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The World in 2050

How big will the major emerging market economies get and how can the OECD compete?

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Contents[1]

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The World in 2050: How big will the major emerging market economies get and how can the OECD compete?

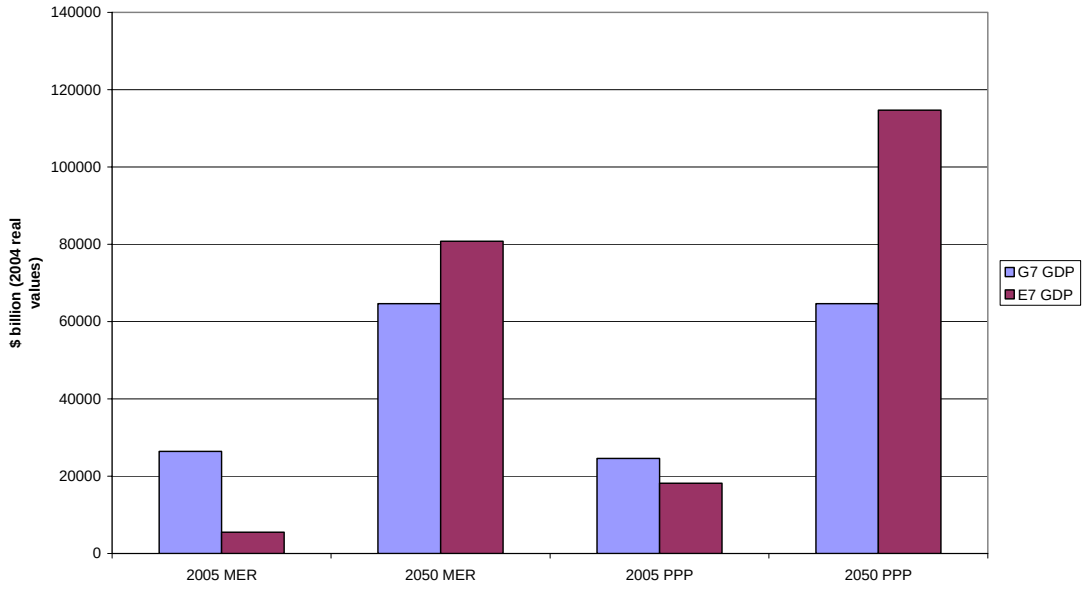
Executive Summary

In this paper we develop a methodology for projecting the relative size in the period to 2050 of the 17 largest economies in the world in purchasing power parity (PPP) terms. These comprise the current G7 (US, Japan, Germany, UK, France, Italy and Canada), plus Spain, Australia and South Korea, and the seven largest emerging market economies, which we refer to collectively as the 'E7' (China, India, Brazil, Russia, Indonesia, Mexico and Turkey).

The first important conclusion from this research is that there is no single right way to measure the relative size of emerging economies such as China and India as compared to the established OECD economies. Depending on the purpose of the exercise, GDP at either market exchange rates or PPP rates may be most appropriate measure. In general, GDP at PPPs is a better indicator of average living standards or volumes of outputs or inputs, while GDP at current exchange rates is a better measure of the size of markets for OECD exporters and investors operating in hard currencies. For long-term investments, however, it is important to take into account the likely rise in real market exchange rates in emerging economies towards their PPP rates in the long run, although our modelling results suggest that, for countries such as China and India, this exchange rate adjustment may still not be fully complete even by 2050.

The second conclusion is that, in our base case projections, the E7 economies will by 2050 be around 25% larger than the current G7 when measured in dollar terms at market exchange rates (MER), or around 75% larger in PPP terms. In contrast, the E7 is currently only around 20% of the size of the G7 at market exchange rates and around 75% of its size in PPP terms (see Figure A below).

Figure A: Relative size of G7 and E7 economies



Third, however, there are likely to be notable shifts in relative growth rates within the E7, driven by divergent demographic trends (see Table A below). In particular, both China and Russia are expected to experience significant declines in their working age populations between 2005 and 2050, in contrast to relatively younger countries such as India, Indonesia, Brazil, Turkey and Mexico, whose working age populations should on average show positive growth over this period, although they too will have begun to see the effects of ageing by the middle of the century.

Table A: Projected real growth in GDP and income per capita: 2005-50 (%pa)

Country	GDP in US $ terms	GDP in domestic currency or at PPPs	Population	GDP per capita at PPPs
India	7.6	5.2	0.8	4.3
Indonesia	7.3	4.8	0.6	4.2
China	6.3	3.9	0.1	3.8
Turkey	5.6	4.2	0.7	3.4
Brazil	5.4	3.9	0.7	3.2
Mexico	4.8	3.9	0.6	3.3
Russia	4.6	2.7	-0.5	3.3
S. Korea	3.3	2.4	-0.1	2.6
Canada	2.6	2.6	0.6	1.9
Australia	2.6	2.7	0.7	2.0
US	2.4	2.4	0.6	1.8
Spain	2.3	2.2	0.0	2.2
UK	1.9	2.2	0.3	2.0
France	1.9	2.2	0.1	2.1
Italy	1.5	1.6	-0.3	1.9
Germany	1.5	1.8	-0.1	1.9
Japan	1.2	1.6	-0.3	1.9

Source: PricewaterhouseCoopers GDP growth estimates (rounded to nearest 0.1%), population growth projections from the UN

Fourth, taking account of these demographic trends, our base case projections suggest that India has the potential to be the fastest growing large economy in world over the period to 2050, with a GDP at the end of this period of close to 60% of that of the US at market exchange rates, or of similar size to the US in PPP terms. China, despite its projected marked growth slowdown, is projected to be around 95% the size of the US at market exchange rates by 2050 or around 40% larger in PPP terms. These base case projections (see Table B below) also suggest that:

- the Brazilian economy would be of similar size to that of Japan by 2050 at market exchange rates and slightly larger in PPP terms, but still only around 20-25% of the size of the US economy;
- Indonesia and Mexico would also grow relatively rapidly, being larger than either Germany or the UK by 2050 (even at market exchange rates);
- Russia would grow significantly more slowly due to its projected sharply declining working age population, but would still be of similar size to France by 2050 at either market exchange rates or PPPs; and

- Turkey would grow more strongly due to its younger population, being of similar size to Italy by 2050 at both market exchange rates and in PPP terms.

Table B: Projected relative size of economies in 2005 and 2050 (US = 100)

Country (indices with US = 100)	GDP at market exchange rates in US $ terms		GDP in PPP terms	
	2005	2050	2005	2050
US	100	100	100	100
Japan	39	23	32	23
Germany	23	15	20	15
China	18	94	76	143
UK	18	15	16	15
France	17	13	15	13
Italy	14	10	14	10
Spain	9	8	9	8
Canada	8	9	9	9
India	6	58	30	100
Korea	6	8	9	8
Mexico	6	17	9	17
Australia	5	6	5	6
Brazil	5	20	13	25
Russia	5	13	12	14
Turkey	3	10	5	10
Indonesia	2	19	7	19

Source: PricewaterhouseCoopers estimates (rounded to nearest percentage point)

Fifth, these long-term projections are, of course, subject to significant uncertainties, which our model allows us to explore. Our sensitivity analysis suggests that long-term relative E7 GDP projections are particularly sensitive to assumptions on trends in education levels, net investment rates and catch-up speeds, which in turn depend on a broad range of policy and institutional factors. In PPP terms, our analysis suggests that it would certainly not be implausible for the relative size of the E7 compared to the G7 to be around 30% higher or lower than in our base case projections. Adding in real exchange rate uncertainty would make this 'funnel of uncertainty' even larger for GDP at market exchange rates in 2050. But we consider these uncertainties to be broadly symmetric around our base case assumptions, so this analysis does not alter our conclusion that the overwhelming likelihood is that there will be a significant shift in world GDP shares from the G7 to the E7 by the middle of the century.

Sixth, while the G7 and other established OECD countries will almost inevitably see their relative GDP shares decline (although their per capita incomes will remain much higher than those in emerging markets), the rise of the E7 economies should boost average OECD income levels in absolute terms through creating major new market opportunities. This larger global market should allow OECD companies to specialise more closely in their areas of comparative advantage, both at home and overseas, while OECD consumers continue to benefit from low cost imports from the E7 and

other emerging economies. Trade between the E7 and the G7 should therefore be seen as a mutually beneficial process, not a zero sum competitive game.

Seventh, however, while the net effect of the rise of the E7 should be beneficial for the OECD economies overall, there will be significant numbers of losers at both a corporate and individual level. These losers may not outnumber the winners but could be more politically vocal in their opposition to globalisation. Mass market manufacturers will tend to suffer, both in low tech and increasingly in hi-tech sectors, and economies like China and India will also become increasingly competitive in tradable services sectors such as banking and other wholesale financial services. There may also be a tendency for income inequalities to increase within the OECD economies, with global star performers doing well, but low and medium-skilled workers facing an increasing squeeze from lower cost workers in the emerging economies in internationally tradable sectors, as well as migrant workers in non-tradable service sectors. This competition will also increasingly affect highly skilled professionals below the 'global star' level, who may find their ability to attract premium income levels constrained by lower cost but equally qualified graduates on the end of an internet connection in Beijing or Chennai.

Finally, we explored the important public policy challenges posed by these developments. The main roads to avoid are a relapse into protectionism, subsidies for declining sectors (except possibly through strictly time-limited assistance to smooth the adjustment process), or attempts to pick winners through industrial policy. Instead the focus should be on boosting general education levels, facilitating retraining and business start-ups in areas adversely affected by global competition, and developing active labour market programmes based on conditional benefit regimes, childcare support and in-work tax credits. But the optimal policy response and the extent to which OECD governments should 'lean against the wind' of increased income inequality through more progressive tax regimes will be a matter for local democratic decisions reflecting local circumstances. This will involve hard choices, but national governments will still retain significant discretion to choose overall tax and spending levels.

The World in 2050: How big will the major emerging market economies get and how can the OECD compete?

Introduction

There has been an increasing focus in recent years on the opportunities and challenges posed by China, India and other emerging market economies to the established advanced economies of the US, Europe and Japan. On the one hand, these emerging economies provide a flow of cheap imports to OECD countries that has helped to keep down inflation and interest rates and boost consumer welfare. At the same time, as countries like China and India grow and open up their domestic markets, this has created many new opportunities for Western companies. On the other hand, the rapid increase in low cost exports from China in particular has put great competitive pressure on manufacturers in much higher cost OECD economies, while India poses an increasing competitive challenge in the IT sector, as well as being a prime location for 'offshoring' of back office functions, particularly from English-speaking countries such as the US and the UK.

Public debate on these issues is often confused by widely differing estimates of the current relative size of the leading emerging market economies. China is varyingly described as either already the second largest economy in the world, with a Gross Domestic Product (GDP) in 2005 that was already more than twice as large as Japan and around 75% of the size of the US, or only the fourth largest, with a GDP in 2005[2] only slightly above that of the UK and France and only around 18% of that of the US. India is similarly described as either already the fourth largest economy in the world, with a GDP of around 30% of the US and rapidly catching up with Japan, or only the tenth largest, with a GDP in 2005 some way below that of Canada or Spain and only around 6% of US levels. These widely varying estimates similarly lead to widely varying projections of how long it will take China to overtake the US as the world's largest economy if recent relative growth rates are projected forward, and indeed for India to relegate the US to third place at some later date.

In this paper, we explain the reasons for these differences, which relate to the choice of exchange rates used to compare GDP in different countries, and explain which methodology (PPPs or market exchange rates) is the more appropriate for which purposes. We then present our own projections of how the relative size of the leading emerging market economies, as compared to the major advanced economies, might evolve over time based on plausible assumptions. We include the top 17 economies ranked by total GDP at PPP rates[3] in 2004 in this analysis, which comprises the G7 plus Spain, Australia, Korea[4], Mexico, Indonesia, Turkey and the four 'BRIC' economies (Brazil, Russia, India and China). Finally, we consider the opportunities

[2] Our analysis here makes allowance for the significant upward revision in Chinese GDP estimates announced recently, which (at market exchange rates) moved it well ahead of Italy in 2004 and then ahead of both France and the UK into fourth place in 2005 according to preliminary estimates for all three countries.

