

Chapter 1

Development Implications of the Baseline Scenario of the OECD Environmental Outlook to 2030

Modelling framework

The modelling framework used for the *OECD Environmental Outlook to 2030* (EO) comprises the ENV-Linkages computable general equilibrium model coupled with the Integrated Model to Assess the Global Environment (IMAGE) developed at MNP, the TIMER energy model, and a GTAP agricultural-economy model developed at the Agricultural Economics Institute of the Netherlands. Basically macroeconomic variables from ENV-Linkages and population variables from the United Nations 2004 Medium Variant projections are inputs to the other models. There is no feedback from the MNP suite of environmental models to the macroeconomic ENV-Linkages model. In the baseline, modest improvements in environmental policies in developing countries and equipment modernisation entailing greater use of less-polluting technologies are assumed to lead to some reductions in emission coefficients over time.

Developing and transition economies have been disaggregated to include the 6 individual BRIICS countries and 9 sub-regions. The sectoral breakdown comprises 30 sectors including four sectors important for simulation of policy coherence, *i.e.*, vegetables and fruits; plant-based fibres; refined sugar; and textiles and wearing apparel. This permits some analysis of such issues as end of EU tariff preferences for bananas, suppression of OECD domestic support measures for cotton and sugar, as well as the impact on trade shares of the recent implementation of the Uruguay Round liberalisation of textiles and wearing apparel.

The baseline projection used here is not a prediction of the future worldwide economy; it merely attempts to reflect how the future economy

and environment might evolve in the absence of new policies or unforeseen disturbances. In the *OECD Environmental Outlook* the emphasis in developing the baseline was on constructing an analytical tool that would be useful for comparative analysis. Since some trends are obviously related to the introduction of new policies, they were suppressed so as to facilitate comparisons of policy simulations with a policy-neutral baseline. An example is seen with globalisation. As is reported below, the baseline has the ratio of imports to GDP stabilising over time – rather than continuing to increase as has been the case over recent periods.

Main drivers of economic growth

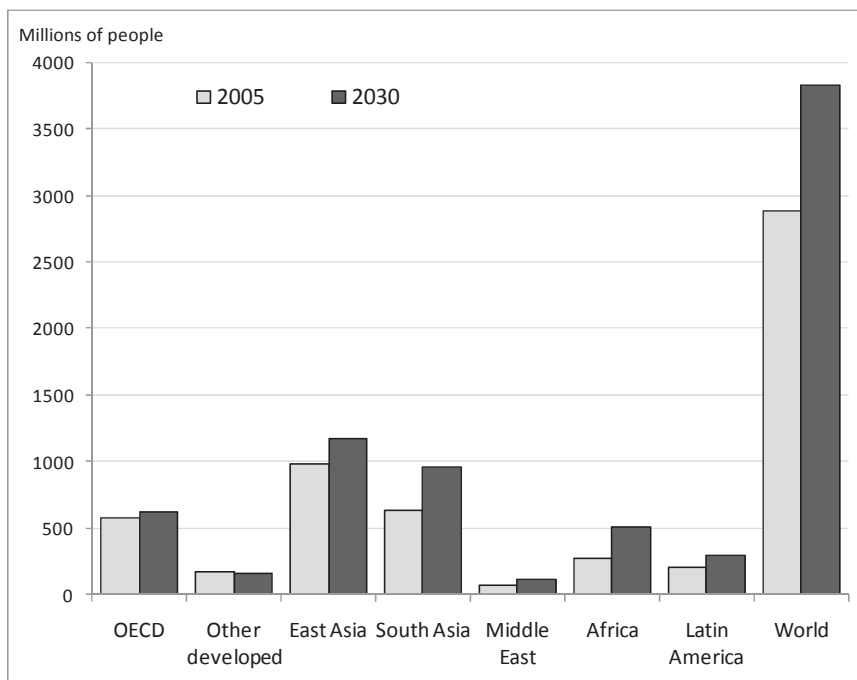
Changes in the primary economic drivers, *i.e.*, labour force, labour force participation rates, labour productivity by economic sector, and import/GDP ratios, have been used to compute growth in GDP and in GDP per capita for the period to 2030. These were projected for each of the 87 country/regions in the GTAP database prior to aggregating to the country/regional groupings used in this report. The potential labour supply, defined as people of age 15 or more, has been taken from the “medium variant” of the United Nations 2004 Revision, in which population grows to somewhat more than 8 billion by 2030 and eventually stabilises around 9 billion in 2050. Distribution of population among the countries of the world is also dependent upon assumptions about international migration that have been incorporated in the projections.

