The growth of global wealth until 2020

Stefan Bergheim
Senior Economist, Deutsche Bank Research

Over the next decades, much of the world's new income and wealth will be created in Asia. As a result, the world of wealth will increasingly become multi-polar. These are by now quite familiar insights and many financial institutions base their strategic planning on them. However, most strategists and analysts leave unclear whether these insights are merely assumptions, simple extrapolations of the past, or indeed deeply rooted in fundamental economic analysis.

To provide this fundamental underpinning for forecasts of income and wealth around the globe, Deutsche Bank Research has developed an analytical framework for long-term growth analysis. This Foresight Model for Evaluating Long-term Growth, or Formel-G, provides a transparent and systematic framework based on modern growth theory, state-of-the-art econometric analysis, and innovative trend analysis to forecast annual GDP growth until the year 2020. The model consists of three layers, which will be outlined in detail below. The first layer is GDP, the variable of interest, which is the best available measure of economic activity in a country and highly correlated with wealth. The second layer consists of four growth drivers, which are linked to GDP with an econometric equation. Finally, the third layer includes six trend clusters, which allow the inclusion of a very large set of information and the modeling of structural breaks[1].

The four main drivers of long-run GDP growth

Four variables made it into Formel-G, namely, population growth, the investment ratio, human capital, and trade openness. They all fulfill three criteria. Firstly, a stable relationship across countries, periods, and model specifications with economic growth exists in the theoretical and empirical growth literature. Secondly, sufficiently long time series are available. Finally, our own estimates show a statistically and economically significant relationship with per capita GDP of the 15-64 age group in our two panels with annual data from 1970 to 1998 for 21 rich countries and 12 emerging markets.

Driver 1 - population growth

The first and most obvious driver for overall GDP growth is the growth rate of the population as an indicator for labor input. In a number of our selected countries, population growth accounts for roughly one-third of total future GDP growth and is thus one of the most important fundamental drivers of growth. Of course, this is of secondary importance for the individual citizen, who is more interested in income per capita. Certainly, a better measure of actual labor input would be hours worked, which would also account for differences in participation rates and retirement ages. These variables have to be closely monitored in any country analysis, but unfortunately sufficient data are not available for all countries in our group.

Driver 2 - Investment ratio - accumulation of capital

One of the classic drivers of growth is the investment ratio, which determines the accumulation of real capital. It is included in every theoretical and empirical model, even though the investment ratio cannot rise forever and, in view of declining marginal returns, does not allow higher GDP growth per capita but only a higher GDP level in the long-run. Over the past decades, investment (or its ultimate determinants) played a major role for economic growth, especially in South Korea and Germany. In South Korea the investment ratio rose from 5% of GDP in the early 1960s to over 35% by the early 1990s. By contrast, in Germany it fell from 25% at the beginning of the 1960s to below 15% in 2002. While investment ratios usually do not have a long-term time trend, their development can have a significant impact on growth over the next 15 years. The Formel-G forecasts for the investment ratios, therefore, make use of the fact that these move outside the 15-30% range only for short periods of time. In South Korea, the investment ratio has meanwhile fallen back to 25%. The ratio in China is still close to 40%.

Driver 3 - Human capital - quality of labor input

The human brain is one of the major sources of wealth and growth. Human capital represents the quality of labor input, the ability to combine production factors efficiently, and the capacity to absorb and apply new knowledge and to pass it on. A rise in human capital allows a rise in GDP per capita. The

1   More details can be found in: Bergheim, S., 2005, 'Global growth centres 2020 – Formel-G for 34 economies,' Deutsche Bank Research Current Issues, March 23

best available yardstick for human capital is the average number of years of education per capita of the 25-64 age group, which the OECD calculated back in 2002 for 95 countries for the past and until 2010. This measure takes into account university-level education, but does not include training on the job. According to this definition, Germany (13.5 years), Switzerland (12.9 years), and Canada (12.9 years) had very high levels of human capital in 1998; China (5.8 years) and India (4.1 years) ranked at the lower end. From 1988 to 1998, Italy, Spain, and South Africa made a particularly great leap forward of more than 1.5 years each. By contrast, almost no progress was registered in the U.S., Denmark, and recently Germany.