[3] We select our economies using PPP rates since these provide a better indication of long-term potential size than current market exchange rates. These 17 economies make up around 75% of total world GDP at PPP rates, or around 80% at market exchange rates.

[4] All references to Korea in this report refer to South Korea.

and challenges posed to the established OECD economies by the rise of China, India and other emerging economies.

The discussion is organised as follows:

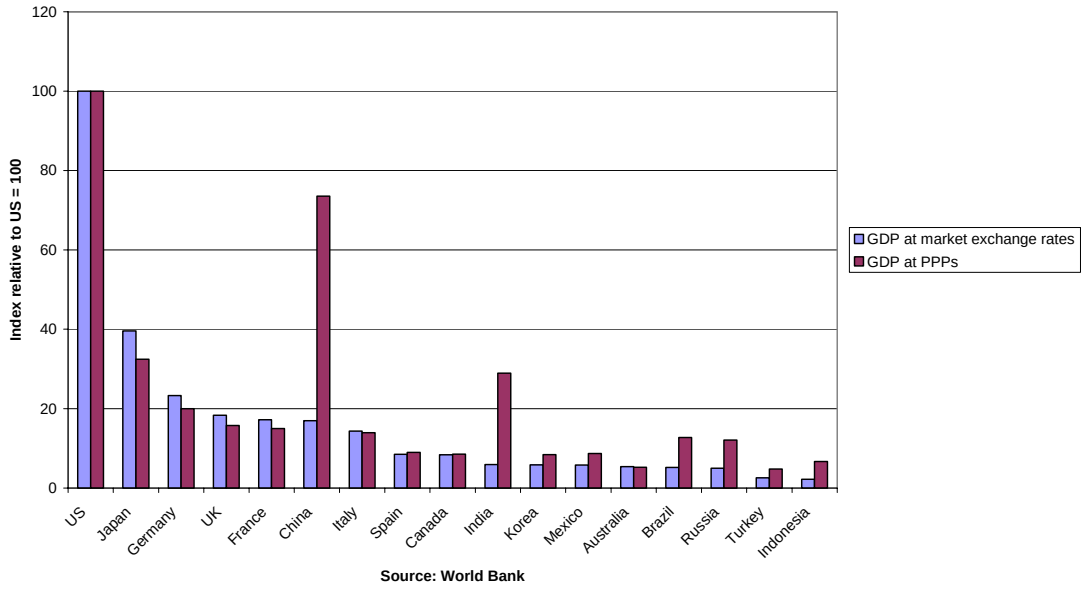
- Section 1: Alternative measures of relative economic size
- Section 2: Methodology and key assumptions
- Section 3: Base case GDP projections to 2050
- Section 4: Sensitivity analysis
- Section 5: Opportunities and challenges for OECD economies
- Section 6: Conclusions

A technical description of the model and references to other studies are provided in the Annex.

1. Alternative measures of relative economic size

There are two main methods of comparing the relative size of economies with different currencies: GDP at market exchange rates (MER) and GDP at purchasing power parities (PPP)[5]. For economies at a similar level of development, these methods tend to give broadly similar answers, but it can lead to radical differences when looking at emerging market economies, as Figure 1 below illustrates for the 17 economies covered in our study using World Bank estimates for 2004.

Figure 1: Relative GDP at market exchange rates and PPPs (2004)



Source: World Bank

This chart illustrates the widely varying estimates of the relative size of the Chinese and Indian economies depending on whether MERs or PPPs are used. More generally, we can see that, while estimated PPPs[6] do not vary by more than 20% from MERs for the established advanced economies (i.e. the G7 plus Spain and Australia, which we refer to in this article as the 'established OECD' group of economies) and could be either higher or lower than MERs, PPPs are systematically higher than MERs for all of the emerging economies, although there are three distinct sub-groups:

- for relatively new OECD members such as Korea and Mexico, where the economic development process is well-advanced and long-established but income per capita levels are still clearly below average OECD levels, PPPs are around 40-50% above MERs;
- for emerging economies at an intermediate level of development, such as Russia, Brazil and Turkey, PPPs are around 80-150% above MERs; and
- for the lowest income per capita economies, PPPs range from just over 200% (Indonesia) to nearly 400% (India) above MERs, with China closer to India at around 330%.

[5] There is also the World Bank's 'Atlas method', which uses market exchange rates averaged over a number of years to smooth out short-term volatility, but for simplicity we do not consider that further here.

[6] These are World Bank estimates. Alternative estimates by the IMF and the OECD/Eurostat vary somewhat, but the broad patterns are similar to those shown in Figure 1.

The reason for the large differences between PPPs and MERs in emerging economies is that, while prices of readily tradable goods and services would be expected to show a reasonable degree of convergence across countries due to the pressures of international competition[7], the same is not true of the prices of non-tradable goods and, in particular, services. The latter are likely to be much lower in emerging economies such as China and India due to lower labour costs: a haircut that costs $20 in New York might cost less than $1 in Beijing at current MERs, but no-one is going to travel to Beijing just to get a cheap haircut, so there are no arbitraging mechanisms that could equalise these kind of prices across countries. PPPs attempt to correct for these differences by identifying the exchange rates that will equate the value of a representative basket of goods and services produced/consumed in each country, though there is considerable scope for variations in PPP estimates depending on the particular basket of goods and services chosen, as well as the way in which quality differences are dealt with. Nonetheless, through exercises such as the UN International Comparisons Programme and the joint OECD-Eurostat PPP Programme, which conduct periodic detailed comparisons of price levels in different countries, a reasonable degree of confidence has been built up in PPP estimates over the years.

As indicated by the different sub-groups of emerging economies discussed above, the relationship between PPPs and MERs will vary as productivity rises over time in the emerging economies (reflecting high returns on capital investment from a lower initial capital stock and their ability to import the latest technology and productive techniques and business processes from more advanced economies). Higher productivity will tend to push up labour costs in the long run and, as result, non-tradable prices will tend to converge. This will generally be associated with rising real exchange rates for emerging economies over time (the so-called Balassa-Samuelson effect) and a consequent narrowing of the gap between PPPs and MERs as economic development proceeds. As discussed further in Section 2 below, this needs to be taken into account in any long-term projections of relative GDP levels at MERs.

It is quite common now to find statements in economic articles and official documents to the effect that using PPPs is the preferred method for comparing and aggregating GDP and GDP per capita levels across economies. In practice, however, this rather depends on the purpose of, and intended audience for, the exercise. Table 1 below gives our assessment of the most appropriate technique to use for different purposes.

[7] In practice, tariff and non-tariff trade barriers and imperfect competition may mean that tradables prices do vary across countries. Different goods and services will also have varying degrees of 'tradability'.

Table 1: How should GDP be compared for different purposes?

Purpose	Preferred measure	Why?
1. Compare living standards across countries	GDP per capita at PPPs	Living standards depend on relative price levels in each country
2. Project volume of outputs or inputs (e.g. Chinese energy demand or carbon emissions)	Projected levels of GDP at PPPs	PPPs provide the best measure of volumes of outputs (or inputs required to produce these outputs)
3. Estimate current value of market demand (e.g. for a US company considering exporting to or setting up business in China)	Current level of GDP at MERs	MERs indicate current value of demand in Western currency terms
4. Estimate future level of market demand (for longer term business planning and investment appraisal purposes)	Projected level of GDP at MERs allowing for expected future real exchange rate appreciation	Allows for tendency of MERs to rise towards PPPs for emerging economies as incomes rise over time

Source: PricewaterhouseCoopers

In this paper we have therefore looked at projected GDP and GDP per capita levels in both MER and PPP terms. PPP exchange rates are assumed to remain constant in real terms, while market exchange rates for the emerging market economies are assumed to rise in real terms over time towards their PPP levels as relative productivity levels rise (see Annex for details), which is in line with historic experience.

2. Methodology and key assumptions

In line with established economic theory and a large number of previous research studies, we adopt a simplified model of long-term economic growth[8] in which the shares of national income going to capital and labour are assumed to be constant[9]. GDP growth in this model is driven by assumptions on four factors, which we discuss in turn below:

- growth in the physical capital stock, which is determined by new capital investment less depreciation of the existing capital stock;
- growth in the labour force;
- growth in the quality of labour ('human capital'), which is assumed to be related to current and projected average education levels in the workforce; and
- technological progress, which drives improvements in total factor productivity (TFP).

In addition, as noted above, the model also makes assumptions about future trends in real market exchange rates relative to PPP rates.

In applying this approach we take the US as our benchmark economy, as this is assumed to be at the 'global frontier' in terms of technology and so productivity. US GDP growth is modelled in a somewhat simpler manner based on assumed labour productivity growth of 2% per annum and UN working age population projections. As described further below, other countries are then assumed to catch up gradually with US productivity levels over time (at rates that vary by country depending on their circumstances).

One limitation of our model that is worth noting up front is that, although it does allow for linkages between country performance due to shifts in the global technological frontier, it does not allow for performance in one country (except the US) to affect performance in other countries directly. Capturing these inter-linkages would require a much more complex modelling approach covering trade and investment flows between countries. Our approach limits the value of the model for global simulation purposes, but is much more tractable for the purposes of producing long-term growth projections for individual countries. Furthermore, our base case assumptions are chosen in a manner that is intended to be broadly consistent across countries, so that they constitute a plausible 'main scenario' for the world economy as a whole.

[8] The model goes back to the Nobel Prize-winning work of Solow (1956, 1957), which has remained the standard academic approach ever since the late 1950s and was later applied empirically by Denison (1985) and many others. A well-known recent example of a research study on this topic is D. Wilson and R.Purushothaman, 'Dreaming With BRICs: The Path to 2050', Goldman Sachs, Global Economics Paper No:99, October 2003. This applies a similar growth modelling approach to four leading emerging market economies, except that it does not explicitly include human capital in its calculations. Given the importance of this factor, we prefer to make our assumptions on this variable explicit, as in many recent academic studies (e.g. Hall and Jones (1998) and Barro and Lee (2001)).

[9] More formally, as described in the Annex, we assume a Cobb-Douglas production function with constant returns to scale.

Growth in the physical capital stock

We began with estimates from King and Levine (1994) of capital stock to output ratios in the mid-1980s. These ratios are projected forward to our 2004 base year using data on investment as a % of GDP from the Penn World Tables (v. 6.1) database up to 2000, supplemented by IMF data for more recent years. We assume a uniform 5% annual depreciation rate of the existing capital stock both in this calculation and in the forward-looking projections, which is consistent with the 4-6% depreciation rates generally assumed in the academic literature. The resulting capital-output ratios in 2004 vary from around 2.1-2.2 in India and Brazil to 4.1 in Japan.

Looking forward, we assume that recent average annual investment/GDP ratios, which vary from around 17% in the UK to around 36% in China, continue until 2010. Thereafter they are assumed to adjust gradually to long run investment levels after 2025 that vary more narrowly from 17% in the UK to 25% in China (see Table 2 for details of these short and long term investment assumptions). These base case assumptions reflect the view that, with declining marginal returns on new investment over time, the very high investment/GDP ratios seen in China and other Asian emerging markets will tend to decline in the long run as these economies mature (as has happened with Japan since the early 1990s).