The actual labour force depends on labour force participation rates as well. When labour force participation rates are calculated for the total population age 15 or more, they will naturally be lower than for the age group 15 – 64 because participation rates are lower in older population cohorts as people move into retirement. These total labour force participation rates are expected to decline in OECD countries from current levels of 60 % to about 55% by 2030 due to the ageing of the population, although within the older cohorts themselves they may well increase somewhat compared to present levels due to reforms in labour markets and pension systems. For people in the age cohort 15 – 64, European countries have set a target for the participation rate of 70% by 2020. In developing countries, where currently measured labour force participation rates are considerably lower than 60%, an assumption is made that 1% of the gap between current labour force participation rates and 60% is closed per year. These assumptions lead to a considerable change in the world-wide distribution of the labour force. The developing country share would rise from 78% in 2005 to 82% by 2030 while that of the OECD countries would fall from 20% in 2005 to 16% in 2030, and the share of economies in

transition would fall from 5.9% in 2005 to 4.3% in 2030. Within the developing countries, the share of Africa in the world labour force would increase the most from 9% in 2005 to 13% in 2030.

Table A.5 provides more country and regional detail of the projected trends in labour force growth in the reference scenario.

Figure 1.1 Labour supply, 2005 and 2030



Source: ENV-Linkages/IMAGE model analysis.

Long-term productivity growth in OECD countries has tended towards a mean of 1.76% per year for OECD countries. All OECD countries are therefore assumed to move towards that rate by closing the gap between their individual historical rates during the period 1980-2001 and 1.76% at the rate of 2% per year beginning in 2012. During a transition period taking into account OECD medium-term forecasts they are also assumed to move from their current actual rates to their own long-term trend rates by 2011. For developing countries the same approach was used, except that for countries where the historical average was negative, the starting point was assumed to be a zero rate of productivity growth in 2011, and then gradually

moving towards the OECD rate by closing the gap at the rate of 2% per year. Overall rates of labour productivity growth have been disaggregated for 7 economic sectors, and those rates applied to the 26 sectors currently used in the ENV-Linkages model. In general, rates of productivity growth are higher in the durable and non-durable manufacture sectors and lowest in the services sectors. Differentiating among sectors is important because changes in the sectoral composition of output as economies grow will change their overall productivity growth rates. Increases in labour productivity measured may also be understood as the result of improvements in the skill level of the labour force, the rate of capital accumulation, and the rate of change of total factor productivity. In the baseline scenario, increasing scarcity of labour relative to capital results in a continuation of capital deepening with a gradually increasing share of investment in GDP. Thus, the capital stock grows at a somewhat faster rate than that of GDP as may be seen in Table A.4.

Economic outcomes

Growth in GDP and in GDP per capita

Based on the assumptions mentioned above, world economic growth gradually slows from a peak in 2005 and a peak decade growth rate of 3.35% for 2002-10 to 2.48% for the period 2020-30. For the entire forecast period 2002-2030 the average world rate of GDP growth is 2.82%. Transition economies exhibit a growth rate more than one percentage point higher on average, and developing countries one and one-half percentage point higher. OECD countries, on the other hand, are assumed to show average growth of 2.34%, about one-half percentage point lower than the world average. As may be seen from Table A.1, GDP growth rates in developing countries exhibit considerable variation among various countries and regions but average about one and one-half percentage points higher than the OECD countries.

In 2010 China and India would be growing at about 6% per year, but this growth would slow to about 4% per year in 2030 – somewhat higher in India and somewhat lower in China due to demographic factors that result in lower growth rates of the labour force. Indonesia, other countries in East Asia and in South Asia exhibit broadly similar trends, but since their growth is projected to be considerably less than that of India and China between 2005 and 2010, this trends imply considerable convergence in their growth rates with those of China and India. Brazil and other developing countries in Central and South America are expected to have GDP growth rates of about

3% by 2010, but slowing somewhat by 2030. This is due to slow growth of the working age population, and a gradual convergence of growth in labour productivity to that of OECD countries. Sustained implementation of ambitious economic reform policies involving greater competition and labour market flexibility could result in higher growth rates. The countries in the Middle East and in Africa are projected to exhibit faster growth than countries in Central and Latin America because of more rapid growth rates of the labour force combined with improvements in labour productivity trends. South Africa, however, is expected to continue to exhibit considerably slower growth leading to some convergence in per capita incomes with its neighbouring countries.

