

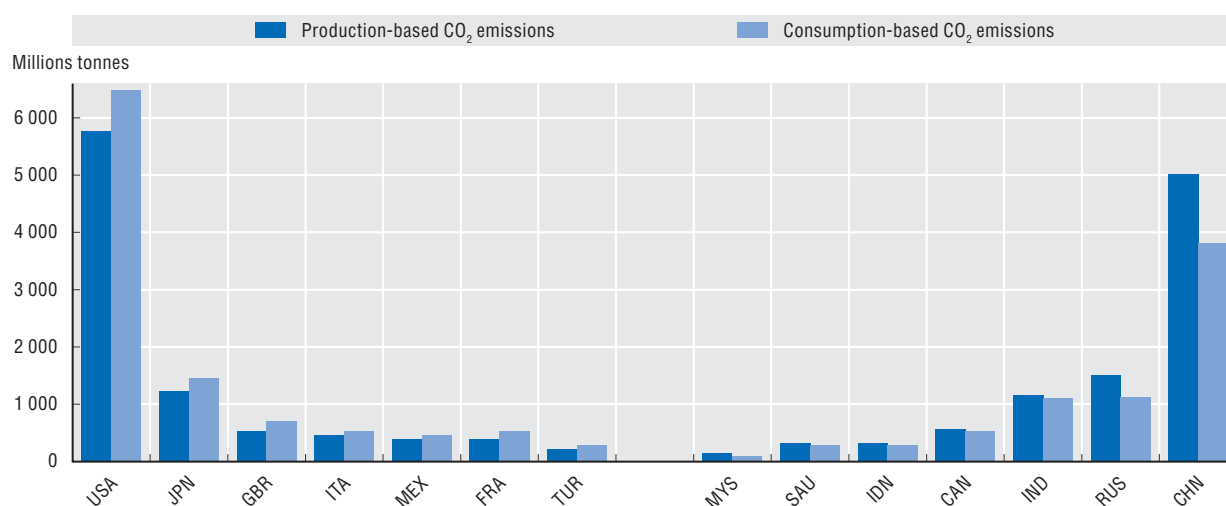
## The challenges ahead

A corrigendum has been issued for this page. See: <http://www.oecd.org/dataoecd/26/8/48742541.pdf>  
CO<sub>2</sub> emissions

The gains from growth, while distributed unevenly around the world, have been dramatic. Over the past 150 years life expectancy increased by around 30 years in most regions, including some of the world's least developed. The growth dynamic that has yielded these improvements in living standards has imposed substantial costs on the physical environment on which human well-being ultimately depends. It is increasingly apparent that the current use of natural resources could put higher living standards and even conventionally measured growth at risk. Without decisive action, energy-related emissions of CO<sub>2</sub> will double by 2050. Efforts to mitigate greenhouse gas (GHG) emissions, such as the Kyoto Protocol, will be less effective in reducing global emissions of GHG if countries with emission commitments source their carbon-intensive production activities from economies without such commitments, particularly if production in the latter countries is GHG-intensive.

### Biggest net CO<sub>2</sub> importers and exporters, 2005

Estimates of consumption-based emissions and production-based CO<sub>2</sub> emissions, selected countries



Source: OECD, Input-Output Database, May 2011; International Energy Agency (2010), *CO<sub>2</sub> Emissions from Fuel Combustion 2010*, OECD, Paris. See chapter notes.

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### How to estimate imports and exports of CO<sub>2</sub>?