Table 2: Investment rate assumptions

Investment as % GDP	2005-10	From 2025
Japan	30%	25%
Germany	22%	20%
UK	17%	17%
France	24%	20%
Italy	22%	20%
China	36%	25%
Spain	25%	20%
Canada	25%	20%
India	22%	20%
Korea	32%	25%
Mexico	20%	20%
Australia	24%	20%
Brazil	19%	19%
Russia	25%	20%
Turkey	20%	20%
Indonesia	28%	22%

Note: Investment rates assumed to adjust smoothly between 2010 and 2025 to long run level shown in final column above.
Source: PricewaterhouseCoopers base case assumptions

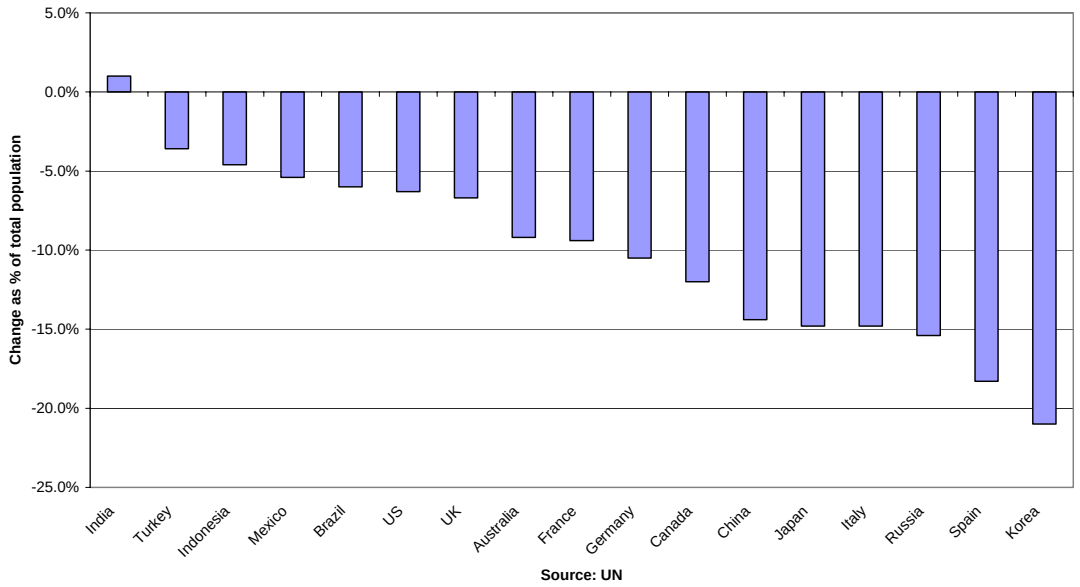
In line with many past academic studies, we assume the share of physical capital in national income is constant at 1/3. This is broadly in line with national income accounts data for OECD countries.

Growth in labour force

We use the latest UN projections (2004 revision) for the population aged 15-59 as a proxy for labour force growth. Some economies might be able to achieve faster growth here if they can raise their employment rates, but any such effects are difficult to predict and we have therefore not included them in our base case estimates.

All of the countries considered in this study, with the exception of India, are projected by the UN to see a declining share of their total populations in the prime 15-59 working age group between 2005 and 2050 (see Figure 2). This is the counterpart of the fact that all 17 countries (including India) are projected to see a rising share of their populations aged 60 or over. Korea, Spain, Russian, Japan, Italy and China are expected to see the largest declines in the share of the prime working age group over the period to 2050. Significant ageing effects are therefore by no means confined to the existing developed countries, but are also important for some of the major emerging market economies.

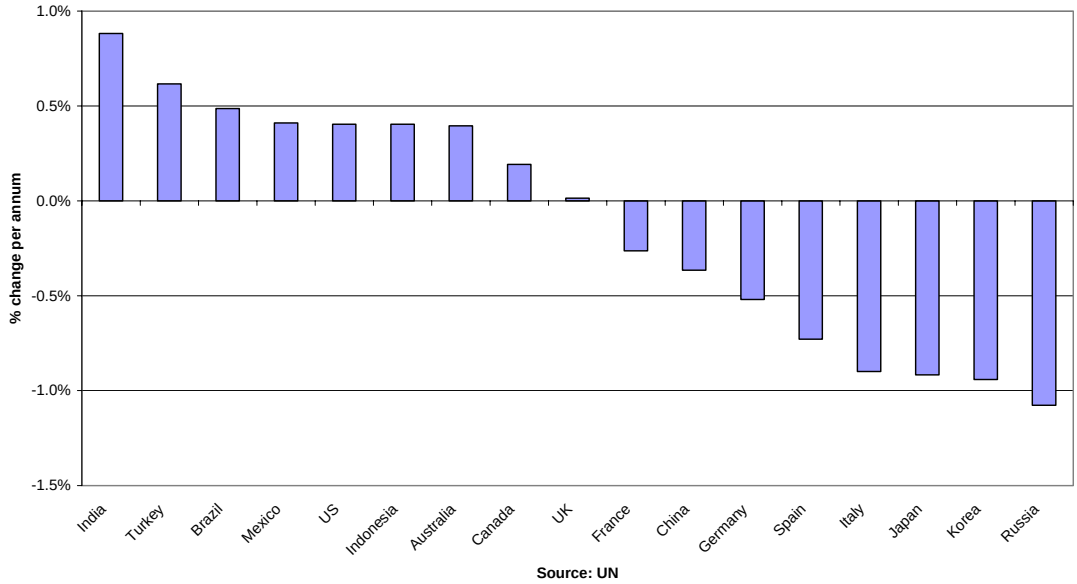
Figure 2: Projected change in % share of population aged 15-59



Source: UN

If we look instead at expected growth in prime working age (15-59) populations (see Figure 3), then there are more countries with positive growth rates due either to relatively high birth rates (e.g. India, Turkey) and/or immigration rates (e.g. the US). But all of the OECD countries in Europe are facing declining working age populations (except the UK where it is projected to be static) and this is also true of Japan, Korea, China and, in particular, Russia. As we shall see, the impact of a declining, ageing population is particularly significant in restricting Russia's ability to increase its share of world GDP in a similar way to other large emerging economies. An ageing population also acts as a drag on Chinese growth in the longer term relative to that of India.

Figure 3: Projected average growth rate of working age population: 2005-50

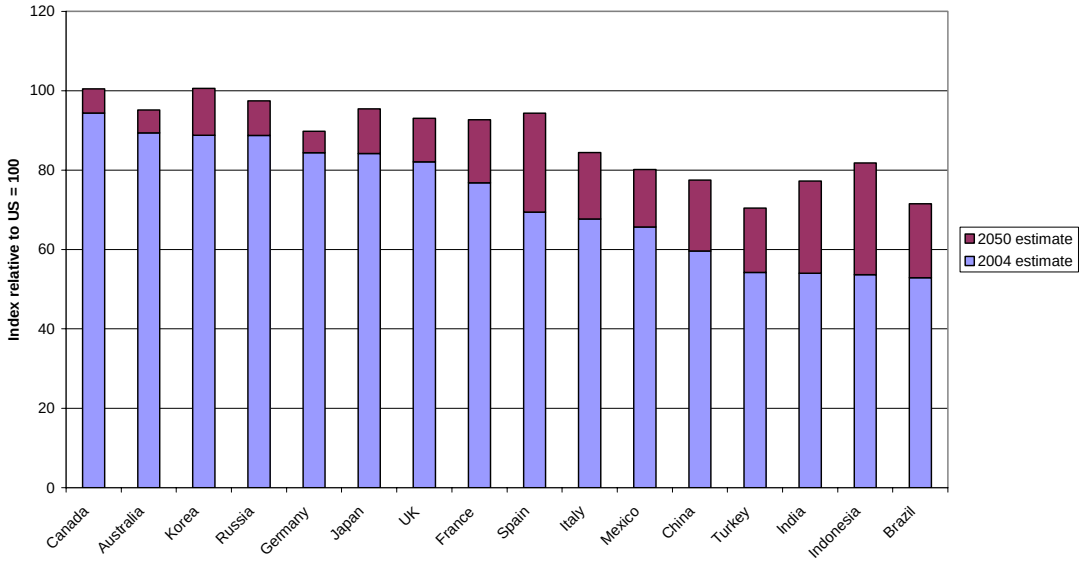


Source: UN

Human capital development

In common with several past academic studies, we have based our estimates of the human capital stock on the data on average years of schooling for the population aged 25 and over from Barro and Lee (2001). We then follow the approach of Hall and Jones (1998), which in turn was based on the survey of international estimates of the returns to schooling in countries at different levels of economic development by Psacharopoulus (1994). Specifically, for the first four years of education, we assume a rate of return of 13.4%, corresponding to average estimates for sub-Saharan Africa. For the next four years, we assume a return of 10.1%, corresponding to the average for the world as a whole. For education beyond the 8th year, we assume estimated OECD average returns of 6.8%. This approach leads to estimates of the stock of human capital per worker in 2004 as an index relative to the US, which has the highest average schooling level according to the Barro and Lee dataset, as shown in Figure 4 below.

Figure 4: Human capital per worker relative to the US



Source: PwC estimates using base data from Barro and Lee (2001)

We then assume that the average years of schooling of the over-25 population rises over time in each country at rates derived by extrapolating forward from trends over the past 5-20 years (the weight given to past averages over 5, 10 or 20 years varies across countries depending on what we consider to be the best indicator of underlying trends in education levels in each country). In line with trends over this past period, average years of schooling are assumed to rise at the slowest rate in the US, reflecting their higher starting point. This allows other countries to catch up with estimated average US levels of human capital per worker, as indicated by the estimates for 2050 shown in Figure 4. The fastest catch-up rates are assumed to be seen in India and Indonesia, which is consistent with trends in recent periods and is an important factor in their relatively strong projected growth performance, as discussed further in Section 3 below.

Technological progress

This factor is assumed to be related to the extent to which a country lags behind the technological leader (assumed here to be the US) and so has the potential for 'catch-up' through technology transfer, conditional upon levels of physical and human capital investment (as set out above) and other more institutional factors such as political stability, openness to trade and foreign investment, the strength of the rule of law, the strength of the financial system and cultural attitudes to entrepreneurship. These latter institutional factors are not readily quantifiable through a single index, but are reflected in our assumptions on the relative speed of technological catch-up in each country.

In some cases (e.g. India, Indonesia and Brazil), we assume a slower rate of technological progress in the short term, but assume the pace of catch-up accelerates in the longer term as these countries strengthen their institutional frameworks. In the longer term, the rate of catch-up is assumed to converge to an annual rate of 1.5% of the total factor productivity gap with the US, which is in line with the results of past

academic research[10] suggesting typical long-term catch-up rates of around 1-2% per annum.

It is important to stress that this approach is only intended to produce projections for long-term trend growth. It ignores cyclical fluctuations around this long-term trend, which history suggests could be significant in the short term for emerging economies in particular, but which we cannot hope to predict more than a year or two ahead at most. It also ignores the possibility of major adverse shocks (e.g. political revolutions, natural disasters or military conflicts) that could throw countries off their equilibrium growth paths for longer periods of time, but which are inherently impossible to predict. At the same time, our modelling ignores the possibility of a sudden leap forward in the technological frontier (here represented by US labour productivity growth, which as noted above we assume to increase at a steady 2% per annum rate in real terms, reflecting recent historic trends) due to some major new wave of innovation not yet imagined.