The pattern of per capita GDP growth in the various developing countries and regions is somewhat different because those countries with relatively faster growth in their labour force do not have sufficiently rapid growth in labour productivity to fully offset the increases in population, so that the growth rate of their per capita incomes lags behind many countries and regions with slowing growth of population and labour force.

When purchasing power exchange rates are used to aggregate countries, a number of large developing and transition economies exhibiting rapid growth have larger weights in regional and world aggregates than results from using official exchange rates, resulting in substantially higher growth. Table A.2 shows the growth rates that result from this alternative weighting method.

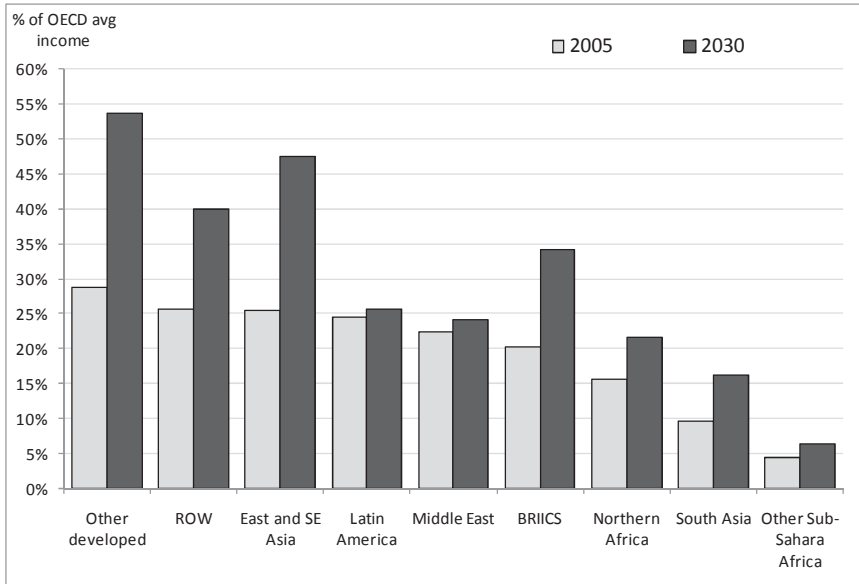
Levels of GDP per capita

The trends mentioned above translate into different rates of growth of per capita income which in turn result in varying degrees of convergence in the levels of per capita income. Table A.9 shows growth in per capita income for major countries and regions.

As the figure below shows, per capita incomes as a percentage of the OECD averages increase quite strongly for the BRIICS as a group, for East Asia and for South Asia, with less improvement in North Africa and little or no improvement in Middle East, Central and South America, and sub-Saharan Africa.

Shares of countries/regions in world GDP

Figure 1.2. Per capita income as a percentage of OECD average, 2005 and 2030

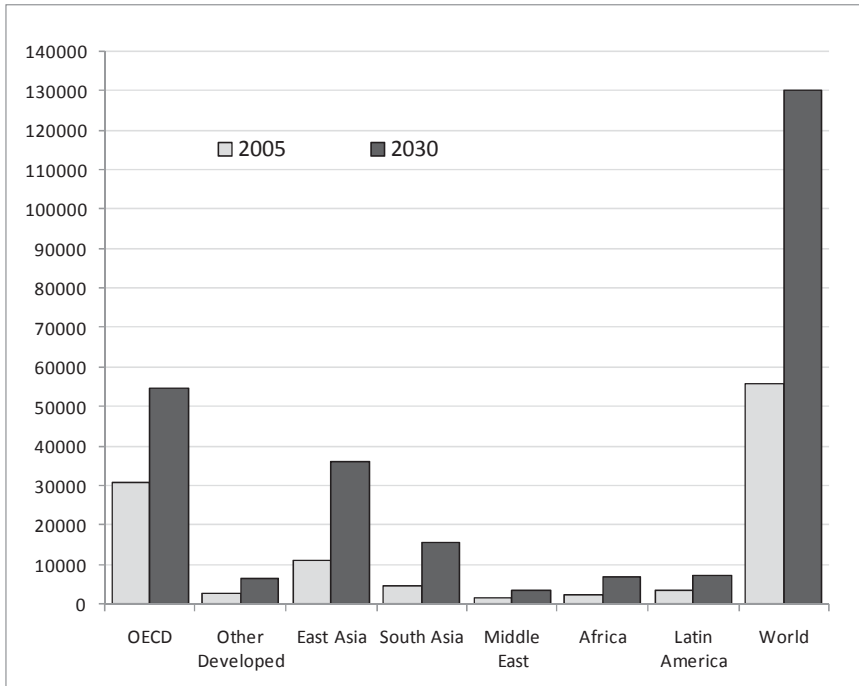


Source: Env-Linkages/IMAGE model analysis.