The empirical correlation between education and income is unequivocally positive. Microeconomic analyses regularly explain much of the differences in income between people with differences in the levels of education. What applies to individuals also applies to entire economies. Our panel estimate finds a statistically significant relationship between the level of human capital and the level of GDP for both the OECD countries and the emerging markets. The size of the coefficient is consistent with estimates generated by the OECD, in that in the long run a 10% increase in the number of years of education results in an 8% increase in per capita GDP in the OECD countries and a 9% increase in the emerging markets. A 10% rise would today translate into an additional 1.4 years in Germany and 0.6 years in China.

Driver 4 – Trade openness – promotes learning

If a country trades more with others, then the competitive pressures on companies and the state increases, leading to efficiency gains and a higher production potential. In addition, the country can benefit from technological progress embodied in imported capital goods. Economies of scale in production may be realized. With the same amount of labor and human capital (as defined above) more output can be produced. The measure of the openness of a country in Formel-G is based on the average of the shares of imports and exports in GDP. This share of foreign trade is adjusted using purchasing power parity exchange rates in order to correct for the differences between the domestic price level of non-tradable goods and the world market prices of exports and imports. With the exceptionally high domestic price levels in Japan, the country's national accounts, for example, report a lower foreign trade share than at the average prices of the other countries. Since small countries conduct more foreign trade than large countries, we make a further adjustment to the purchasing power parity foreign trade share using the size of the country's population.

The resulting measure of trade openness has been on an upward trend for all countries during the last decades. The most open economies in 2002 were Germany, Belgium, the Netherlands, and France – all at the centre of Europe and founding members of the E.U. The most closed economies were Argentina, South Africa, and New Zealand. During the last 10 years Mexico, India, and Turkey have opened their economies most rapidly. The empirical part of the model finds a significant positive link between the degree of openness and the level of GDP, with the coefficient in the OECD countries more than twice as high as in the emerging markets. According to the estimates for the emerging markets, per capita GDP in India would be 10% higher in the long-term if India were to achieve the current level of openness in China.

The other candidates for the model

Other candidate variables did not make it into Formel-G for various reasons, mainly because they either did not add much new information beyond the four drivers, the econometric relationship with the growth rate was not clear, or there were not enough historic data. For example, spending on research and development (R&D) is an obvious candidate for explaining technological progress. However, it is strongly positively correlated with human capital, and long-term time series are not available. In addition, openness can be a partial substitute for domestic R&D spending; for example, through trade or direct investment a country can gain access to technology from abroad, but usually at a cost. However, the user country must also be in a position to apply this knowledge by first investing in education itself.

The difficulties with government influence and the political environment lie elsewhere, as decisions taken by the government undoubtedly have a major impact on economic growth. However, there is no clear theoretical or empirical relationship between overall government spending and growth. State infrastructure investment, education spending, and social peace promoted by transfer payments generally have a positive impact on income levels and possibly even on growth rates. By contrast, early retirement programs and subsidies for sunset industries have negative consequences. The overall impact of government spending is therefore unclear. The Scandinavian economies show that a large government sector can be accompanied by high growth rates. Consequently, government spending does not enter Formel-G.

On the other hand, it is easy to see theoretically that more efficient financial systems boost economic growth; savings of private households along with those from abroad flow into more efficient projects with higher returns. Risks are diversified more efficiently and riskier (higher return) projects are pursued. The investment ratio would rise at least in the medium-term. Unfortunately, it is very difficult to define exactly what constitutes an efficient financial system. It is even more difficult to find good measures with the appropriate history. Stock market capitalization as a percentage of GDP is often used as a measure of the efficiency of a financial market. However, the high market capitalization in Japan at the start of the 1990s was not followed by high growth in subsequent years. That is a reason why Formel-G does not include stock market capitalization.

