

Brussels, The Destree Institute, June 20, 2007

Global Growth Centres 2020

DBR's Foresight Model for Evaluating Long-term Growth



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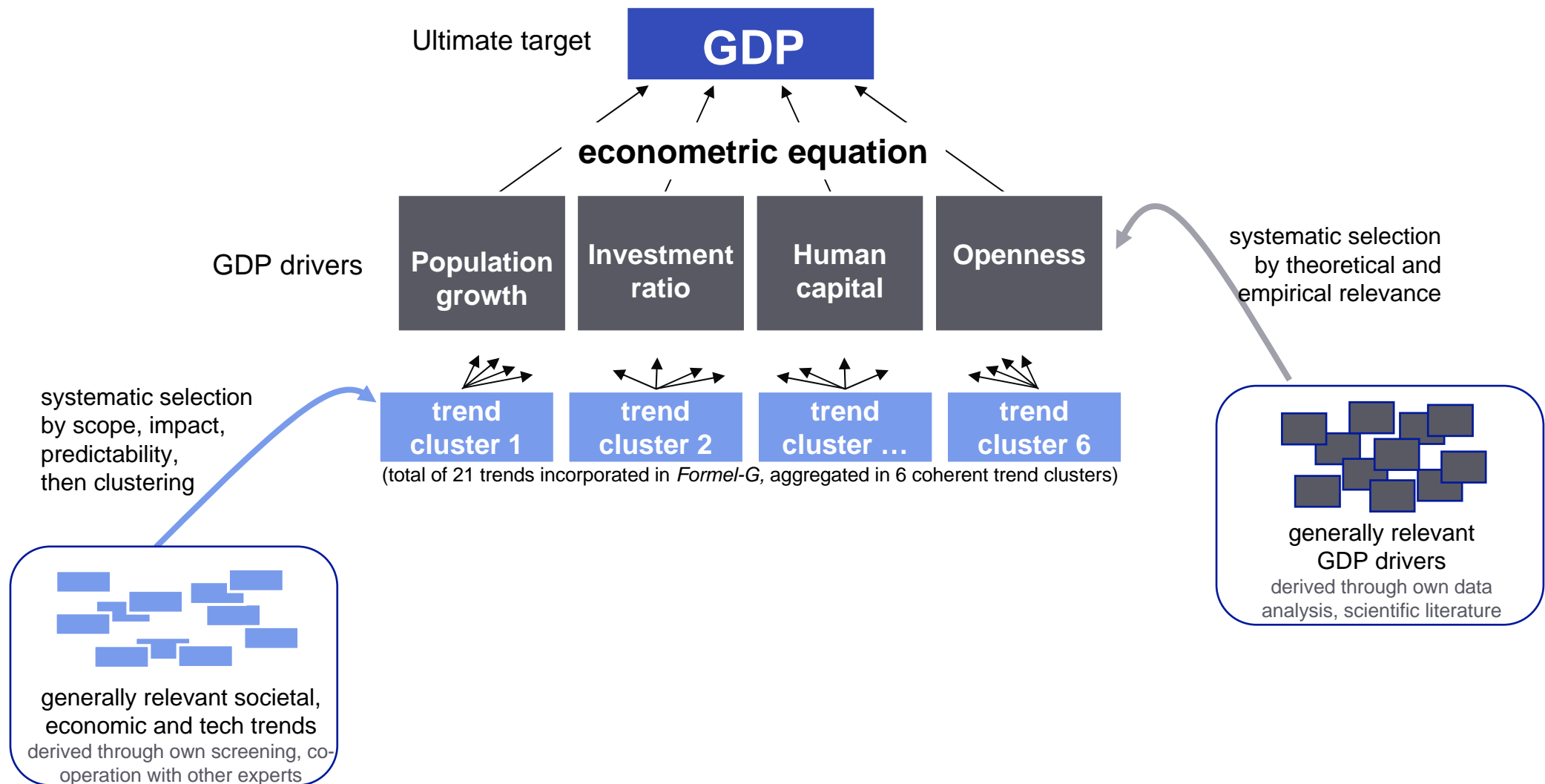


Global growth centres 2020: goals

- **Target:** growth rate of gross domestic product (GDP) in the period 2006 to 2020 (per capita and overall)
- **34 countries:** 21 rich countries and 13 emerging markets
- Value added: combination of **quantitative** and **qualitative** elements
- Quantitative element: drivers influence GDP directly. Uses state-of-the-art empirical methods to model the links between drivers and GDP in the econometric equation.
- Qualitative element: broad-based interdisciplinary trend analysis to improve forecasts of drivers. Structural breaks are captured.