By 2030, GDP outside of the OECD countries is projected to be larger than within the OECD countries. The OECD share in world total would have fallen from about 55% in 2005 to 42% in 2030 and to about 36% in 2050. Most of the shift will be towards East and South Asia, regions dominated by China, India, and Indonesia. Table A.7 provides more regional and country detail on the evolution of shares of world GDP.

Figure 1.3. World GDP at PPP exchange rates by major region, 2005 and 2030

USD millions



Source: Env-Linkages/IMAGE model analysis.

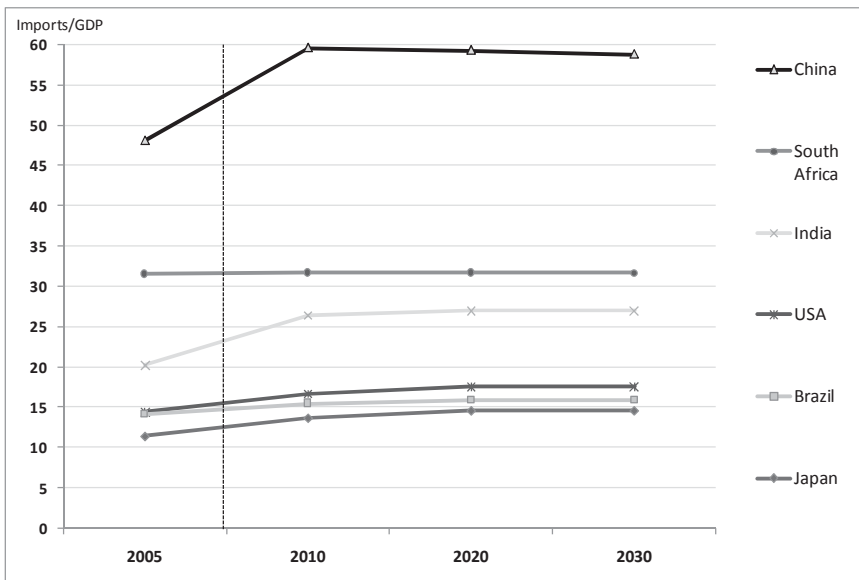
Changes in economic sector shares within each country/region

Regarding sectoral shares, most developing countries and regions are projected to have falling shares in their own GDP for agriculture; some of them are expected to have falling shares in manufactures (Middle East, Republic of South Africa) as well, but others will see the shares of manufactures increase (India, Other South Asia, Northern Africa, Other Sub-Saharan Africa). Nearly all are projected to exhibit an increase in the shares of the service sectors. In the OECD countries, sector shares in agriculture and in manufactures are expected to fall (but not by much because they are already quite low), and the share of services is expected to increase. World-wide, there is a shift from agriculture to services with industry broadly retaining its share between 2005 and 2030. In all regions the shares of trade and transport are projected to increase with consequences for environmental pressures discussed below.

Changes in import shares

Trade is represented in ENV-Linkages by an assumed import/GDP ratio. In the absence of *additional* policies to further liberalise trade, it is assumed that the recent growth in that ratio will gradually end so that the ratio becomes constant. This assumption has been implemented by placing countries in one of three categories. If there had been little growth in trade shares recently, no growth was assumed in the projection. If they had exhibited moderate growth, a 5% rate of import share growth was assumed for the initial period of the projection, which then gradually decreases toward zero. For countries that had shown high rates of growth in import shares, a 10% rate of growth was assumed for the initial period of the projection, which then gradually decreases toward zero. Import/GDP ratios are thus projected to continue to rise but at declining rates to reach about 33% worldwide in 2030, compared to 27% in 2005. Within this moderate increase are continued increases in China and India. China's projected import/GDP ratio will reach 60%, a very high ratio for a large economy, but the alternative of a declining ratio would have been arbitrary. Table A.10 provides more detail on changes in trade shares over time in the baseline scenario.