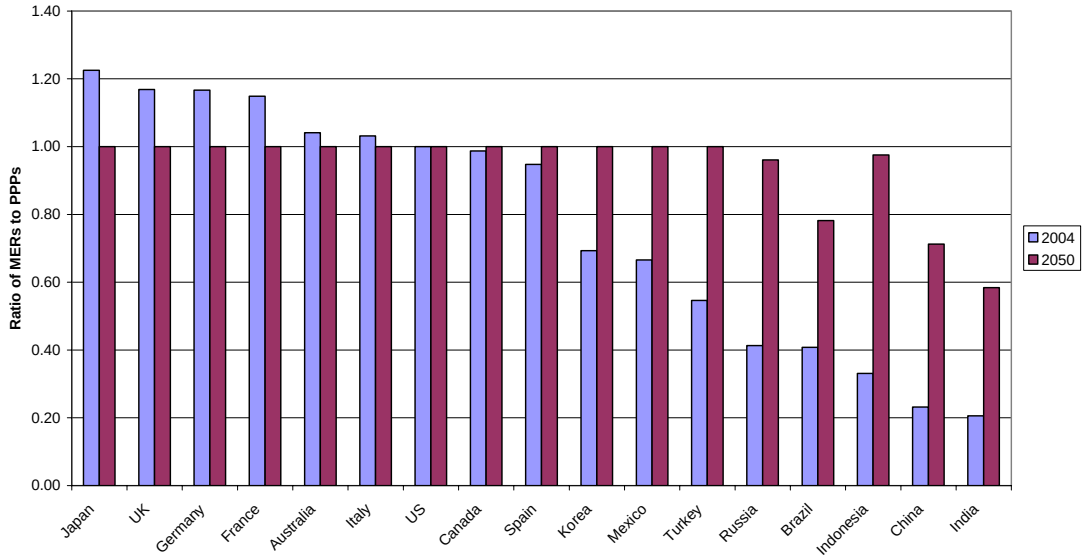
Real exchange rate trends

In addition to modelling GDP growth in constant domestic currency terms using the above approach, we have also attempted to model how the real level of market exchange rates evolves over time. For this purpose we adopt the same simplifying assumption as Wilson and Purushothaman (2003), namely that the real exchange rate for emerging market economies rises relative to the dollar proportionately to labour productivity growth differentials relative to the US in each year, subject to the market exchange rate not moving above its PPP level. As discussed further in the Technical Annex, this assumption is broadly consistent with a standard Balassa-Samuelson effect on the assumption that tradable and non-tradable sectors are of broadly similar scale in these emerging markets and that productivity growth differentials relative to the US are focused on the tradables sector. Given that it would overcomplicate the analysis to attempt to model the tradables and non-tradables sectors separately in this paper, this seems a reasonable simplifying assumption, although it should be recognised that any such real exchange rate assumptions are subject to significant uncertainties.

This methodology leads to projections of significant rises in real market exchange rates for the major emerging market economies, although these still fall some way below PPP levels in 2050 in the case of India, China and Brazil. Market exchange rates in Russia, Turkey and Indonesia are, however, projected to be at or close to PPP levels by 2050 (see Figure 5).

[10] As summarised, for example, in Chapter 6 of *Macroeconomics and the global business environment* by David Miles and Andrew Scott (John Wiley & Sons, 2004).

Figure 5: Ratio of market exchange rates to PPPs in 2004 and projected in 2050



Source: World Bank, PwC estimates

For the OECD economies, we assume that real exchange rates converge very gradually to their PPP rates at a steady pace over the period from 2005 to 2050. This is consistent with academic research[11] showing that purchasing power parity does hold in the long run, at least approximately, but not the short run. As shown in Figure 5 above, this implies (given initial PPP estimates from the World Bank) that there will be some downward adjustment in real exchange rates in the long run in Japan, the UK, Germany and France relative to the US, though this occurs very gradually over time. The other established OECD economies (Australia, Italy and Canada) are estimated to be close to their PPP rates already in 2004 and so are not projected to see any significant changes in their real exchange rates against the dollar in the period to 2050. The two relatively new OECD members, South Korea and Mexico, are projected to see a gradual real exchange rate appreciation to PPP levels over the same period.

[11] As discussed in Miles and Scott, *op cit*.

3. Base case GDP projections to 2050

Having outlined our methodology and base case assumptions, we can now proceed to discuss our key results under the following headings:

- projected economic growth rates;
- projected relative economic size; and
- projected income per capita levels.

In all cases we look at results at both market exchange rates and PPPs (bearing in mind that one or other of these measures may be more appropriate for particular purposes, as described in Table 1 above).

Projected economic growth rates

Table 3 below summarises our estimates of average annual real GDP growth in 2005-50 in US $ terms (i.e. including the effect of real exchange rate changes relative to the dollar) and in domestic currency and PPP terms[12], as well as growth rates in living standards, as measured by GDP per capita at PPP rates. The 17 countries included in the study are listed in descending order of GDP growth in US $ terms, although the rankings for GDP growth in domestic currency/PPP terms is very similar.

Table 3: Projected real growth in GDP and income per capita: 2005-50 (%pa)

Country	GDP in US $ terms	GDP in domestic currency or at PPPs	Population	GDP per capita at PPPs
India	7.6	5.2	0.8	4.3
Indonesia	7.3	4.8	0.6	4.2
China	6.3	3.9	0.1	3.8
Turkey	5.6	4.2	0.7	3.4
Brazil	5.4	3.9	0.7	3.2
Mexico	4.8	3.9	0.6	3.3
Russia	4.6	2.7	-0.5	3.3
S. Korea	3.3	2.4	-0.1	2.6
Canada	2.6	2.6	0.6	1.9
Australia	2.6	2.7	0.7	2.0
US	2.4	2.4	0.6	1.8
Spain	2.3	2.2	0.0	2.2
UK	1.9	2.2	0.3	2.0
France	1.9	2.2	0.1	2.1
Italy	1.5	1.6	-0.3	1.9
Germany	1.5	1.8	-0.1	1.9
Japan	1.2	1.6	-0.3	1.9

Sources: PricewaterhouseCoopers GDP growth estimates (rounded to nearest 0.1%), population growth projections from the UN

[12] Note that, by assumption in our model, real GDP growth is the same in domestic currency and PPP terms.

As would be expected, the emerging economies are generally expected to grow significantly faster than the established OECD economies (excluding newer members such as Mexico and South Korea, which have greater growth potential). What might surprise some readers is that India and Indonesia, rather than China, top our growth league table. This reflects the following factors:

- significantly slower population growth in China due to its one child policy; this will lead to a rapid ageing of the Chinese population over the next 45 years and, as shown in Figure 3 above, a projected decline in its working age population;
- the fact that average productivity and education levels across the population are currently lower in India and Indonesia than in China, giving them greater scope to catch up with the OECD countries in the long run, provided that these countries can maintain the right kind of institutional policy framework to support economic growth (as illustrated in Figure 4 above, improved education levels are a particularly important driver of growth in India and Indonesia in these base case projections); and
- China's growth to date has been driven by very high savings and capital investment rates, but experience with Japan and other earlier 'Asian tigers' suggests that such investment-driven growth eventually runs into diminishing returns once income levels approach OECD levels; as China ages, it is also likely that its savings rate will drop as assets are 'cashed in' to pay for the retirement of its ageing population (although we still assume that Chinese savings and investment rates remain somewhat above OECD average levels in the long run in our base case projections).

Other emerging economies with relatively young, fast-growing populations include Turkey, Brazil and Mexico. As with India and Indonesia, the key to them achieving the growth potential indicated by our model will be establishing and maintaining a macroeconomic, legal and public policy environment conducive to trade, investment, increased education levels and hence economic growth. This is by no means guaranteed in any of these economies, but progress over the past 3-5 years has generally been positive in all of these countries, which gives some grounds for optimism.

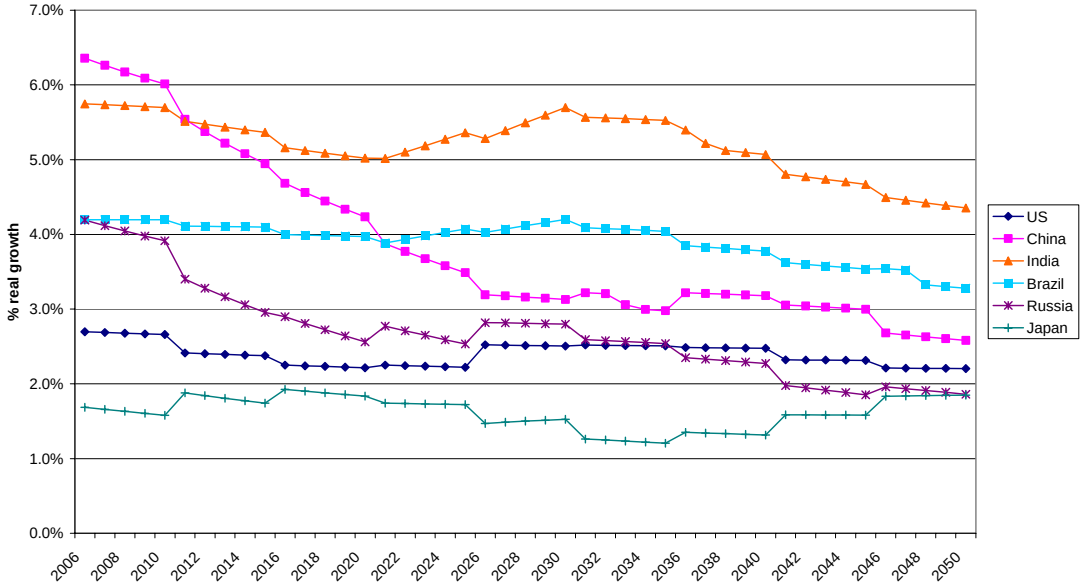
South Korea and Russia are in a different category, with relatively strong expected growth in GDP per capita (particularly in Russia), but declining populations that hold back overall GDP growth.

As you would expect, growth rates of the established OECD economies (excluding newer members such as South Korea and Mexico) are generally projected to be slower, with most of the variation reflecting differences in population growth in our model. In this respect, Australia, Canada and the US are projected to continue to grow at around 2.4-2.7% per annum, while countries with shrinking populations such as Germany, Italy and Japan see total GDP growth of only around 1.6-1.8% in domestic currency or PPP terms. In GDP per capita terms, however, our model suggests much less marked variations in growth rates between the established OECD economies within a 1.8-2.2% per annum range.

It is also interesting to consider the projected profile of growth over time. Figure 6 below illustrates these trends for the BRIC economies relative to the US and Japan (based on GDP growth in domestic currency or PPP terms, rather than at market exchange rates).

We can see that China is projected to remain the fastest growing BRIC economy for the next few years[13], but is gradually overtaken in terms of growth rates (although not levels of GDP) by India in around 2013 and Brazil in around 2023. The decelerating growth profile in China reflects the factors discussed above, in particular its rapidly ageing population (the same factor accounts for the marked deceleration in projected growth in Russia over the next 20 years). In contrast, the much younger and faster growing Indian and Brazilian populations are able to sustain a relatively stable rate of growth up to around 2030, although after that they too experience a gradual deceleration as their populations also begin to age.

Figure 6: Real GDP growth in US, Japan and the BRICs



Projected future size of economies

Table 4 below summarises our estimates of the relative size of each economy relative to the US in 2050 as compared to the current position.

[13] Too much attention should not be paid to the precise growth projections shown in Figure 6, given that our analysis here is focused on long-term trends and does not take account of cyclical variations or other country-specific factors that will influence growth in the short term. In particular, the projections for the immediate future should not be regarded as the best available current forecasts for these economies.