Formel-G: Foresight Model for Evaluating Long-term Growth





First step: identify drivers of economic growth

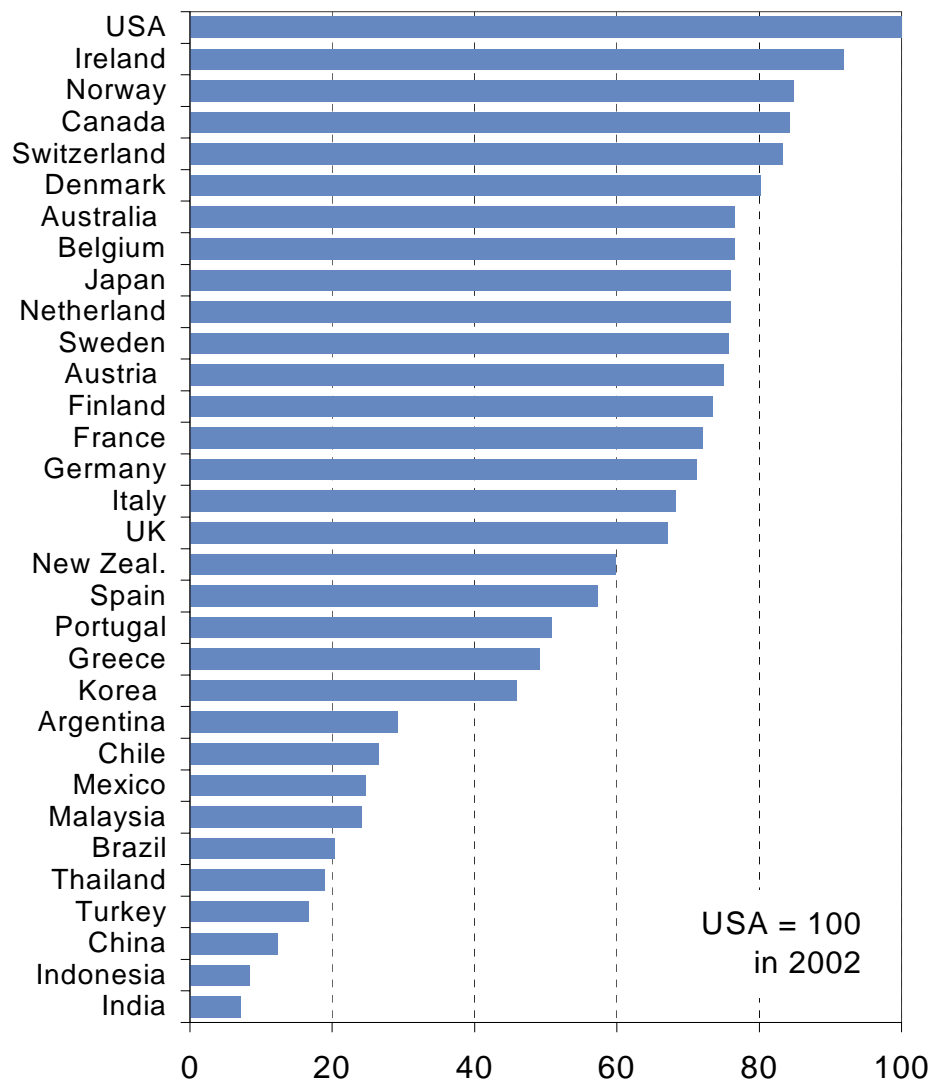
- **Theoretical** relationship with GDP growth
- **Empirical** relationship is both statistically and economically significant (our panel estimates)
- **Time series** must be available (Central and Eastern Europe therefore not included)
- Includes information not covered by any of the other drivers (collinearity)





Driver: Level of GDP per capita?

