.1
Gambia_ The	1.3	12.1	8.7	3.8	4.9	15.1	88.6	57.4	15.2	20.5	137.0	21.3	14.6	5.0	7.2	27.4	12.7	11.2	6.0	6.3	16.1
Tanzania	1.3	14.4	9.0	3.4	4.4	17.4	114.1	59.0	13.1	17.4	168.2	26.2	15.4	4.3	6.2	32.1	13.8	11.2	5.7	6.0	17.4
Chad	1.2	11.7	6.4	3.1	4.2	14.6	107.0	53.5	11.9	20.8	166.0	21.3	10.5	3.7	6.1	27.2	16.3	14.7	5.8	7.8	20.8
Afghanistan	1.2	24.4	13.5	6.1	9.4	29.4	142.1	75.1	21.6	34.5	211.7	48.8	25.9	10.3	17.2	59.2	9.6	9.1	5.1	5.3	12.4
Uganda	1.1	11.2	7.4	3.3	3.9	14.1	105.1	59.5	14.4	17.8	163.8	22.1	13.7	4.8	5.9	28.4	16.7	14.1	6.6	7.3	21.2
Burkina Faso	1.1	13.0	6.4	2.6	3.9	16.4	100.9	50.4	9.1	17.0	156.9	26.2	11.8	3.3	6.2	33.8	13.6	13.6	5.0	6.6	17.2
Nepal	1.1	7.9	5.8	2.6	4.1	9.7	70.6	44.4	10.0	20.9	106.5	15.9	11.1	3.5	6.9	19.9	15.8	13.2	5.7	8.3	20.1
Guinea-Bissau	1.1	11.5	7.4	2.8	4.3	14.8	111.6	62.8	12.8	19.7	174.3	24.6	14.8	4.0	7.5	32.3	17.4	15.0	7.2	7.2	21.6
Rwanda	1.0	11.0	7.1	3.1	4.5	13.8	93.5	50.9	12.7	20.9	145.4	23.9	14.5	4.9	8.2	30.6	15.0	12.3	6.2	7.4	19.1
Haiti	1.0	12.0	8.6	3.3	4.7	14.9	92.3	56.4	13.5	16.9	137.5	27.6	19.0	5.7	9.4	34.9	13.4	11.2	6.3	5.1	16.5
Comoros	1.0	8.2	5.7	2.5	3.1	10.5	88.2	52.5	11.6	17.0	139.2	18.3	12.0	3.8	5.5	24.2	19.6	16.4	7.3	8.8	24.5
Guinea	1.0	9.4	5.5	2.5	3.3	11.8	115.4	62.7	10.2	20.8	183.4	21.6	11.5	3.8	6.0	27.7	22.4	20.9	6.3	10.5	29.1
Mali	1.0	10.0	5.0	2.4	3.3	12.5	88.0	43.6	9.0	17.3	137.2	23.6	10.6	3.8	6.1	30.3	15.6	15.5	5.5	8.6	19.9
Ethiopia	0.9	11.3	6.9	3.0	4.8	13.7	104.3	52.1	10.4	23.5	155.8	27.7	16.1	5.4	10.4	34.1	16.5	13.0	5.0	7.7	20.8
Togo	0.9	7.7	5.4	2.4	3.3	9.4	68.7	41.1	10.2	16.4	102.7	19.1	12.7	4.2	6.8	23.6	15.8	13.1	6.5	7.9	20.0
Madagascar	0.9	8.2	5.2	2.0	3.0	10.7	90.1	50.0	10.0	17.9	143.4	21.2	12.5	3.3	6.1	28.2	19.9	17.1	7.9	10.0	24.9
Mozambique	0.8	12.4	6.9	2.6	4.1	15.0	133.9	60.8	11.1	22.1	198.7	34.1	17.8	5.2	9.6	41.8	19.7	15.8	6.5	8.8	24.6
Malawi	0.8	5.9	3.9	1.5	2.0	7.7	77.8	43.5	8.9	12.2	123.9	16.2	9.7	2.3	3.7	21.8	24.3	20.5	9.8	10.5	30.3
Sierra Leone	0.7	14.1	9.1	3.7	5.4	17.7	111.5	65.9	15.7	24.5	171.8	45.0	28.2	10.0	15.6	57.2	13.8	12.4	6.4	7.1	17.4
Central African Republic	0.7	8.9	5.6	2.1	3.7	11.4	103.7	55.3	10.9	22.7	164.3	28.8	17.2	5.0	10.4	37.9	21.4	17.8	8.2	10.4	26.7
Niger	0.7	9.4	4.3	1.7	2.8	11.9	99.6	44.5	8.0	16.6	155.5	33.3	13.9	4.1	8.4	43.2	19.3	18.8	7.3	9.7	24.0
Eritrea	0.5	3.3	2.3	0.9	1.3	4.1	48.2	29.7	5.9	10.6	73.5	14.4	9.5	2.2	4.2	18.3	27.2	23.3	11.0	14.2	34.2
Zimbabwe	0.4	3.8	2.8	1.1	2.2	4.9	56.3	36.2	7.9	26.3	90.1	21.8	15.1	4.2	11.8	28.9	27.6	24.2	12.9	21.4	34.5
Liberia	0.4	7.6	3.8	1.6	2.3	9.6	105.0	51.9	8.6	17.2	166.4	48.1	22.5	8.3	12.5	61.6	25.6	25.6	8.6	13.3	32.6
Burundi	0.4	4.9	2.9	1.2	2.1	6.3	62.4	32.0	6.1	15.5	99.8	30.7	17.5	5.8	12.0	40.6	23.7	19.9	8.0	12.6	29.6
Congo_ Dem. Rep.	0.3	5.3	3.6	1.3	2.1	6.6	73.2	42.7	8.1	16.2	111.3	39.7	26.0	7.8	14.3	50.6	25.9	22.1	10.5	13.5	31.6