The link to GDP with a panel model

The four selected drivers are linked to GDP growth through two econometric equations — one for the rich countries and one for the emerging markets — using the pooled mean group panel technique. It takes into account the information embedded in the series' time dimension but saves some degrees of freedom by assuming the same long-run relationship between the level of the growth drivers and GDP per capita in all countries. Country-specific convergence coefficients, constants,

and short-term dynamics take care of the respective economic cycles. This procedure has the advantage that long-term growth in a specific country is not only based on that country's own historic experiences but also on the estimated average growth-relationship across all countries. This is extremely helpful for our purposes as a forecast for a country should ideally be based on a general long-term relationship between changes of the drivers and GDP growth across all countries.

Forecasts of the four drivers to 2020

Having pinned down the econometric equation, the model now requires forecasts for the four drivers until 2020 to calculate GDP growth rates and levels. A three-stage process is used: In the first stage (extrapolation), it is the past development alone that determines the future course of each time series. The exception is population growth, for which Formel-G uses the U.N.'s forecasts as the baseline. The second stage (cross-check) factors in additional information from the historic and future developments in the other countries. In some cases the extrapolation results in levels or changes in the time series that differ starkly from those of other countries in the past and the future. These were systematically corrected with the help of information from averages and changes from the other countries in order to dampen extreme projections. The third stage (trend analysis) is by far the most complex and is applied to all four drivers. This innovative stage is designed to increase the reliability of the forecasts and to help recognize and model structural breaks. This stage assesses a broad range of information that is not contained in the extrapolating baseline forecast or other growth models. Internal and external knowledge from trend and future research about the individual countries can thus be systematically incorporated into the forecast.

The trends that will shape future growth

In an ongoing process Deutsche Bank Research monitors more than 40 trends from the five following categories: The individual and society, institutions and political environment, organizational forms and markets, innovation and technology, and natural resources. For the global growth centers proj-

ect 21 trends that are likely to be particularly relevant for future economic growth were selected.

In order to reduce the complexity of the model the individual trends were first combined by means of a cluster analysis into 6 consistent trend clusters. Trends within a cluster pull in the same direction relative to other clusters; trends in clusters that are far apart may impede each other. An important advantage of this approach is that information about the development of one trend in a certain country can simultaneously supply information about the other trends in the same cluster[2].

With the aid of a multitude of indicators that supply information about both the level of and the changes in the various trends, we have examined how fast these trend clusters have developed in the last 10 to 15 years in the 34 countries. The decisive impact on our growth forecasts comes from changes in the speed of the trend clusters over time – their acceleration. If a trend cluster develops just as quickly in the future as in the past, then it provides no additional information beyond the simple extrapolation in the baseline forecast.

Cluster 1 – Opening of work and society
The trend cluster 'opening of work and society' refers to the ongoing process in which the rigid structures in the labor markets and societies are being dismantled, flexibility is increasing and more people are being integrated into the economy. Career paths and working environments are becoming more flexible, so the practice of doing the same job for the same employer for one's whole working life is becoming less important, making lifelong learning more important and resulting in more frequent changes of job duties and employers. This trend cluster has developed particularly rapidly over the last 10 to 15 years in Scandinavia, where labor markets have become much more flexible and the employment rate for women has reached record levels, even when compared to the employment rate for men. The most pronounced acceleration in the opening of work and society in the next 10 to 15 years is likely to occur in Germany, Italy, and Japan.

Cluster 2 – Enlarging scope of life
The trend cluster 'enlarging scope of life' consists of two trends that clearly belong together, namely, aging populations and the expansion of the healthcare sector. The healthcare sector offers superior goods for which demand rises more than proportionally with income. The rapid pace of technological progress is another key driver of this trend. Many goods and services in the health sector increase life expectancy; therefore, the average age of the population will rise even faster than assumed in most official projections. The most marked acceleration of the trend cluster is expected in the coming years in the emerging markets of India and South Africa.

Cluster 3 – Conquest of smallest structures
The trend cluster 'conquest of smallest structures' is comprised of two technological and two institutional trends. Biotechnology will become a major growth area, while micro- and nanotechnology become important areas of innovation. In addition, work on and with ever smaller components will tend to be promoted in many regions by better institutions. This relatively new trend cluster has developed particularly fast over the last 10 to 15 years in the U.S., Germany, the U.K., and Sweden. In the future, too, we expect particularly rapid developments in the U.S. and Germany, partly because the size of the market and the research location will be positive factors.