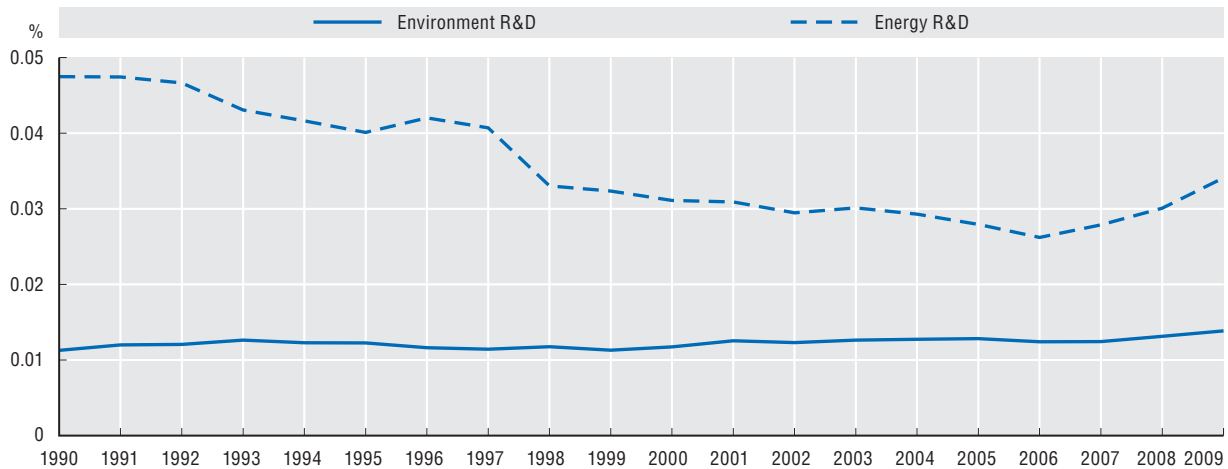
The OECD's input-output tables, bilateral trade in goods and services statistics and the IEA's energy statistics (e.g. fuel-combustion-based CO<sub>2</sub> and international electricity transfer), together with other industry statistics, can be used to estimate the effects of international transfers of CO<sub>2</sub> emissions. The results highlight differences among countries in production-based and consumption-based emissions. Consumption-based CO<sub>2</sub> emissions of OECD countries were, on average, about 16% higher in 2005 than conventional measures of production-based emissions suggest. The divergence exceeds 30% in seven OECD countries (Austria, France, Luxembourg, Portugal, Sweden, Switzerland and the United Kingdom). The magnitude of the differences increased in the late 1990s as trade in goods and services increased. The emissions structure of countries varies owing to differences in consumption activities, sources of electricity generation and the carbon intensity of imported goods. Electricity-sourced emissions are relatively high in emerging economies (e.g. China and India), whereas emissions due to transport activity and consumption of imported goods are relatively high in developed OECD economies (e.g. Japan and Germany).

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**Innovation and global challenges**

Wherever they originate, the effects of greenhouse gas emissions are universal, and any solution that reduces these emissions will benefit all countries. Similarly, many infectious diseases have no regard for national borders, and new medicines can benefit all. High food prices and water scarcity are another important issue for both developed and developing countries. Innovation is increasingly perceived as essential for tackling such challenges. Meeting these challenges depends crucially on the pace of innovation in new technologies, for example in the areas of renewable energy, carbon capture and storage, lower emissions, bioremediation, smart grids, synthetic biology, bio-informatics and personalised medicine.