Real GDP per capita in PPP



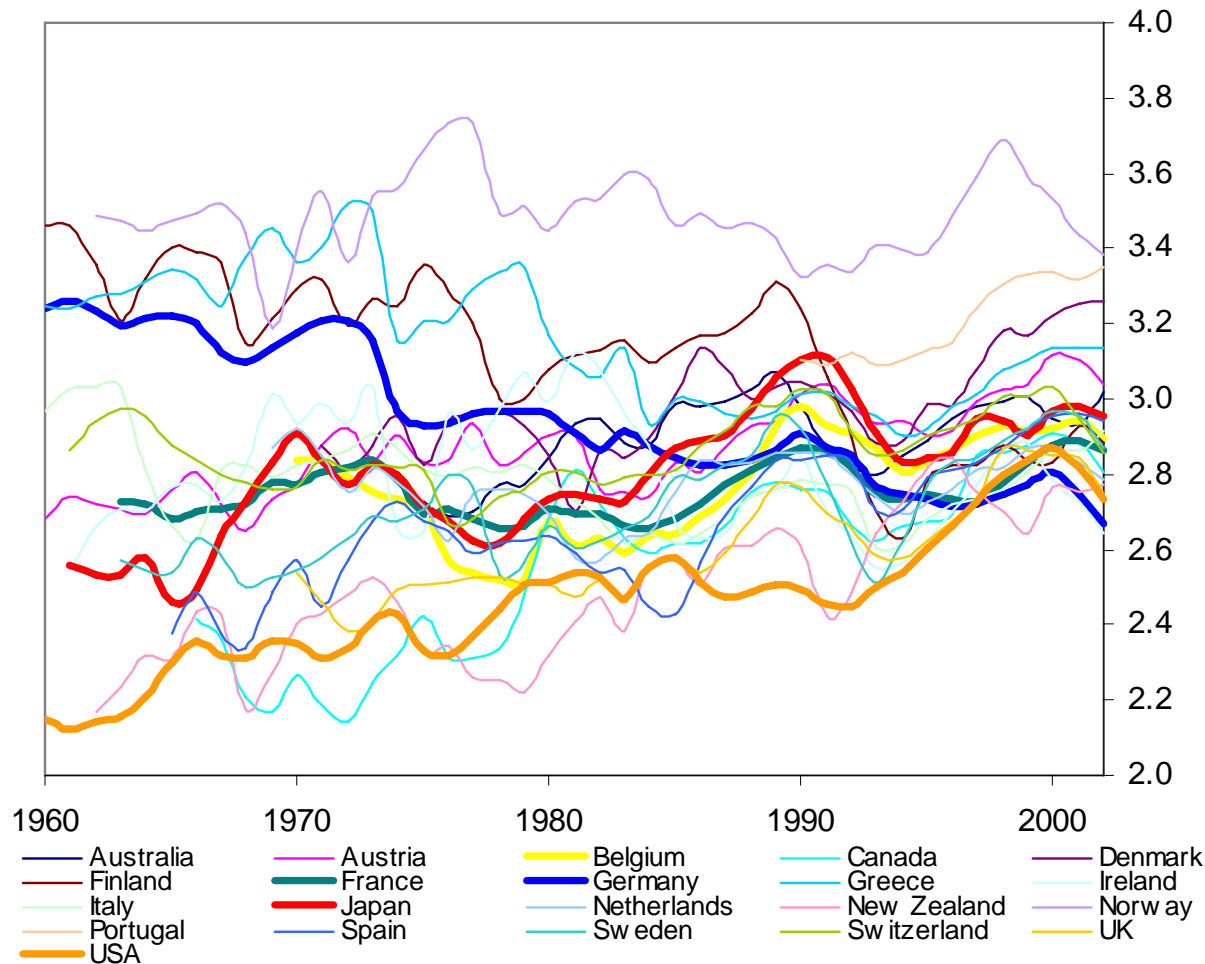
Source: OECD und WDI

- Conventional wisdom: „poor countries grow more strongly than rich ones“
- But no empirical evidence for assumption of absolute convergence. Will not use that idea
- Growth centres exist among rich and poor countries
- => There is no automatism! Growth requires „hard“ work