Table 4: Projected relative size of economies in 2005 and 2050 (US = 100)

Country (indices with US = 100)	GDP at market exchange rates in US $ terms		GDP in PPP terms	
	2005	2050	2005	2050
US	100	100	100	100
Japan	39	23	32	23
Germany	23	15	20	15
China	18	94	76	143
UK	18	15	16	15
France	17	13	15	13
Italy	14	10	14	10
Spain	9	8	9	8
Canada	8	9	9	9
India	6	58	30	100
Korea	6	8	9	8
Mexico	6	17	9	17
Australia	5	6	5	6
Brazil	5	20	13	25
Russia	5	13	12	14
Turkey	3	10	5	10
Indonesia	2	19	7	19

Source: PricewaterhouseCoopers estimates (rounded to nearest percentage point)

Table 4 shows that the relative size of the major economies is set to change markedly over the period to 2050, with the emerging markets becoming much more significant:

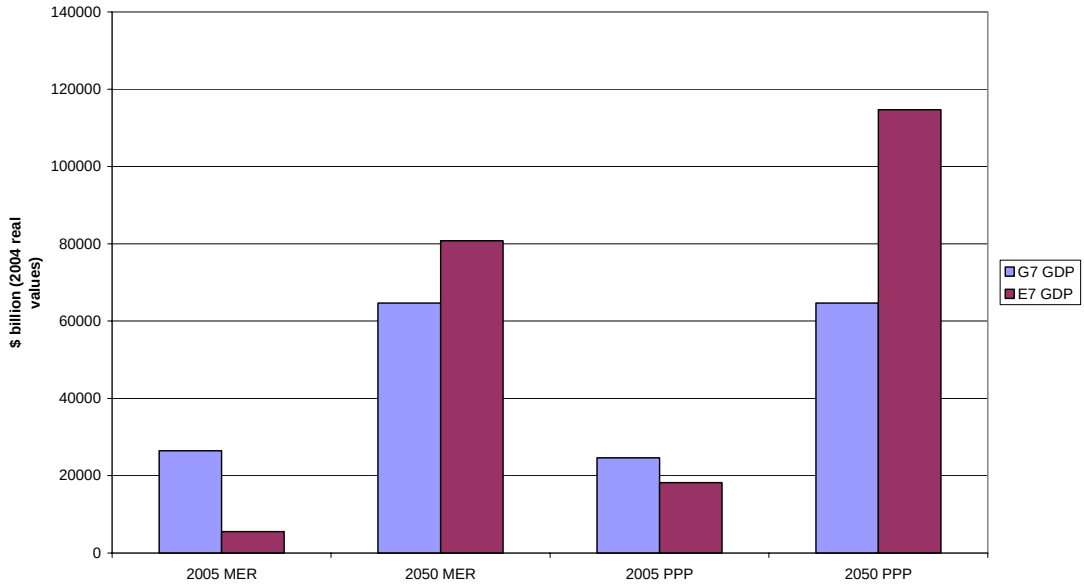
- China's economy is projected to grow to around 94-143% of the size of the US economy by 2050, depending on whether it is measured at market exchange rates or PPPs (although the difference between these two measures is projected to be much less in proportional terms by 2050 due to the expected rise in China's real exchange rate versus the dollar);
- India's economy is projected to grow to between 58% and 100% of the size of the US economy over this period; this would make India clearly the third largest economy in the world in 2050 when measured at market exchange rates (or equal second behind China when measured at PPP rates); and
- the economies of Mexico, Brazil, Russia, Turkey and Indonesia are projected to grow from only around 2-6% of the size of the US economy at market exchange rates today to around 10-20% by 2050 (and 25% in the case of Brazil at PPP rates), although they are likely to remain significantly smaller than those of either China or India due to their much smaller populations.

In contrast, most established OECD economies, with the exception of Canada and Australia, are projected to lose some ground relative to the US economy by 2050 due to their slower population growth. As a result:

- by 2050, the Japanese economy is projected to be of comparable size to those of Brazil and Indonesia, having been overtaken much earlier by China and India;
- the German, UK and French economies are projected by 2050 to be somewhat smaller than the Mexican economy and similar in size to the Russian economy; and
- the Italian economy is projected to be of similar size to the Turkish economy by 2050.

Of course, as discussed further below, any such long-term projections are subject to great uncertainties, but the broad conclusion of a shift in the balance of the global economy towards what are today regarded as emerging markets seems clear. We can illustrate this further by comparing the size of the G7 economies with the 'E7', which we define here as the four BRIC economies plus Indonesia, Mexico and Turkey (see Figure 7 below).

Figure 7: Relative size of G7 and E7 economies



As Figure 7 above illustrates, the E7 are currently only around a fifth of the total size of the G7 based on market exchange rates (MER), though they are already three-quarters of the size when measured in PPP terms. Looking ahead to 2050, however, our projections suggest the E7 economies would be anywhere from 25% to 75% larger than the G7 depending on whether MERs or PPPs are used in the comparison.

It should be emphasised, however, that we are only projecting a *relative* decline in the size of the G7 economies. In *absolute* terms, our model suggests that they might grow be more than 250% in real terms between 2005 and 2050 and a critical precondition for this growth will be increased demand for their goods and (in particular) services from the E7 economies. While some companies in established OECD economies may see the rise of the E7 as a major competitive challenge, this is likely to bring significant potential benefits at the national economic level. In the long run, we see the growth of the E7 and the G7 as being mutually beneficial and reinforcing rather

than competitive, as each has the opportunity to specialise in its areas of comparative advantage. But, as discussed further in Section 5 below, the transition path may be bumpy for many individuals and companies in the G7.

Projections of relative per capita income levels

A key factor in the E7 markets becoming more attractive to G7 companies is that their average income per capita levels, and so purchasing power, rises. This is also, of course, an essential development if high poverty levels in many of the countries are to be reduced. In Table 5 below, we therefore present our estimates, again at both MERs and PPPs, of income per capita levels in 2004 $ terms in 2005 and 2050.

Table 5: Projected relative income per capita levels in 2005 and 2050

Country (in constant 2004 $ terms)	GDP per capita at market exchange rates		GDP per capita in PPP terms	
	2005	2050	2005	2050
US	40,339	88,443	40,339	88,443
Canada	31,466	75,425	31,874	75,425
UK	36,675	75,855	31,489	75,855
Australia	32,364	74,000	31,109	74,000
Japan	36,686	70,646	30,081	70,646
France	33,978	74,685	29,674	74,685
Germany	33,457	68,261	28,770	68,261
Italy	29,455	66,165	28,576	66,165
Spain	23,982	66,552	25,283	66,552
Korea	15,154	66,489	21,434	66,489
Russia	4,383	41,876	10,358	43,586
Mexico	6,673	42,879	9,939	42,879
Brazil	3,415	26,924	8,311	34,448
Turkey	4,369	35,861	7,920	35,861
China	1,664	23,534	6,949	35,851
Indonesia	1,249	23,097	3,702	23,686
India	674	12,773	3,224	21,872

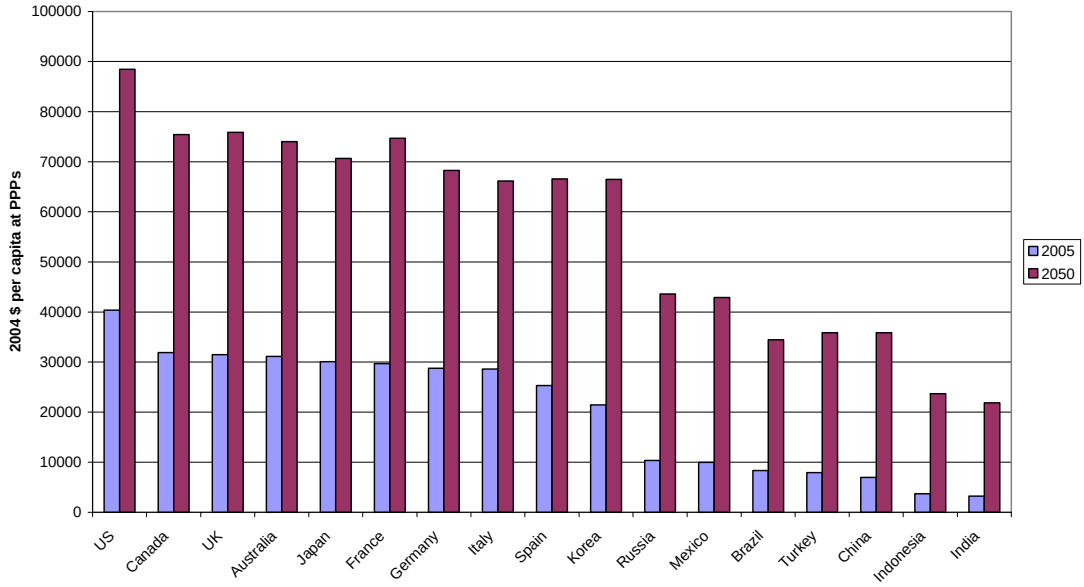
Source: PricewaterhouseCoopers estimates (ranked in order of GDP per capita in PPP terms in 2005) based on World Bank estimates of PPP rates for 2004 and UN population projections.

As indicated in Table 1 above, GDP per capita at PPP rates is the best indicator of relative living standards, but GDP per capita at MERs may provide a better indicator of relative potential average purchasing power for OECD goods and services.

While these projections suggest that the rankings of countries in terms of income per capita do not change much over time, with US still at the top and India and Indonesia still at the bottom, there is clearly considerable relative convergence as the E7 economies catch up with the established OECD economies. In PPP terms, average living standards in India or Indonesia in 2050 might be broadly on a par with Spain or

Korea today. On the same basis, China, Turkey and Brazil might by 2050 be broadly on a par with the leading G7 economies today (see Figure 8 below).

Figure 8: Projected GDP per capita in PPP terms



This clearly has implications for the types of goods and services that consumers in these emerging economies will demand in the long run, which will move much more towards the patterns of demand seen in the leading OECD economies today[14]. The opportunities this will create for OECD companies are discussed further in Section 5 below. Firstly, however, we look at some of the significant uncertainties that inevitably surround any such long-term projections.

[14] Although cultural differences in demand patterns will remain and technological advances will mean that the technical capabilities of many of the products (e.g. cars, mobile communications devices, computers) bought by a Chinese or Indian consumer in 2050 will far exceed those of typical products bought by US, Japanese or European consumers today.

4. Sensitivity analysis

All of the base case long-term projections discussed above are clearly subject to many uncertainties. It is not feasible in this report to carry out sensitivity tests for all countries and all key assumptions, so instead we focus on three key results, expressed both at market exchange rates and PPPs:

- the size of the Chinese economy relative to the US in 2050;
- the size of the Indian economy relative to the US in 2050; and
- the total size of the E7 economies relative to the G7 economies in 2050 (using the same definitions as discussed in relation to Figure 7 above).

Table 6 below summarises the results of this analysis for plausible variations in key model assumptions. The first three sensitivity tests apply to all 17 countries (including the US productivity growth change, which affects all countries since this defines the global productivity frontier in the model), while the other sensitivity tests apply only to the emerging economies (i.e. the E7), holding the assumptions for the G7 economies constant. In practice, of course, there are also many uncertainties around G7 growth rates and these will depend in part on what happens to the E7 economies. But exploring these uncertainties is beyond the scope of this paper, which is primarily focused on projecting the future size of the leading emerging market economies.

In general, the results are in line with prior expectations and confirm that the model is working in an appropriate manner, although in some cases they highlight the limitations inherent in any such aggregate growth model. We comment briefly on each of the sensitivity tests in turn below. It should be noted that, for reasons of space, we only report one sensitivity test for each key variable, but in general the uncertainties are broadly symmetric in each case.

Sensitivities affecting all economies

Slower US labour productivity growth

As you would expect, this assumption has most impact on the US and so tends to boost projected Chinese and Indian GDP relative to the US in the long run, and also E7 GDP relative to G7 GDP (given the US has a heavy weight in the latter). However, the scale of the effects on these relative GDP ratios is small (only around 1-3%) due to the fact that, by restricting the growth of the 'technological frontier' in the model, all countries lose out to some degree from slower US productivity growth. This is, however, a feature of this and other similar models (including the Goldman Sachs BRICs model) rather than necessarily a feature of reality, since it is quite possible that countries such as China and India will make future productivity advances in ways that are not reliant on, or easily copied by, US and other OECD producers. This is particularly true in relation to culturally-specific products and services aimed at their domestic markets. The 'single good' assumption in the model, although of considerable use in making the model analytically tractable, does not allow us to capture these kind of effects.