### R&D spending for energy and the environment, OECD countries, 1990-2009

Percentage of GDP

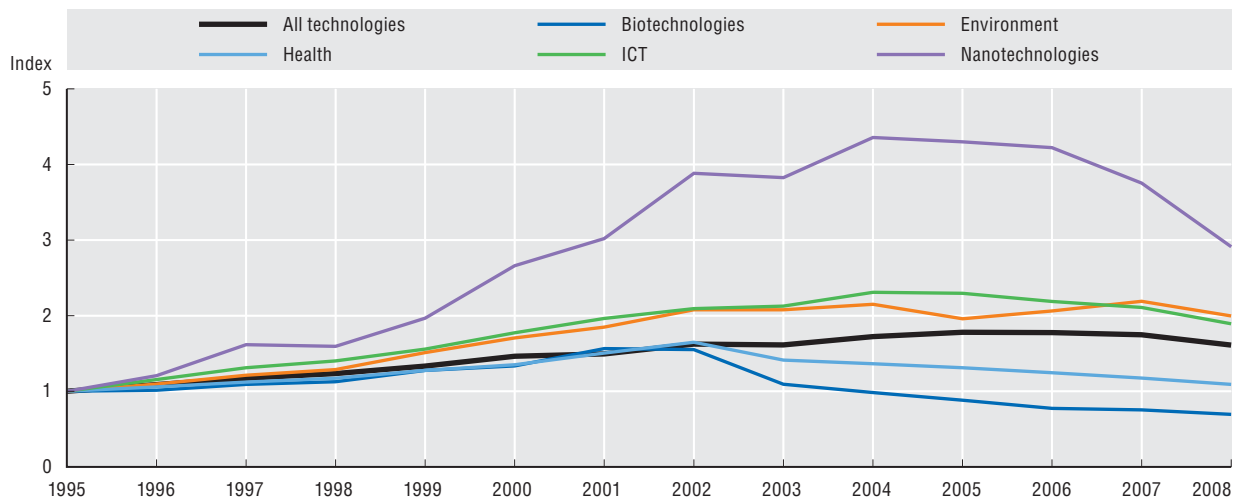


Source: OECD, Research and Development Statistics Database, May 2011. See chapter notes.

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### Trends in patents by technology fields, 1995-2008

"Claimed priorities" (patent counts) in selected technology fields (index 1995 = 1)



Source: OECD, calculations based on the Worldwide Patent Statistical Database, EPO, April 2011. See chapter notes.

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# 1. KNOWLEDGE ECONOMIES: TRENDS AND FEATURES

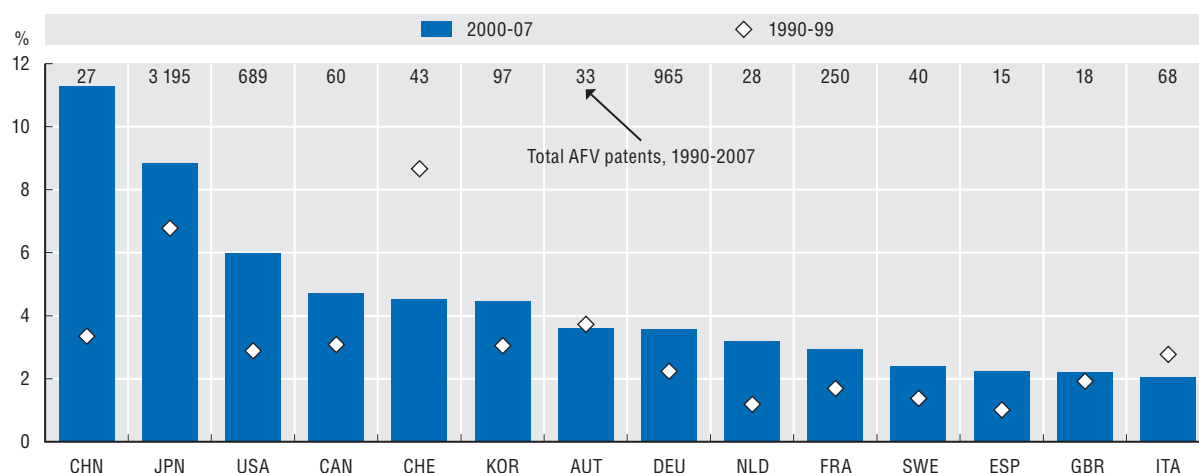
## The challenges ahead

### Innovation and environment

Encouraging innovation that reduces environmental impacts requires appropriate sequencing of policy measures. It is necessary to “price” the negative environmental effects of the production and use of goods and services in order to develop and adopt new, less environmentally damaging technologies, although changes in relative prices may not suffice to encourage breakthrough technologies. Alternative-fuel vehicles (AFV) have seen the introduction of a combination of policy instruments, sometimes with different but related environmental objectives. The mix of policies that, directly or indirectly, provide incentives for development of AFV technologies includes fleet-level fuel-efficiency standards (e.g. US ZEV mandates), after-tax fuel prices, targeted public support for R&D, as well as measures such as public procurement programmes or differentiated vehicle taxes. As a result of such measures, innovation in AFV technologies has accelerated and is now the fastest-growing type of technology in the motor vehicles sector. However, the rate of innovation in AFV remains low in absolute terms, although there are important differences among countries.