Cluster 4 – Global networking in business and politics
The cluster 'global networking in business and politics' comprises of five trends from the institutions and markets categories. More and more market participants are becoming globally active, entering new sectors, and encountering fewer state regulations worldwide. This will provide them with more opportunities to escape the rigid structures inherent within their home countries. The importance of transnational companies of all sizes will grow, as will the influence of global institutions such as the IMF, the WTO, and non-governmental organizations such as Greenpeace. Knowledge-intensive services will gain importance and these services will increasingly be provided across borders. In order to facilitate this, national

2   The DBR trend map can be found in the introductory study on page 21 and on
    www.dbresearch.de (Macro Trends).

product, labor, and capital markets will be deregulated. In the past this trend cluster developed particularly vigorously in Sweden, Malaysia, and the Netherlands, where the proportion of exports generated with services has risen particularly sharply. In the next 10 to 15 years we expect the biggest changes to occur in China, India, and Germany. In these countries there is still a great deal of scope for deregulation and the pressure to take action is immense.

Cluster 5 – Process virtualization in networks

'Process virtualization in networks' will become more and more important in the coming years. It will bring together an increasing number of participants via more efficient channels; organizational and market processes will increasingly operate in the virtual space. These relatively new trends have only emerged in the last 10 to 15 years. The U.S. led the way, followed by the U.K. and the Scandinavian countries. In the future, too, the U.S. will, in our opinion, continue to be the most rigorous in pursuing this course. In Spain, Germany, and Japan the trend cluster is likely to accelerate appreciably.

Cluster 6 – Restriction of growth

The 'restriction of growth' cluster is comprised of all those trends that tend to put a brake on growth. They often exacerbate one another and hinder some of the other trends or their positive impact on economic growth. The potential for social frictions rises when income differentials widen or ethnic and religious tensions intensify. The threat from international terrorism is growing and leading to higher spending on security. This ties up resources that could be deployed more productively elsewhere. In the past 10 to 15 years these trends have been particularly pronounced in the U.S., Italy, Russia, and Indonesia. In the future, this cluster is likely to accelerate appreciably for different country-specific reasons in Germany, the U.K., and Italy.

The trends influence the drivers of growth

These six trend clusters will influence the future path of the four drivers in Formel-G. For example, an acceleration in the cluster 'opening of work and society' will have a positive impact on human capital because more and more people will be able to achieve higher returns on their education. The cumulative add-ons result, for example, in a rise in human capital in Germany, Japan, India, and China by almost one year more than in the baseline forecast between 2005 and 2020. In Germany and Japan the main reasons are the expected acceleration of the trend clusters 'opening of work and society' and 'process virtualization in networks,' whereas in India and China the acceleration of 'global networking' is an important factor boosting incentives for training. In the final stage the forecasts for the four drivers are fed into the econometric model. This calculates annual growth rates for GDP per capita for the 15 to 64 age group until 2020. Using our population forecasts for both this group and the population as a whole we are able to calculate the levels and growth rates of GDP overall and GDP per capita.

The growth stars of 2006-20

The star in the global growth ranking according to Formel-G is India, with an expected annual average rate of GDP growth of 5.5% over the years 2006 to 2020. This model forecast is roughly in line with the current consensus expectations. As a result, India will, in purchasing power parity (PPP) terms, take the place of Japan as the world's third-largest economy behind the U.S. and China by the end of this decade (Figure 1). Strong population growth of 1.6% per annum over 2006-20 contributes significantly to overall GDP growth. But per capita GDP is also set to rise significantly, by 3.9% per annum, as human capital will improve rapidly and India will probably continue to open strongly to the rest of the world. With that growth rate, per capita GDP doubles every 18 years. However, India's per capita income will still be the second lowest in our group of countries by 2020.