Table 6: Results of Sensitivity Analysis

Sensitivity tests (% changes from 2050 base case in brackets)	Chinese GDP in 2050 relative to US = 100		Indian GDP in 2050 relative to US = 100		E7 GDP in 2050 relative to G7 = 100	
	MER	PPP	MER	PPP	MER	PPP
Base case in 2005	18	76	6	30	21	74
Base case in 2050	94	143	58	100	125	177
Applied to all economies						
Slower US productivity growth (1.75%)	96 (+2%)	145 (+1%)	60 (+3%)	101 (+1%)	127 (+2%)	179 (+1%)
Lower capital share (30%)	91 (-3%)	141 (-1%)	59 (2%)	100 (0%)	124 (-1%)	177 (0%)
Depreciation up 1% pa to 6%	84 (-11%)	135 (-6%)	53 (-9%)	95 (-5%)	117 (-6%)	173 (-2%)
Applied to E7 economies only						
Working age population growth down by 0.2% pa	86 (-9%)	131 (-9%)	53 (-9%)	91 (-9%)	114 (-9%)	162 (-9%)
Investment rate up by 2% of GDP	101 (+7%)	148 (+3%)	64 (+10%)	104 (+4%)	135 (+8%)	185 (+5%)
Initial capital to output ratio up 0.2	90 (-4%)	140 (-2%)	55 (-5%)	97 (-3%)	120 (-4%)	173 (-2%)
Convergence speed down by 0.5% pa	68 (-28%)	122 (-15%)	35 (-40%)	77 (-23%)	88 (-30%)	147 (-17%)
Trend rise in average school years down 0.02 pa	84 (-11%)	135 (-6%)	52 (-10%)	94 (-6%)	112 (-10%)	167 (-6%)
Lower real exchange rate response relative to productivity growth differences (0.5 rather than 1)	56 (-40%)	143 (0%)	35 (-40%)	100 (0%)	83 (-34%)	177 (0%)

Note: E7 comprises China, India, Brazil, Russia, Indonesia, Turkey and Mexico.
Source: PricewaterhouseCoopers model estimates (these exclude knock-on effects from changes in E7 growth on OECD growth)

Lower capital share of output

As noted in Section 2 above, we make the standard assumption of a 1/3 capital share in our base case model run, but changing this to 30% does not alter the results

materially as shown in Table 6 above. The biggest impact is on relative Chinese GDP, reflecting its relatively capital-intensive growth profile, but even here the effect not large (at most 3%).

Higher depreciation rate

This is another generic model assumption, but one that makes rather more difference to the results than the capital share assumption. As shown in Table 6 above, assuming a 6% rather than a 5% depreciation rate for the capital stock in all countries (e.g. because a faster pace of technological progress requires the capital stock to be replaced more frequently than before) tends to reduce the projected relative GDP of China, India and other emerging market economies relative to the US/G7. This is because it reduces the speed with which these emerging economies can catch up through a given rate of capital investment. It should be noted, however, that in practice a higher depreciation rate might be fully offset by a higher gross investment rate, so leaving the overall results unchanged.

Sensitivities affecting emerging economies only

Slower working age population growth

This might reflect either lower fertility rates or (in the short term) higher net outward migration from the emerging economies than assumed in the baseline UN population projections used in the model (both of which are possible, though it is worth saying that we have no reason to believe that the UN projections are upwardly biased in this way: the uncertainties are probably broadly symmetric). Given the structure of the model, this assumption goes straight to the GDP 'bottom line' with an average reduction of 0.2% per annum in working age population growth between 2005 and 2050 translating directly into a 9% fall in relative GDP in 2050 for the affected countries. In practice, the effects of demographic changes may be more complicated than this due, for example, to interactions between fertility rates and female labour force participation rates, but this is beyond the scope of our model to explore.

Higher capital investment rates

As expected, higher investment rates feed through into higher relative GDP for the emerging economies, with the effects being quite material for an assumed 2% of GDP rise in investment. As with other sensitivity tests (except demographic changes), the effects are larger for GDP at market exchange rates since these combine a pure labour productivity growth effect of higher investment and a consequent real exchange rate response to increased productivity differentials between the E7 and the G7. Note also that the proportionate effect of a 2% investment ratio rise is somewhat greater for India than China due to the former having a lower initial investment ratio (see Table 2 above).

Higher initial capital-output ratio

Perhaps slightly counter-intuitively, assuming a higher initial capital-output ratio in the emerging market economies slightly reduces their long-run growth rates. This is because, for given assumptions on gross investment rates and depreciation, the growth

of the capital stock relative to GDP is slower with a higher initial ratio. However, as Table 6 shows, the magnitude of these effects is not particularly large for plausible variations in initial capital-output ratios (i.e. a change of 5% or less in projected relative GDP in 2050).

Slower convergence speeds

A much more significant source of uncertainty in the model relates to the speed of convergence of total factor productivity between the emerging economies and the global productivity leader (in our model, the US). As discussed in Section 2 above, we assume in the long run (i.e. after 2030) that all of the E7 economies converge with US levels of total factor productivity at a rate of 1.5% per annum, though in the shorter term we assume slower convergence rates of around 0.5-1% per annum for countries (including India, Indonesia and Brazil) that do not yet seem to have all the preconditions for sustained catch-up in place. These would include: reasonable political stability; an economic policy framework capable of achieving macroeconomic stability; a fair and predictable legal and regulatory system; and openness to cross-border trade and investment.

If we reduce assumed catch-up rates by 0.5% per annum in both the short term and the long term (e.g. China makes up 1% of its productivity gap relative to the US each year rather than 1.5% as assumed in our base case projections), then total factor productivity growth is accordingly slower and relative E7 GDP in 2050 is projected to be around 17% lower in PPP terms, or around 30% lower once associated real exchange rates effects are taken into account. The effects are larger for India than China since the base case catch-up speed is reduced to zero in the period to 2020 in the case of India, which has a proportionately greater effect than the slower but still positive catch-up rate assumed in the case of China in this sensitivity test. It should be noted, however, that countries such as India and Indonesia probably have more upside potential here than countries like China that currently appear to be somewhat further down the road to creating an economic environment favourable to sustainable growth.

Slower trend rise in average education levels

As indicated in Figure 4 above, increases in relative average education levels are important elements in the catch-up process for the emerging economies and it is therefore not surprising that this sensitivity shows material effects. Specifically a reduction of around 0.02 in the rate of annual increase in the average number of years of education of the over-25 population results in a reduction of around 10% in the projected relative GDP at market exchange rates in 2050 of China, India and other E7 economies.

Lower real exchange rate response to productivity growth differentials

Our base case assumption is that real exchange rates in emerging economies relative to the dollar rise one for one with productivity growth differentials relative to the US. Reducing this ‘responsiveness coefficient’ from 1.0 to 0.5 predictably has a major dampening effect on the extent to which GDP at market exchange rates converges with GDP at PPP rates in the E7 economies.

Summary of sensitivity analysis

The sensitivity tests discussed above predictably show that our long-term projections for the relative size of the E7 economies are subject to significant uncertainties. Some model assumptions (US productivity growth, capital shares and initial capital-output ratios) are not all that important, but assumptions on working age population growth, investment and depreciation rates (though these may offset each other) and trends in education levels are all significant. Probably the most important factor, however, is the speed of catch-up in total factor productivity growth, which will depend on whether the major emerging economies can maintain and further develop growth-friendly political, economic and institutional frameworks. Real exchange rate assumptions are also important for the long-term value of emerging markets to OECD producers.

Combining the various uncertainties discussed above, while allowing for some possible offsets, we could certainly construct plausible scenarios in which the total GDP of the E7 economies relative to the G7 in 2050 was around 30% higher or lower than our base case projections in PPP terms, with wider divergences possible in terms of MERs. We still consider our base case projections to be reasonable central estimates, however, and in almost any plausible scenario the relative size of the E7 economies compared to those of the G7 is likely to be significantly higher in 2050 than in 2005, even if one or two of the major emerging economies do not fulfil their potential due to local political, economic or environmental problems.

5. Opportunities and challenges for OECD economies

The analysis in the previous two sections suggests that a significant shift in the relative balance of power in the world economy is all but inevitable over the next few decades and that this shift could just as easily be larger than our base case projections suggest than smaller. Some commentators have interpreted this as representing a severe threat to the established OECD economies that will require a significant shift in public policy, particularly in parts of Europe, though the exact policy prescriptions of those concerned by the rise of the E7 vary from protectionism to fast-track market liberalisation.

Often, however, such 'doomsayers' seem to rely on analogies with business competitiveness that, while valid up to a point[15], need to be interpreted with considerable care when applied to national economies. Our own view is more optimistic, seeing the rise of the emerging market economies primarily as an opportunity for the established OECD economies to boost their absolute standards of living through a combination of cheap imports and growing income from exports and overseas investments[16], even as their shares of world GDP decline. At the same time, we recognise that, at the level of many individual workers and companies in sectors where the existing OECD economies are at a comparative disadvantage relative to E7 producers, painful adjustment processes will be required and OECD governments will need to take an active role to facilitate these adjustments and smooth out some of the income inequalities that are otherwise likely to result from these adjustments.

We discuss these issues below under the following sub-headings:

- competitive advantage versus comparative advantage;
- potential winners and losers within the established OECD economies; and
- possible public policy responses.

Competitive advantage versus comparative advantage

While companies originating from different countries clearly do compete with one another, it is less clear that this is the right conceptual framework to apply to nations. On the contrary, economic theory stretching back to David Ricardo in the early 19th century suggests that international trade is a mutually beneficial process that operates by allowing each country to specialise in its areas of greatest comparative advantage. The stress here is on *comparative* rather than absolute competitive advantage, since one country may have an absolute competitive advantage in all tradable goods and services and yet still benefit from focusing on producing and exporting those goods and services where it has the greatest competitive advantage, while importing those for which its competitive advantage is lower.

[15] As discussed, for example, in Michael Porter's well known book on 'The Competitive Advantage of Nations' (1990), which highlights the importance of specialised sectoral clusters in relative national economic performance.

[16] As described in Section 2 above, our model does not capture these inter-linkages directly, although some such effects are implicit in our base case assumptions and projections for potential OECD growth (i.e. the OECD could probably not grow as fast as we project if E7 growth was significantly lower than we project).

In contemporary terms, what this Ricardian view implies is that even if, for example, China could produce everything its population wants at lower unit cost than OECD countries, it would still be to its advantage to specialise primarily in those areas (e.g. labour-intensive manufacturing at present) where it has the greatest unit cost advantage and to import other goods and tradable services (e.g. certain business and financial services) from OECD countries. Given reasonably flexible labour and product markets, this process of specialisation would be expected to be driven by market forces with only minimal need for government intervention, since returns to capital should be highest in areas of greatest competitive advantage. The only exception might be where there are issues of national security at stake that make governments reluctant to rely too heavily on imports, or where there is a strategic case for supporting (on a strictly time-limited basis) local 'infant industry clusters' that have the potential to develop into major sources of comparative advantage if they can build up sufficient scale to compete on global markets[17].

While the theory of comparative advantage generally seems very logical and convincing to trained economists, it is understandable that some business people and trade unionists in the US or European countries may be less easily convinced. From their perspective, companies from China, India and other emerging economies are already posing a major competitive challenge in many of their markets and, with the rapidly increasing number of graduates and other skilled workers in these countries, will in future decades become effective global competitors in a range of other markets such as hi-tech manufacturing and wholesale financial services, just as Japan did in the 1970s and 1980s. But the fact that China and India have much larger populations than Japan (or other industrialising Asian economies such as South Korea) means that their impact on global markets is potentially much greater and longer lasting. In particular, the rise of China and India implies a huge increase in the effective labour supply of the global economy, which some fear could lead to widespread job losses and/or wage cuts in OECD countries as companies are forced to outsource ever more of their activities to lower cost Asian locations in order to survive.

While there is some truth in these views, it is only a partial picture and ignores several important dynamic factors. In particular, as China, India and other E7 economies become richer over time, as projected by our model, so the opportunities for OECD companies in these emerging markets will increase. It is notable here that the Chief Executive Officers (CEOs) of major international companies interviewed in PricewaterhouseCoopers' 9th Annual Global CEO Survey[18] were very clear that these markets offered significant business opportunities: 78% believed this of China, 64% of India, 48% of Russia and 46% of Brazil.