#### Transition to alternative-fuel vehicle (AFV) technologies, 1990-99 and 2000-07

Share of AFV patent applications (claimed priorities) in motor vehicles patents



Note: Only countries with a minimum of ten patents (claimed priorities) deposited during the two decades are included.

Source: OECD, calculations based on the Worldwide Patent Statistical Database, EPO, April 2011. See chapter notes.

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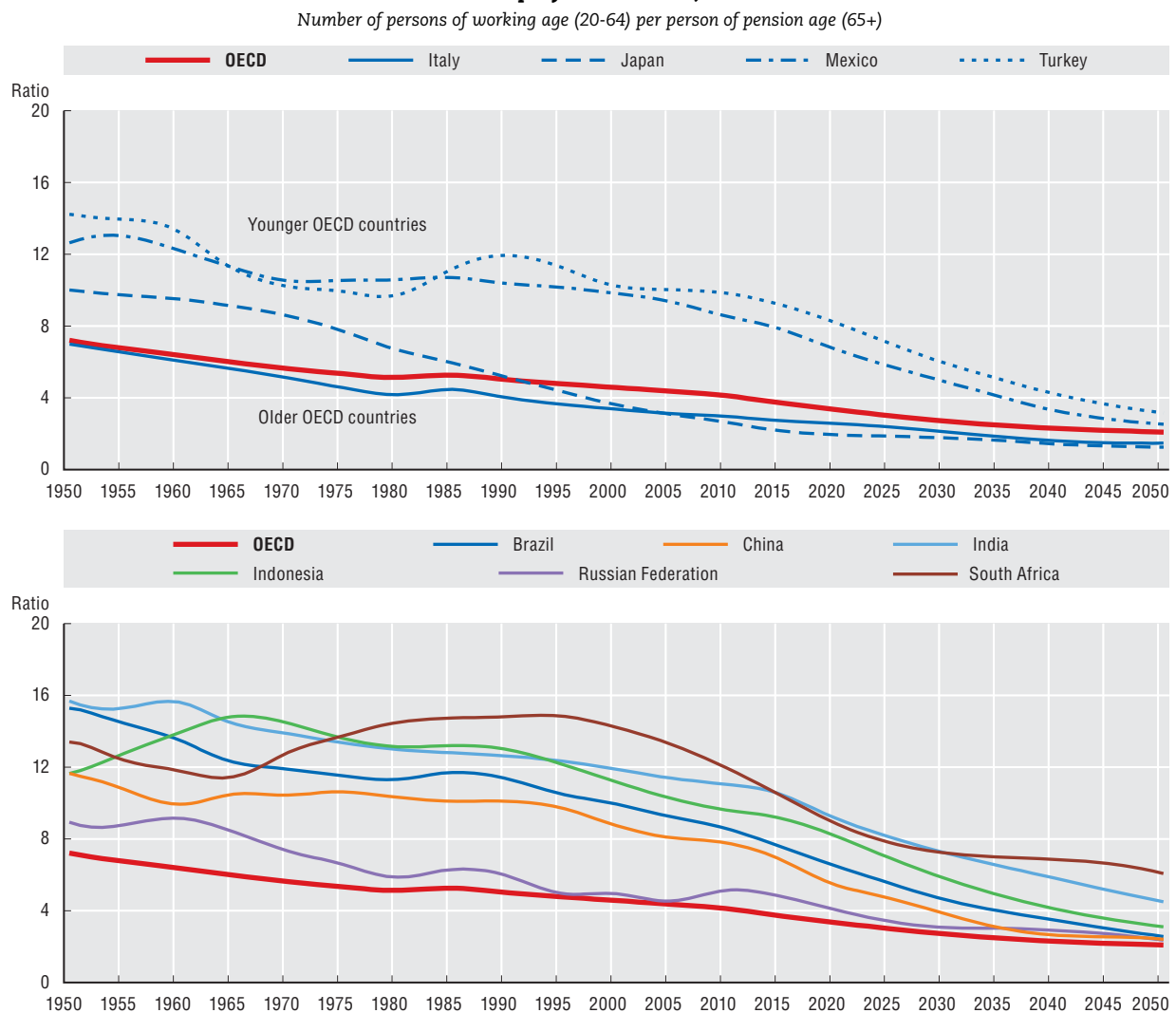
### The impact of policy drivers