Driver investment ratio

Ln Business Investment Share 1960-2002

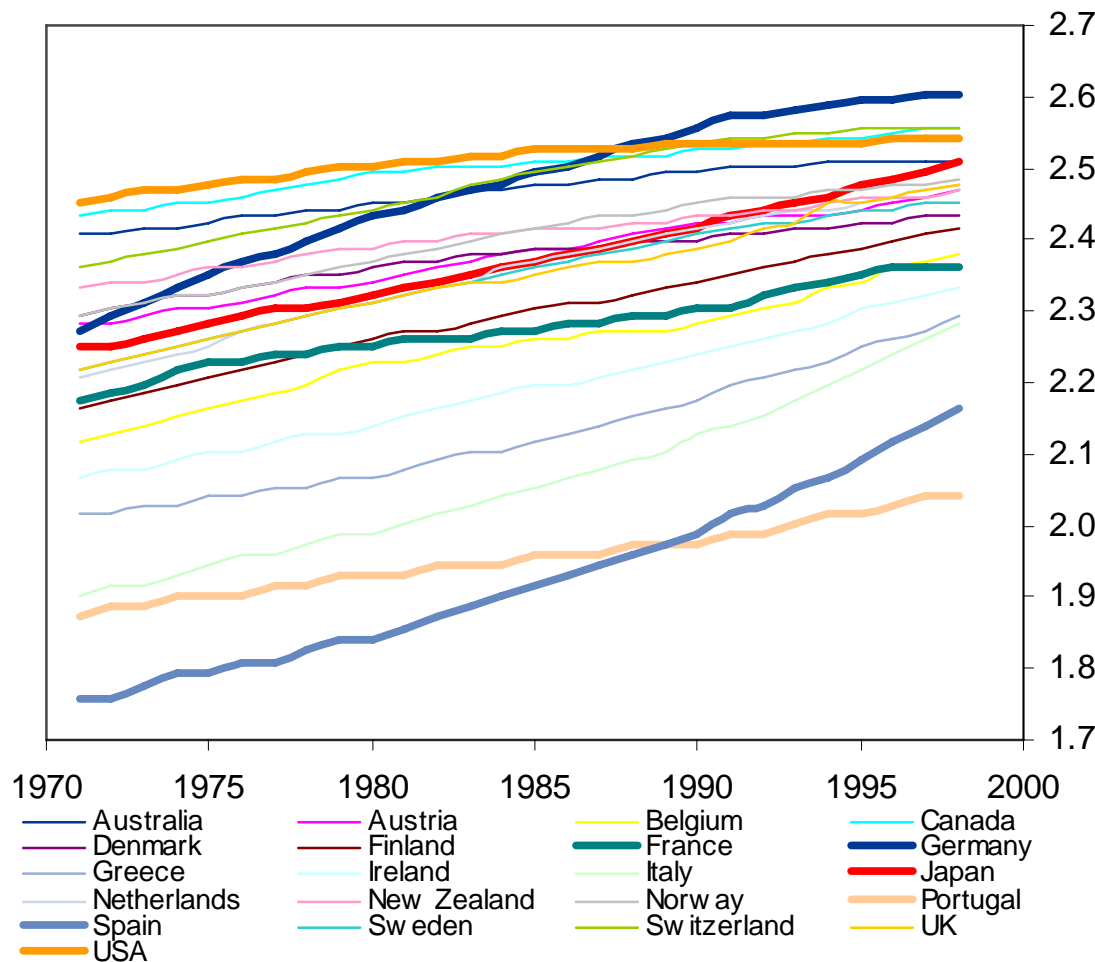


- Our measure: real investment as % of real GDP
- More capital input with a given labour input boosts labour productivity
- Decreasing marginal returns
- On average: seems to be bounded between 10% and 40%