Furthermore, as illustrated in Figure 9 below, the great majority of CEOs (74-82%) saw these opportunities primarily in terms of access to new markets, compared to only a minority who identified reducing costs as a key business opportunity created by the

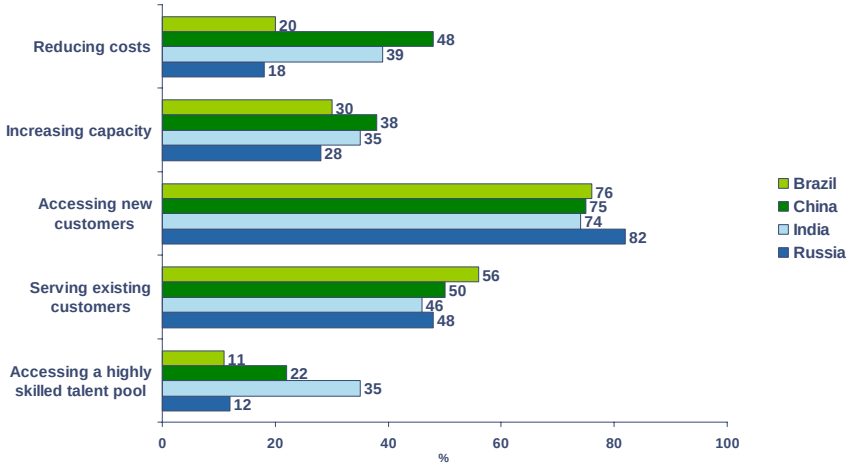
[17] However, as discussed by Paul Krugman, one of the founders of modern strategic trade theory, in his book 'Pop Internationalism' (Boston: MIT Press, 1996), these arguments only apply in certain special cases (e.g. aerospace) where global economies of scale are particularly significant. Such special cases should not be taken to overthrow the established theory of comparative advantage in the great majority of cases.

[18] This survey involved interviews with 1,410 CEOs between September and December 2005, conducted by PricewaterhouseCoopers' International Survey Unit.

rise of the BRIC economies (although the latter figure was only just under 50% in the case of China).

Figure 9: Accessing new customers is the key driver for doing business in emerging economies

Ref: Q5. Which of the following business objectives are driving your decision to do business in……..?

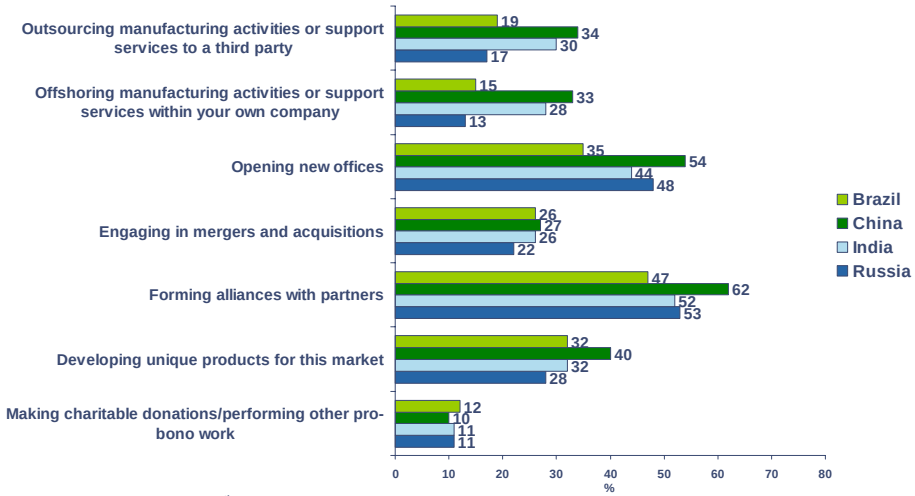


Source: PricewaterhouseCoopers' 9th Annual Global CEO Survey. All respondents, except Brazil, China, India and Russia (331-674)

These findings were reinforced by the fact that, as shown in Figure 10 below, the key actions that the highest proportions of CEOs were planning when the survey was conducted involved opening new offices or forming alliances with partners in the BRIC economies, with only a minority planning outsourcing or offshoring (either in-house or to third parties).

Figure 10: Main actions that CEOs are taking/planning to take in emerging economies

Ref: Q6. Which of the following actions is your organization taking or planning to take in……..?



Source: PricewaterhouseCoopers' 9th Annual Global CEO Survey. All respondents, except Brazil, China, India and Russia (331-674)

This is not to deny that outsourcing and offshoring are significant and growing business phenomena, but they are only one side of the coin and, from the perspective of the CEOs interviewed in the PricewaterhouseCoopers survey, not the most

important side in the majority of cases. These results are particularly notable given that the specific questions asked referred to plans over the next three years, which is a time period over which the BRIC economies will remain highly cost competitive, but which is too short to allow for the significant longer term rises in real income levels and real exchange rates that our model predicts will greatly increase the value of these markets to US and European companies in future decades. It seems that these companies are taking a far-sighted view of the potential of these markets, not just responding to the current situation there. Of course, these countries are already significant markets for many US and EU companies, but these are not nearly as large now as they will be in the longer term as our modelling illustrates.

It is also important to look at this not just from the perspective of OECD producers, but also from that of OECD consumers. The latter have already benefited over the past decade from an increasing flow of low cost imports from China in particular and this trend is set to continue and broaden out to a wider range of products over time. This will not only help to keep inflation and interest rates low in OECD countries, but will also leave consumers with more money to spend on services that, by their very nature, will largely not be subject to international competition due to barriers of distance, language and culture.

Overall, therefore, we would regard the rise of China, India and the other E7 economies as being beneficial to the long-term growth potential and average living standards of the G7 and other established OECD economies. But there will clearly be both winners and losers from the process of adjusting to this new world economic order.

Potential winners and losers within the established OECD economies

While the general principle of comparative advantage is clear enough, predicting how comparative advantage will evolve in the future is notoriously difficult. Certainly it is not sensible to try to do this over the 45 year horizon of our growth model, which as mentioned above is a single good model that does not allow for sectoral disaggregation. Nonetheless, if we adopt a shorter time horizon of, say, ten years, then some educated guesses can be made as to the key winners and losers within the established OECD economies if the emerging economies develop broadly as envisaged in our base case projections over this period, as summarised in Table 7 below.

Table 7: Potential winners and losers within the OECD economies over next 10 years

	Potential winners	Potential losers
Companies	• Retailers • Leading global brand owners • Business services • Media companies • Niche high value added manufacturers • Health care and education providers • Financial services companies able to penetrate E7 markets • Energy and utilities companies	• Mass market manufacturers (both low tech and hi tech) • Financial services companies not able to penetrate E7 markets who may become vulnerable in their home markets • Companies that over-commit to key emerging markets without the right local partners and business strategies
Individuals	• Global 'star performers' • Consumers of low cost imports • Providers of high value personal services with cultural barriers to migrant labour • Individuals with strong cross-cultural skills	• Low and medium-skilled workers in tradable sectors (including those open to offshoring) • Low and medium-skilled workers in non-tradable sectors open to migrant labour

Source: PwC qualitative assessment – for discussion purposes only

Impact on OECD companies

Retailers should be **potential winners** to the extent that they can benefit from lower cost imports into their OECD markets (though much of this benefit will be passed on to consumers unless retailers enjoy significant market power) while also having the potential to set up new stores in the E7 countries. This is, however, subject to the caveat that they identify the right business strategies and local partners for such overseas ventures, which has not always been the case for overseas investments by retailers in the past, particularly in culturally unfamiliar territory such as China or India.

Similar caveats apply to other potential winners such as business services, energy and utilities, healthcare, educational services, media companies and owners of leading global brands. All of these are, in principle, well placed to benefit from the rapid growth in emerging markets projected by our model, provided they can identify and execute the appropriate business strategies, bearing in mind that strong domestic competitors either already exist or will probably soon emerge in these markets.

The financial services sector is one where the likely balance of winners and losers seems less clear. On the one hand, the emerging markets of the E7 provide considerable opportunities, but on the other hand we can expect large financial services providers to emerge in economies such as China and India that may increasingly seek to play on a global stage, just as Japanese banks have done in recent decades, particularly in serving business customers and wholesale markets.

Turning to those OECD-based producers that might be expected to be **potential losers**, these would clearly include mass market manufacturers, many of whom have already suffered from Chinese competition in particular (or have been forced to move their production to China or other low cost economies to compete). As Chinese companies continue to increase the average skills levels of their workforce and adopt the latest OECD technologies, so they will move from low tech to hi-tech areas of manufacturing, both to serve their own domestic markets and to export to OECD markets (the wages of Chinese workers will, of course, also rise as a result, so boosting their demand for Western products). Unless OECD manufacturers can find viable high value added niches that Chinese companies and those from other E7 economies cannot easily copy because they involve highly firm-specific or readily patentable intellectual property, they will find life increasingly tough.

The long-term trend for manufacturing to make up an ever smaller proportion of OECD GDP will therefore continue, possibly at an accelerated pace[19]. This is not necessarily a problem, however, provided that OECD workers from these adversely affected sectors can be retrained and redeployed to sectors that are either not open to international competition, or where OECD companies have a comparative (although not necessarily an absolute) advantage relative to their E7 rivals.

Impact on individuals

This brings us to the impact on individuals. Global 'star performers', ranging from chief executives and financial market traders to footballers and film stars, will benefit from the expanded global markets over which their personal 'brands' can be leveraged. The E7 economies will, of course, produce their own share of global star performers in these and other areas. At this top level, there will still be plenty of money to go around, but one or two levels down from this the premium incomes currently earned by highly skilled and educated professionals from OECD countries (e.g. senior lawyers, accountants, bankers, financial market analysts and the like) will tend to be gradually eroded by an increasing number of equally well-qualified, extremely highly motivated and hard-working, English-speaking professionals from the E7 countries (at present, many of these may move to London or New York, but as rival financial and economic centres develop in Asia this may become less necessary).

[19] Although it should be noted that this trend reflects a shift in demand from goods to services in all OECD countries as incomes rise, as well as the effects of increased competition from emerging market producers. With manufacturing productivity growth generally being higher than services productivity growth, this will lead to an even faster decline in the share of manufacturing in total employment in OECD countries. Martin Wolf (2004) provides a good discussion of these and related issues in arguing against those seeing the rise of the emerging economies as a major threat to the OECD economies.

One group that should be potential winners will be those with strong cross-cultural skills. A working knowledge of Mandarin and experience of working in China may become highly valuable for fast-track professionals and business executives, even though English seems likely to remain the dominant business language for the moment. Experience of working across a range of E7 economies may also be increasingly valuable.

As noted above, consumers in OECD countries have already benefited significantly from an increased flow of low cost imports from China and other E7 economies and this can be expected to continue for some years (although there is likely to be some offset from high prices and other commodities due to increased E7 demand for these products). Eventually, as income levels, labour costs and real exchange rates rise in the E7 as indicated by our model predictions, these gains may be eroded, but probably not within the ten year time horizon adopted in Table 7 above.

To a degree, this enhanced consumer purchasing power within the OECD countries should feed the demand for personal and household services, from fitness training and aromatherapy to plumbing and gardening. But many of these service sector roles will be relatively low wage jobs where competition from migrant labour from the E7 and elsewhere may be fierce (as is already evident in places like London). There will, however, be some higher value services where there is a premium on local cultural knowledge and (particularly outside the English speaking countries) language skills, or where locations are outside the major cities that tend to be the focal points for migrant labour. As income levels in the E7 economies rise in the longer term, however, fewer people from these countries are likely to choose to migrate to the OECD countries (though this may only become a significant factor beyond the ten year horizon adopted for the analysis in Table 7 above).

Generally, however, it does seem likely that many individuals will face increased actual or potential competition either from workers in the E7 and other low cost economies due to outsourcing/offshoring, or from migrant labour moving to the OECD countries. This may constrain wage growth in the OECD countries for those not in the 'star performer' bracket, while also tending to widen income inequalities within these countries.

Possible public policy responses

Although the rise of the E7 should bring significant net benefits to the OECD economies, the fact that there will also be a significant number of losers from this process, and that income inequalities may well tend to rise as a result, poses important public policy challenges[20].

It is relatively easy from an economic perspective to set out what OECD governments should *not* do in response to these challenges. In particular:

[20] Rapid emerging market growth will also pose important global environmental challenges given that much of it probably will be relatively 'carbon-intensive' and so will add to long-term climate change pressures, but it is beyond the scope of this paper to explore these issues in more detail.