An econometric model based on the characteristics of the policy instruments implemented in different countries, combined with measures of inventive activity based on patent data, and controlling for other important factors, has been used to examine empirically the importance of various policy drivers. It has found significant differences between electric and hybrid propulsion, the types of technologies studied. For example, the role of after-tax fuel prices is insignificant for electric cars, but standards play an important role. The reverse applies for hybrid cars. R&D plays a much more important role for electric than for hybrid cars. Simulations conducted using these results indicate that relatively minor changes in a performance standard or automotive fuel prices would yield effects that are equivalent to a much greater proportional increase in public R&D budgets.

## Ageing populations

In 2008 there were on average about four persons of working age for every older person in the OECD area. In 2050 there will be on average two workers per retired person. Countries with the highest current old-age support ratios are expected to experience the biggest drop, with support rates converging over the next 40 years. There are many promising but few proven models for anticipating and responding to the emerging societal needs of ageing societies through innovation. Yet this is a critical challenge for all OECD countries in the years ahead. Stimulating innovation to deal with the needs of the elderly has benefits not just for their quality of life but potentially for the economy as well. There is the potential for the “silver economy” to create jobs and economic activities, especially in sectors such as public services, health and well-being, leisure, sports, culture, tourism, new media, telecommunications and financial services.

**Convergence in the old-age support ratio across the OECD and BRIICS, historical and projected values, 1950-2050**



Source: OECD (2011), *Pensions at a Glance 2011: Retirement-Income Systems in OECD and G20 Countries*, OECD Publishing, Paris. See chapter notes.

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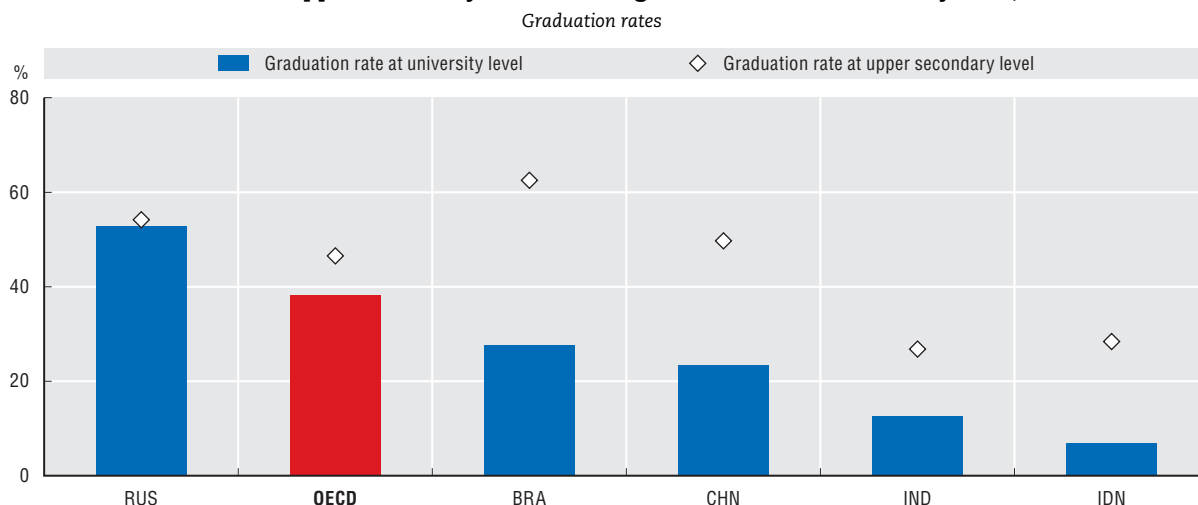
# 1. KNOWLEDGE ECONOMIES: TRENDS AND FEATURES

## The challenges ahead

### Education and gender

People are at the heart of the innovation process and education systems play a key role in the development of a highly qualified and flexible labour force. Relatively high levels of education are often related to higher earnings and productivity, better career progression, health and overall outcomes. Increased labour participation has helped to propel economic growth, often owing to the entry of women into the labour market in many OECD economies. As shortages of skills begin to emerge and as demographic pressures grow, tapping into this source of human capital becomes imperative.