Driver human capital

Ln Average Years of Education 1971-1998

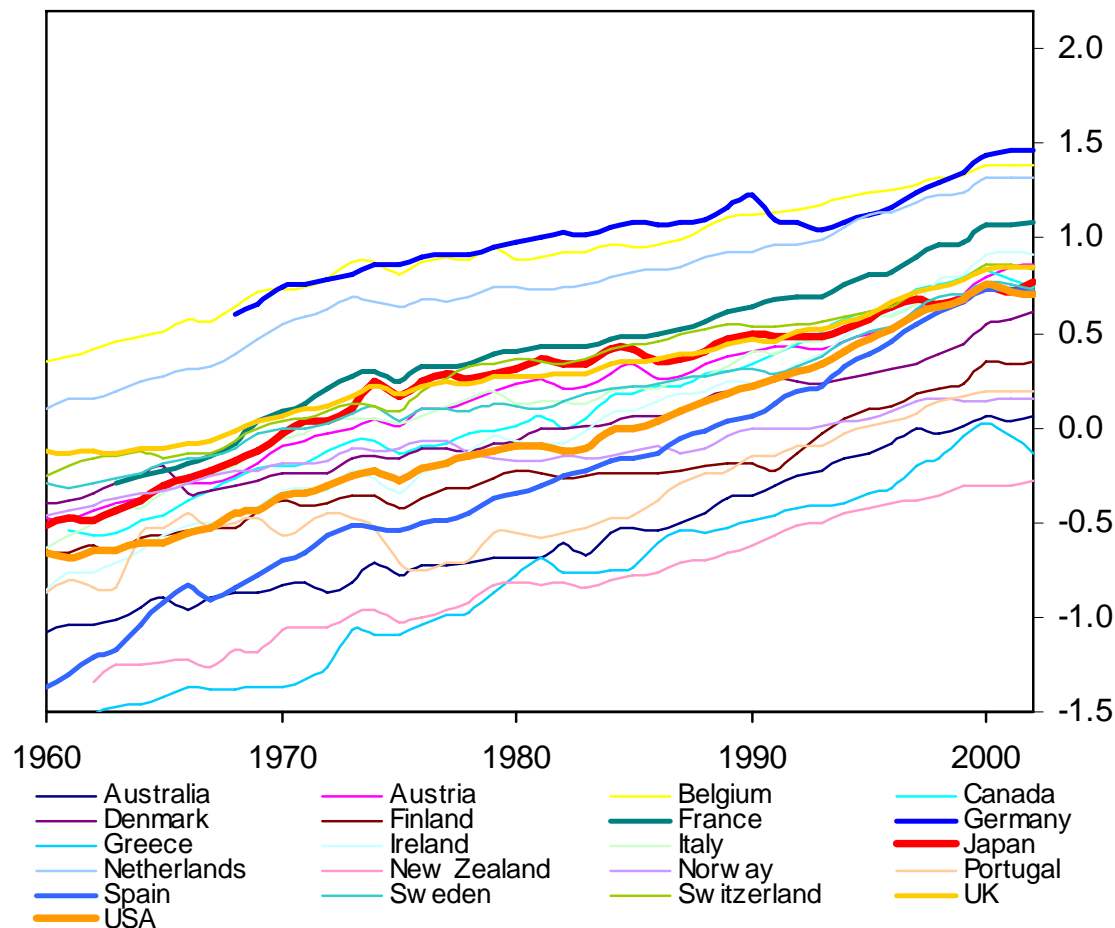


- Our measure: average years of education of the population aged 25 to 64 (OECD Data)
- **Quality** of labour input: Ability to generate and apply new knowledge
- **Growth** of human capital relevant for per-capita GDP **growth** (not: level of human capital). Use log-log specification
- Correlates positively with economic freedom, life expectancy, R&D expenditure



Driver trade openness

Trade Openness



- Our measure: foreign trade in % of GDP corrected for population and price differences
- Exchanging goods and ideas with other countries promotes learning. Plus: Increasing competitive pressure boosts efficiency of companies
- Trade based on comparative advantage does not raise GDP
- **Change** in openness leads to **change** in GDP



Pooled Mean Group Panel Estimation (PMG)