Figure 1.4. Import/GDP ratios, selected countries, 2005-2030



Note: 2005 is included as it is a base year.

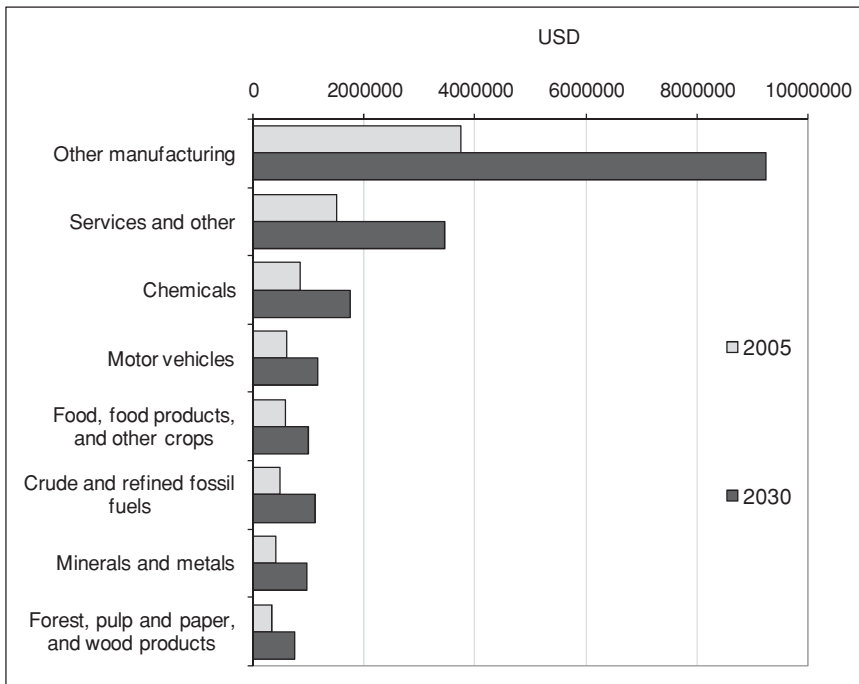
Source: Env-Linkages/IMAGE model analysis.

Changes in sectoral shares in world exports

At constant prices the volume of world trade in the baseline scenario is projected to expand cumulatively by 128% between 2005 and 2030, dominated by growth in the volume of manufactured products as may be seen in Figure 1.5.

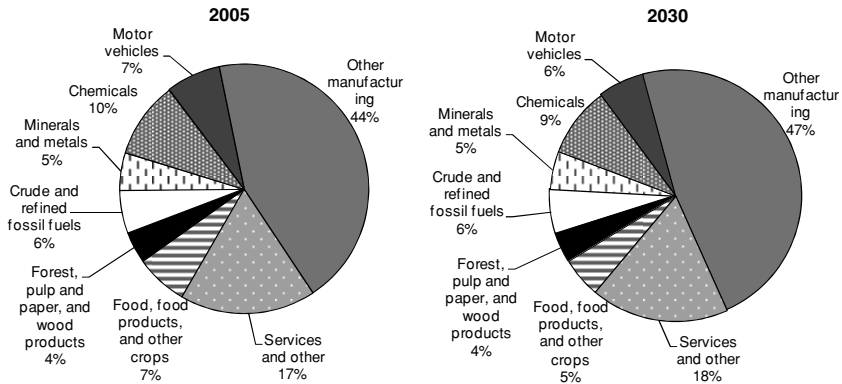
As may be appreciated from Figure 1.6, it is notable that there are relatively small changes in sector shares with the broad category of manufactured items other than food, wood products, chemicals, and motor vehicles expanding its share, and services retaining its share, with slight decreases in the shares of the other categories.

Figure 1.5. Exports to world by broad trade clusters, 2005 and 2030



Source: Env-Linkages/IMAGE model analysis.