#### Transition from upper secondary education to graduation at the university level, 2008

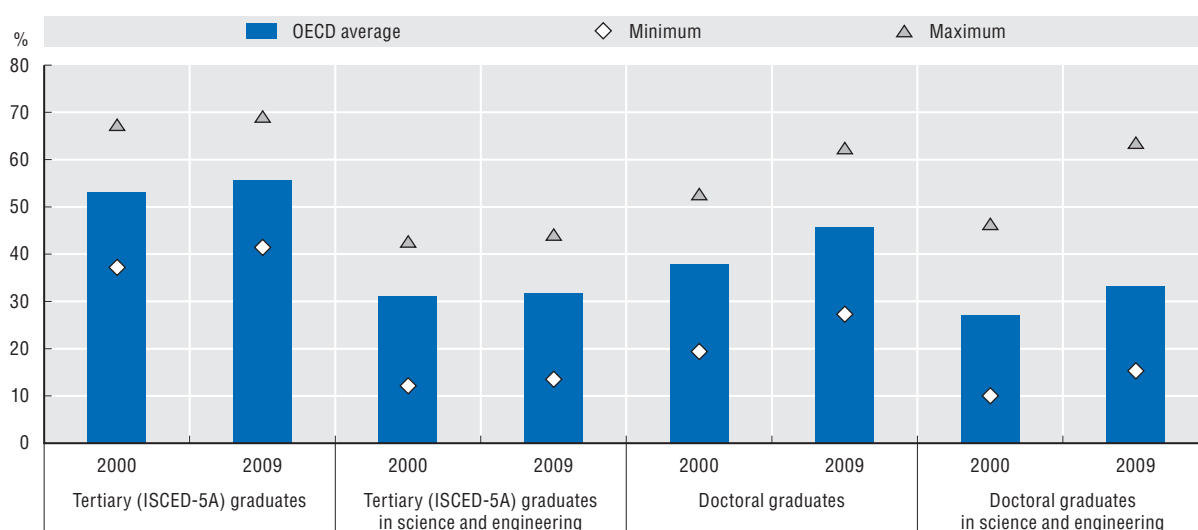


Source: OECD (2010), *Education at a Glance 2010: OECD Indicators*, OECD Publishing, Paris; and OECD (2011), *Economic Policy Reforms 2011: Going for Growth*, OECD Publishing, Paris. See chapter notes.

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#### Women graduates in the OECD area, 2000 and 2009

As a percentage of all graduates at the corresponding level



Source: OECD, Education Database, September 2011.

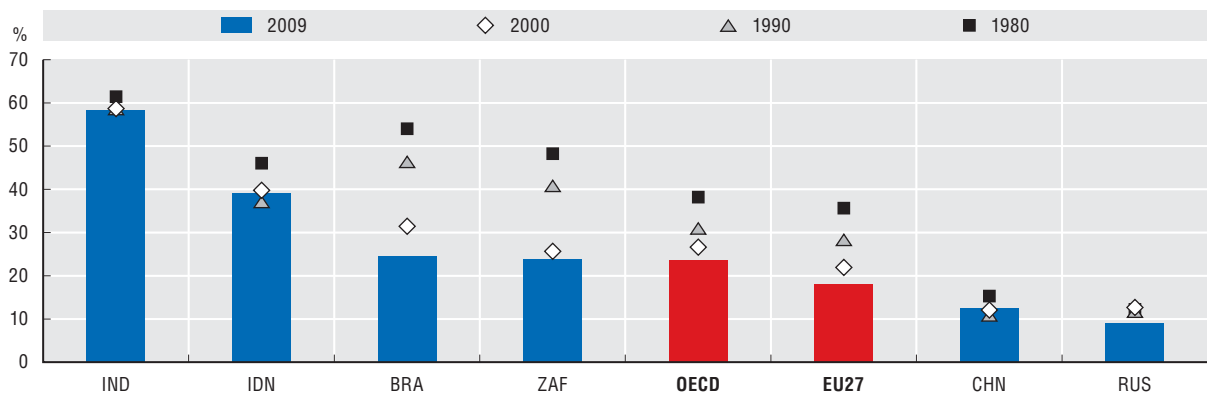
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## Gender and employment