Malaysia's economy of 25 million inhabitants is set to continue the success of the last two decades. According to Formel-G, Malaysia's average annual GDP growth is projected to be 5.4% over 2006-20 – almost as high as in the much poorer India. At 3.6%, the rise in per capita GDP would match the growth rate of 1976 to 2000. By 2020 Malaysia's economy will
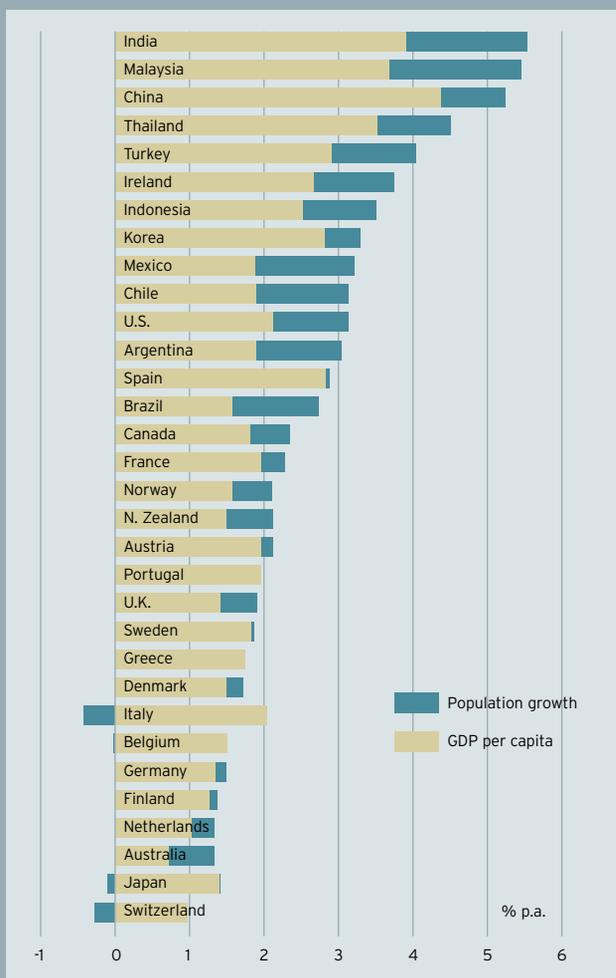
Figure 1 – Ranking of GDP growth 2006-20
Source: Deutsche Bank Research, Formel-G

rate of 10% of the past two decades. The consequences of two decades of one-child-policy are becoming evident. However, the average income of the Chinese will rise by 4.4% annually, topping the rate of increase in India. By 2020 China's per capita income in purchasing power parity terms is set to surpass that of Brazil and almost match Turkey's level.

Growth ranking of the rich economies

Growth rates are not everything. Current per capita income levels are also of major importance for the level of wealth already available and for the types of financial products the average citizen might be interested in.

Formel-G projects 3.8% average annual GDP growth in Ireland over 2006-20, so it is set to remain the top performer among the OECD countries. The U.S. shows that even economies with high income levels can achieve high growth rates of per capita GDP. With growth expected to reach 3% per year, the U.S. ranks second among the rich countries, mainly because it remains at the forefront of technological progress. Thanks to population growth of 1% and per capita GDP growth of 2%, the U.S. economy will continue to post the highest level of GDP overall and per capita in 2020.

Spain's fundamentals, such as the expected rises in human capital and trade openness (bridge between Europe, Latin America, and North Africa), also point to solid growth ahead. The successes of the past 20 years are fundamentally justified. With annual per capita GDP growth expected to run at 2.8%, Spain surpasses all other European countries. If immigration continues at the same pace as in the last few years, overall growth could be even higher.

Besides Spain, France and Austria will post the strongest economic expansions in Europe according to Formel-G's growth ranking. This is attributable to solid population growth and strong fundamentals. With a growth rate of 1.5%, Germany ranks at the lower end of the league table, ahead of Japan's 1.3%, while Switzerland marks the bottom at 0.7%.

probably be larger than Belgium or Sweden (in purchasing power parities). In a few years' time, its per capita income level in PPP terms will be higher than Chile or Mexico.

In the overall growth ranking, China comes in third place with projected annual GDP growth of 5.2% over the years 2006 to 2020. Growth will be even stronger at the beginning of the forecast period with rates of initially almost 7% – albeit below the medium-term consensus forecast of 8% and the average