Figure 1.6. World trade by broad clusters, 2005 and 2030

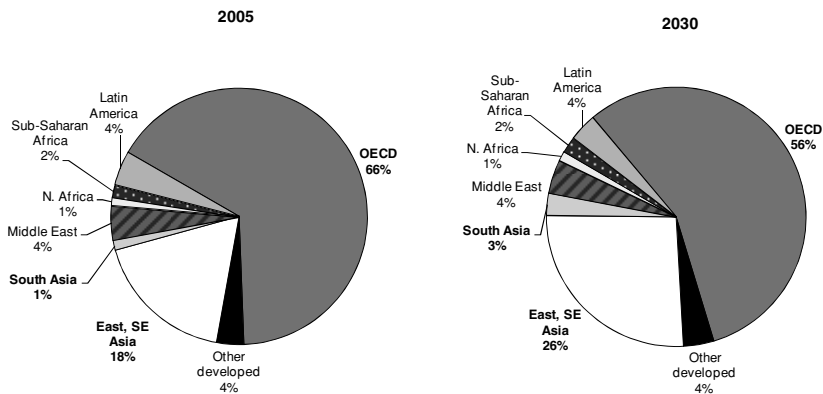


Source: Env-Linkages/IMAGE model analysis.

Changes in shares of world trade by country/region

Changes in the share of world trade by region of origin are more pronounced than changes in the sectoral composition of trade. Developing countries are projected to expand their trade shares at the expense of other regions, with the major increases occurring in East and Southeast Asia, followed by South Asia.

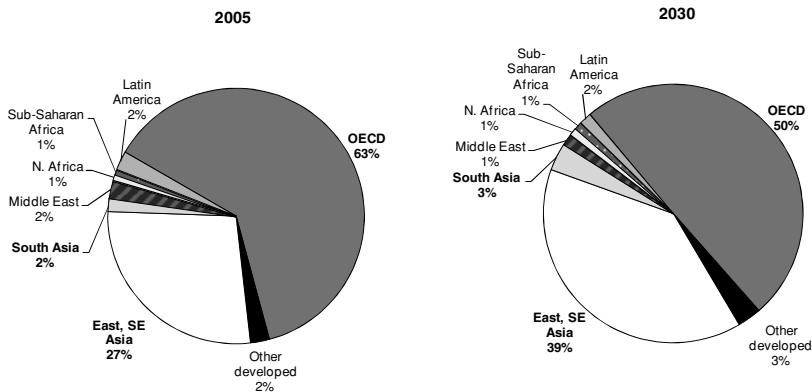
Figure 1.7. Total exports to the world by region, 2005 and 2030



Source: Env-Linkages/IMAGE model analysis.

This change in the distribution of total exports by region of origin is driven by changes in the distribution of exports in the category of other manufactures, which, as discussed in the preceding section was the sectoral category exhibiting the largest increase in share. As may be seen in Figure 1.8, this category exhibits changes in the regional distribution of exports that is considerably more pronounced than total world exports. This is because this category of exports is less closely linked to a raw material base than many other export categories. Capital goods are an important component of “other manufactures”, and they also exhibited substantial shifts in the regional shares of exports to the world as may be seen from Table A.11. Importantly, similar shifts are projected in the worldwide distribution of imports of capital goods, suggesting that the projected expansion of trade comprises intra-industry trade to a considerable extent (Table A.12).

Figure 1.8. Exports of other manufactures to the world, 2005 and 2030



Source: Env-Linkages/IMAGE model analysis.

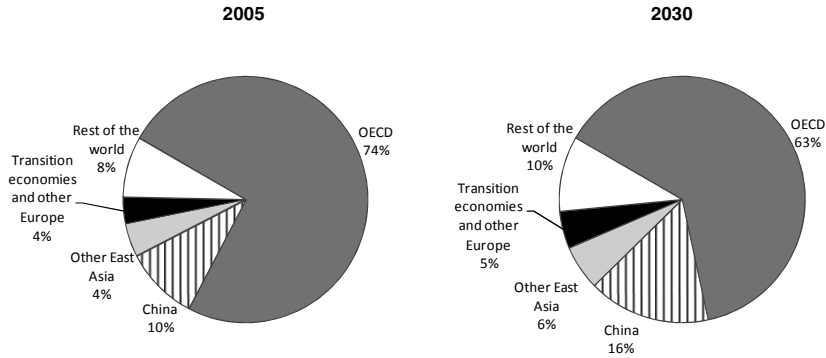
Without further trade liberalisation, the baseline scenario projects the trade deficits of OECD countries in agriculture and food processing to fall substantially except in OECD Asia as may be seen in Table A.17. The counterpart to this is increasing deficits in most developing and transition economies. Countries and regions with increasing surpluses include US & Canada, Australia & New Zealand, Brazil and other Central and South America, and sub-Saharan Africa.