In the OECD area more than half of university graduates are women and they play an increasing role as consumers. Yet, despite recent progress, gender differences still persist in labour force participation, hours spent in paid and unpaid work, employment conditions and earnings. China and the Russian Federation display a smaller employment gender gap than OECD economies, while in India, where many women are employed in the informal sector, the gap has not narrowed in the last 30 years. In developing countries policies are needed to support the design, development and diffusion of technologies in sectors in which women work, including environment, health, energy, agriculture, education and information. Earnings differentials between males and females with the same educational attainment remain substantial. On average, a woman with tertiary education in the OECD area can expect to earn 70% of male earnings. The gap in earnings between males and females is due in part to differences in occupations and in the amount of time spent in the labour force. However, low earnings, particularly for females who have completed tertiary education, will in many instances be detrimental to the supply of labour and thus to the utilisation of the skills produced by the educational system.

### Gender gap in employment, 1980, 1990, 2000 and 2009

Difference in male-female labour force participation rates as a share of male labour participation rate

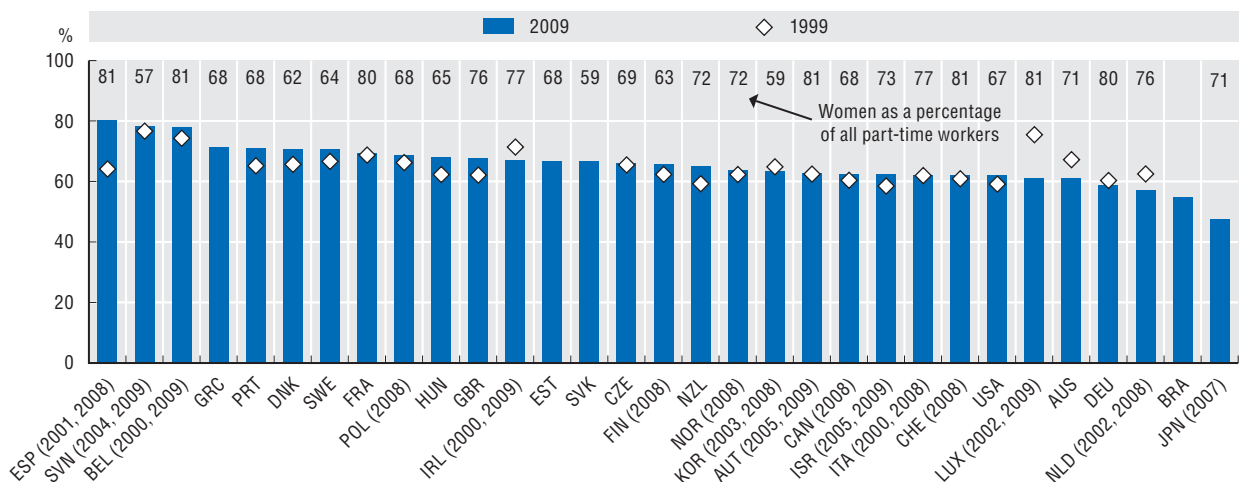


Source: OECD, calculations based on International Labour Organization, Key Indicators of the Labour Market Database, June 2011. See chapter notes.

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### Earning differentials at the tertiary level educational attainment, 1999 and 2009

Average annual earnings of women as a percentage of men's earnings



Source: OECD (2011), *Education at a Glance 2011: OECD Indicators*, OECD Publishing, Paris; and OECD, *Employment Database*, June 2011. See chapter notes.

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