- **they should not relapse into protectionism**, and indeed should seek to move further towards reducing tariffs and improving market access on a reciprocal basis with the emerging economies (making progress during 2006 on the Doha trade round after the relatively modest steps forward in Hong Kong is a priority here, though the political barriers to this remain significant);
- **they should not seek to subsidise industries in their own countries that cannot compete with rivals from the E7 and other low cost economies**, other than possibly through strictly time-limited financial assistance to smooth the process of sectoral adjustment within a particular local economy that might otherwise suffer such a large loss of jobs and demand that it might be pushed into a prolonged slump that may be more costly to deal with later; and
- **they should not be seeking to 'pick winners' through industrial policy**, as opposed to creating the right environment for potential winners to emerge.

It is more difficult to identify what exactly governments should do in the face of these challenges, but clearly they have an important role in raising the general level of education and skills in their countries, which our model makes clear is critical for long-term growth. Governments will also need to play a co-ordinating and enabling role in relation to the retraining and relocation of workers displaced from sectors facing severe competition from low cost emerging economies. This might involve active labour market measures that make benefit payments conditional on engaging in job search, training, community service or work experience. It could also involve support for business start-ups in the worst-affected areas.

Depending on the local political consensus, there might also be a case for OECD governments to 'lean against the wind' to some degree in counteracting the tendency for globalisation (combined with other factors such as technological advances that favour highly skilled workers) to add to income inequalities within their countries. This might involve measures such as in-work tax credits[21], childcare support for lower income families and possibly also more progressive income tax regimes. At the same time, governments will need to be mindful of the incentive effects of such changes, particularly as regards globally-mobile workers and entrepreneurs.

As argued by Adair Turner[22], a former head of the UK Confederation of British Industry (CBI) and currently vice-president of Merrill Lynch Europe, it is wrong to conclude that globalisation prevents national governments from making choices as to overall levels of tax and spending, subject to maintaining sound public finances and designing tax regimes in a way that avoids undue adverse incentive effects (i.e. with broad tax bases combined with marginal tax rates that are as low as is compatible with the desired levels of public spending). It should also be recognised that some public spending, particularly in areas like education and transport and communications infrastructure, can be strongly growth-positive if targeted effectively. Turner also argues that some forms of regulation, particularly in relation to the environment and other 'quality of life' issues, can also be welfare-enhancing to the extent these are 'superior goods' that people in all countries tend to demand more of as they grow richer. From this perspective, globalisation offers a mixture of opportunities and

[21] Although recent UK experience suggests that the administration of such tax credits needs careful attention.
[22] A. Turner, *Just Capital*: *The Liberal Economy* (London: Macmillan, 2001).

constraints, but not a policy straitjacket that necessitates a low tax, low spend economy irrespective of local preferences, which may be very different in, say, France or Germany than in the US (e.g. as regards the appropriate trade-off between leisure and consumption).

6. Conclusions

The first important conclusion from this research is that there is no single right way to measure the relative size of emerging economies such as China and India as compared to the established OECD economies. Depending on the purpose of the exercise, GDP at either market exchange rates or PPP rates may be most appropriate measure. In general, GDP at PPPs is a better indicator of average living standards or volumes of outputs or inputs, while GDP at current market exchange rates is a better measure of the size of markets for OECD exporters and investors operating in dollars, euros, yen or pounds. For long-term investments, however, it is important to take into account the likely rise in real market exchange rates in emerging economies towards their PPP rates in the long run, although our modelling results suggest that, for countries such as China and India, this exchange rate adjustment may still not be fully complete even by 2050.

The second conclusion is that, in our base case projections, the leading emerging economies, which we refer to as the 'E7' (i.e. China, India, Brazil, Russia, Indonesia, Mexico and Turkey) will by 2050 be around 25% larger than the current G7 (US, Japan, Germany, UK, France, Italy and Canada) measured in dollar terms at market exchange rates, or around 75% larger in PPP terms. In contrast, the E7 is currently only around 20% of the size of the G7 at market exchange rates and around 75% of the size in PPP terms.

Third, however, there are likely to be notable shifts in relative growth rates within the E7, driven by divergent demographic trends. In particular, both China and Russia are expected to experience significant declines in their working age populations between 2005 and 2050, in contrast to relatively younger countries such as India, Indonesia, Brazil, Turkey and Mexico, whose working age populations should on average show positive growth over this period, although they too will have begun to see the effects of ageing by the middle of the century.

Fourth, taking account of these demographic trends, our base case projections suggest that India has the potential to be the fastest growing large economy in the world over the period to 2050, with a projected GDP at the end of this period of close to 60% of that of the US at market exchange rates, or of similar size to the US in PPP terms. China, despite its projected marked growth slowdown, is projected to be around 95% the size of the US at market exchange rates by 2050 or around 40% larger in PPP terms. These base case projections also suggest that:

- the Brazilian economy would be of similar size to that of Japan by 2050 at market exchange rates and slightly larger in PPP terms, but still only around 20-25% of the size of the US economy;
- Indonesia and Mexico would also grow relatively rapidly, being larger than either Germany or the UK by 2050 (even at market exchange rates);
- Russia would grow significantly more slowly due to its projected sharply declining working age population, but would still be of similar size to France by 2050 at either market exchange rates or PPPs; and
- Turkey would grow more strongly due to its younger population, being of similar size to Italy by 2050 at both market exchange rates and in PPP terms.

Fifth, these long-term projections are, of course, subject to significant uncertainties, which our model allows us to explore. Our sensitivity analysis suggests that long-term relative E7 GDP projections are particularly sensitive to assumptions on trends in education levels, net investment rates and catch-up speeds, which in turn depend on a broad range of policy and institutional factors. In PPP terms, our analysis suggests that it would certainly not be implausible for the relative size of the E7 compared to the G7 to be around 30% higher or lower than in our base case projections. Adding in real exchange rate uncertainty would make this 'funnel of uncertainty' even larger for GDP at market exchange rates in 2050. But we consider these uncertainties to be broadly symmetric around our base case assumptions, so this analysis does not alter our conclusion that the overwhelming likelihood is that there will be a significant shift in world GDP shares from the G7 to the E7 by the middle of the century.

Sixth, while the G7 and other established OECD countries will almost inevitably see their relative GDP shares decline (although their average per capita incomes will remain well above those in emerging markets), the rise of the E7 economies should boost average OECD income levels in absolute terms through creating major new market opportunities. This larger global market should allow OECD companies to specialise more closely in their areas of comparative advantage, both at home and overseas, while OECD consumers continue to benefit from low cost imports from the E7 and other emerging economies. Trade between the E7 and the G7 should therefore be seen as a mutually beneficial process, not a zero sum competitive game.

Seventh, however, while the net effect of the rise of the E7 should be beneficial for the OECD economies overall, there will be significant numbers of losers at both corporate and individual level. These losers may not outnumber the winners but could be more politically vocal in their opposition to globalisation. Mass market manufacturers will suffer, both in low tech and increasingly in hi-tech sectors, and economies like China and India will also become increasingly competitive in tradable services sectors such as banking and other wholesale financial services. There may also be a tendency for income inequalities to increase within the OECD economies, with global star performers doing well, but low and medium-skilled workers facing an increasing squeeze from lower cost workers in the emerging economies in internationally tradable sectors, as well as migrant workers in non-tradable service sectors. This competition will also increasingly affect highly skilled professionals below the 'global star' level, who may find their ability to attract premium income levels constrained by lower cost but equally qualified graduates on the end of an internet connection in Beijing or Chennai.

Finally, we explored the important public policy challenges posed by these developments. The main roads to avoid are a relapse into protectionism, subsidies for declining sectors (except possibly through strictly time-limited assistance to smooth the adjustment process), or attempts to pick winners through industrial policy. Instead the focus should be on boosting general education levels, facilitating retraining and business start-ups in areas adversely affected by global competition, and developing active labour market programmes based on conditional benefit regimes, childcare support and in-work tax credits. But the optimal policy response and the extent to which OECD governments should 'lean against the wind' of increasing income inequality through more progressive tax regimes will be a matter for local democratic

decisions reflecting local circumstances. This will involve hard choices, but national governments will retain significant discretion to set overall tax and spending levels.

Annex: Technical description of the model and references

In line with mainstream economic growth theory since the late 1950s, we assume that output can be modelled using a Cobb-Douglas production function with constant returns to scale and constant factor shares. Specifically output (i.e. GDP, which we denote below as Y) is given by the following equation:

$$Y = AK^{a}L^{1-a}$$

Where:

A = total factor productivity, which is determined by technological progress in the leading country (here assumed to be the US) plus a country-specific catch-up factor related to the initial productivity gap versus the US

a = the share of capital in total national income and so (1-a) is the share of labour, both of which are assumed constant over time in this model

K = the physical capital stock, which grows according to the standard formula:

$$K_t = K_{t-1}(1-d) + I_t$$

where: d = the depreciation rate; I_t = gross investment in year t

L = the quality-adjusted input of labour, which can be broken down into:

$$L = h(s)eN$$

where: h(s) is a quality adjustment related to the average years of school education of the working age population; e is the employment rate defined as a share of the working age population; and N is the number of people of working age.

Key assumptions

As described in Section 2 above, the key parameter assumptions we make in the model are that:

- The parameters a and d are set at 1/3 and 5% respectively, in line with the values used in many past academic studies.
- The catch-up rate of A is assumed to converge to 1.5% per annum for all of the E7 economies in the long run, in line with the typical 1-2% estimate found in past academic studies. In the shorter term, however, catch-up speeds are lower at around 0.5-1% per annum for emerging economies that we judge to have some way to go before they achieve political, economic and institutional frameworks that are fully supportive of growth convergence. In particular, we assume a catch-up speed of only 0.5% per annum up to 2020 for India, Brazil and Indonesia and 1% per annum for Mexico and Turkey. China and Russia are assumed to have catch-up speeds of 1.5% per annum from the start.

- Initial capital stock estimates (K) for the mid-1980s are taken from Levine and King (1994), updated to 2004 using data on investment to GDP ratios from the Penn World Tables (v. 6.1) and the IMF. These investment (I/Y) ratios are then projected forward assuming recent trends continue up to 2010, followed by a slow convergence to around 20% from 2025 onwards, with the exception of China (25%) and Indonesia (22%).
- Initial estimates of average education levels (s) are taken from Barro and Lee (2001) and projected forward based on a continuation of trends over the past 5-20 years (using judgement as to what to take as the appropriate reference period in each case). The calculation of the labour-quality-adjustment function h(s) follows the same approach as Hall and Jones (1998).
- The working age population projections (N) are the central case from the 2004-based United Nations (UN) projections for 15-59 year olds. Employment rates (e) are assumed to be constant over time.

Market exchange rate projections

As discussed in Section 2, purchasing power parity (PPP) exchange rates are assumed to remain constant over time in real terms, while market exchange rates converge gradually over time to these levels in the very long term.

For the OECD economies (excluding Mexico), this is assumed to be a simple linear process over the period to 2050 for simplicity. For the E7 economies, the change in the real market exchange rate relative to the dollar is assumed to be proportional to the difference in labour productivity growth in each year between the country concerned and the US. This is intended to capture, at least in broad order of magnitude terms, the well-known Balassa-Samuelson effect whereby higher productivity growth, primarily in the tradables sector, leads to a real exchange rate appreciation in fast-growing emerging market economies due to either a nominal appreciation and/or higher price inflation for a fixed nominal exchange rate. We cannot model this effect directly in our single good model, but it can be shown to be broadly equivalent to the theoretical Balassa-Samuelson effect under the following simplifying assumptions:

- all of the productivity differential relative to the US is focused in the tradables sector; and
- the tradables and non-tradables sectors are of broadly similar size.

This is the same simplifying assumption made in the Goldman Sachs model of long-term growth in the BRIC economies. An alternative assumption in which the real exchange rate rise is only half as large as the productivity differential is considered as part of the sensitivity analysis in Section 4 above.

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About PricewaterhouseCoopers

PricewaterhouseCoopers (www.pwc.com) provides industry-focused assurance, tax and advisory services for public and private clients. More than 120,000 people in 144 countries connect their thinking, experience and solutions to build public trust and enhance value for clients and their stakeholders.

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