Changes in country/region economic sector shares in world-wide production

Changes in the world-wide pattern of growth and changing patterns of world trade lead to changing sector shares of production within countries and regions, which in turn results in substantial changes in the world-wide spatial distribution of output in all economic sectors. Sectors of concern for their environmental impacts on air and water quality and energy related greenhouse gas (GHG) emissions include chemicals, iron and steel, cement, pulp and paper, and energy and transport. Changes in agriculture are important for impacts on land use and water quality, and biodiversity. A number of tables in the Annex show changes in the regional distribution of sectoral outputs for agriculture and food, fossil fuels other than refined petroleum products, capital goods, energy-intensive industrial products, and services. The share of developing countries in world production of agriculture and food is projected to increase from 34% in 2005 to 41% in 2030 while that of OECD countries would fall from 57% to 48%. These changes are less pronounced than other sectors as can be seen in Table A.13.

Not surprisingly, the share of developing countries in the production of fossil fuels is projected to increase, from about 46% in 2005 to 53% in 2030. Increasing or stable shares characterise nearly all developing country regions. The share of Russian and other transition economies increases as well, from about 15% in 2005 to about 17% in 2030. Correspondingly, the share of OECD countries is projected to fall by nearly 10 percentage points from 39% in 2005 to 30% in 2030. This reflects the distribution of natural resource endowments (Table A.14).

Changes in the distribution of capital goods production are large, dominated by an increasing share of world production on the part of the BRIICS. Shares of several developing countries are projected to increase by as much as 50%. Thus, the share of developing countries increases from 26% in 2005 to about 36% in 2030 and that of transition economies from 4 to 5%. Correspondingly, the share of OECD countries falls from about 71% to 59% between 2005 and 2030 (Table A.15).

Figure 1.9. Regional composition of world energy-intensive production, 2005 and 2030

Source: Env-Linkages/IMAGE model analysis.

A similar picture is revealed for outputs of energy-intensive sectors, such as mineral refining, metal processing, chemicals, pulp and paper, and cement, although the shifts are slightly smaller than in the case of capital goods (Table A.19).

The shift in the share of services by region is less pronounced because of the low initial share of developing countries of 16% in 2005, which increases to 22% in 2030. This is a 50% increase, but the absolute shift is only 7 percentage points. The counterpart to this is a change in the share of OECD countries from nearly 83% in 2005 to 75% in 2030 (Table A.16).

Acronyms

BRIC	Brazil, Russia, India and China
BRIICS	Brazil, Russia, India, Indonesia, China and South Africa
CBD	Convention on Biological Diversity
CCS	Carbon capture and storage
CDM	Clean Development Mechanism
CO	Carbon monoxide
CO ₂	Carbon dioxide
CO ₂ eq	Carbon dioxide equivalents
CSD	Commission on Sustainable Development
DAC	OECD Development Assistance Committee
EJ	Exajoules
EO	Environmental Outlook
EU-15	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom
EU-25	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom
EUR	Euro (currency of European Union)
FAO	Food and Agriculture Organisation of the United Nations
GBP	Pound sterling
GDP	Gross domestic product

GHG	Greenhouse gas
GJ	Gigajoules
GNI	Gross national income
Gt	Giga tonnes
GTAP	Global Trade Analyses Project
GW	Gigawatt
IEA	International Energy Agency
IMAGE	Integrated Model to Assess the Global Environment
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land use, land use change and forestry
MAD	Mutual Acceptance of Data
MDGs	Millennium Development Goals
MEA	Multilateral environmental agreement
MNP	Netherlands Environmental Assessment Agency
MSA	Mean species abundance
Mt	Million tonnes
MWh	Megawatt-hour
PFC	Perfluorocarbon
PM	Particulate matter
PM _{2.5}	Particulate matter, particles of 2.5 micrometres (µm) or less
PM ₁₀	Particulate matter, particles of 10 micrometres (µm) or less
ppb	Parts per billion
ppm	Parts per million
ppmv	Parts per million by volume
PPPs	Purchasing Power Parities
ROW	Rest of world
RTA	Regional trade agreement

UNFCCC	United Nations Framework Convention on Climate Change
USD	United States dollar
VOC	Volatile organic compound
WHO	World Health Organization
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization

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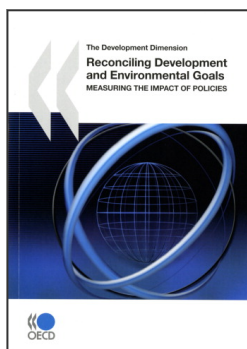
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