Country specific
convergence parameter

Country specific constant

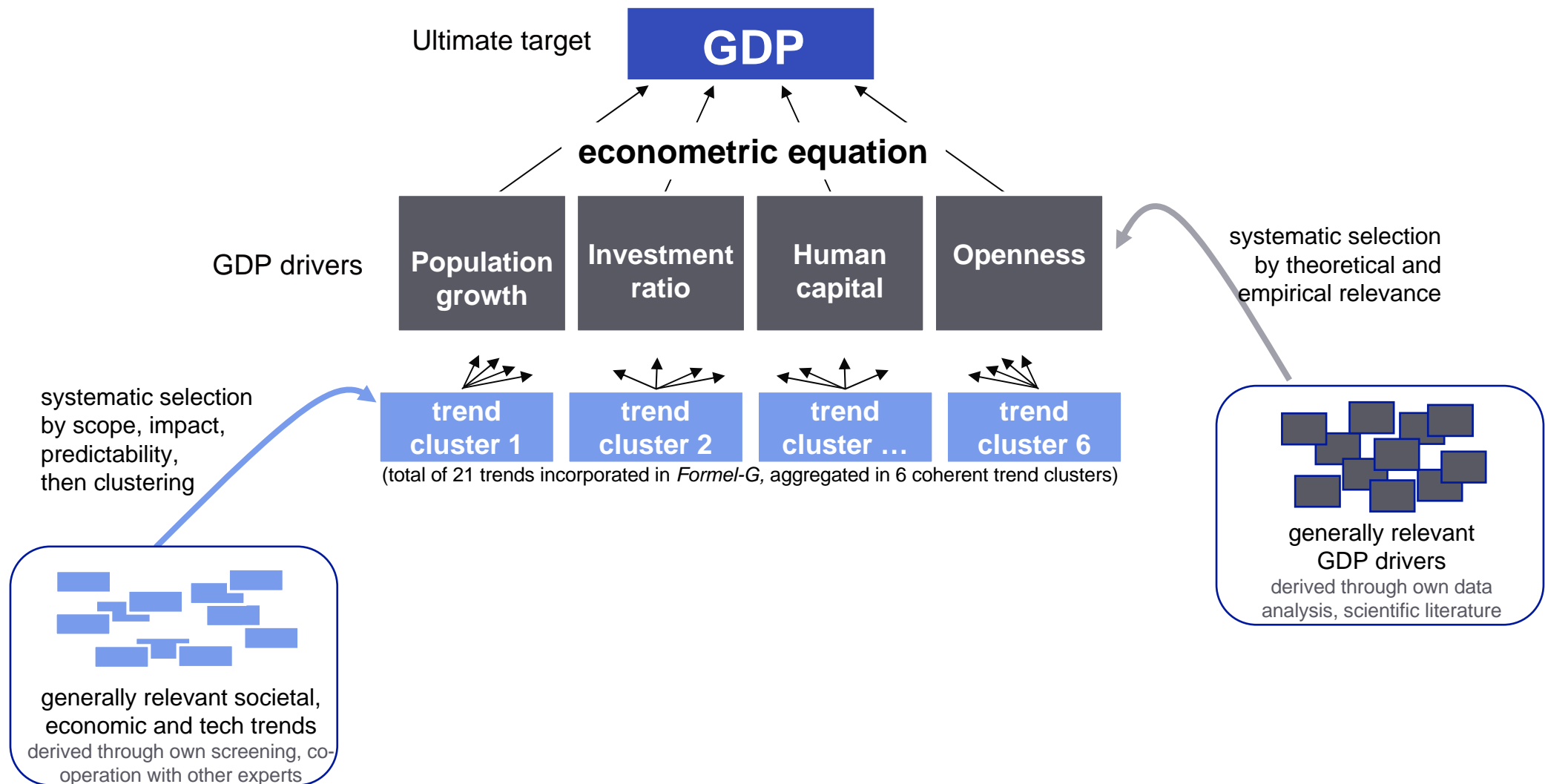
Common long-run cointegration relationship

$$\Delta \ln y_{i,t} = -\phi_i \left(\ln y_{i,t-1} - \theta_1 \ln s_{i,t}^K - \theta_2 \ln h_{i,t} + \theta_3 n_{i,t} - \sum_{j=4}^m \theta_j \ln V_{i,t}^j - a_{m+1} t_i - \theta_{0,i} \right) + b_{1,i} \Delta \ln s_{i,t}^K + b_{2,i} \Delta \ln h_{i,t} + b_{3,i} \Delta n_{i,t} + \sum_{j=4}^m b_{j,i} \Delta \ln V_{i,t}^j + \varepsilon_{i,t}$$

Country-specific short-run dynamics



Formel-G: Foresight Model for Evaluating Long-term Growth





Second step: forecast the drivers until 2020

- **First stage: Extrapolation.** Past development determines future course of each driver (exception: population growth, which uses UN data)
- **Second stage: Cross-check.** Correct extreme developments systematically (only required for investment ratio and human capital)
- **Third stage: Trend analysis.** The reliability of the forecasts is increased by modelling structural breaks and assessing a broad range of information (applied to all four drivers)



Calculate GDP forecasts using the econometric equation





Selecting the trends that will shape future growth

- Basis: **40 DBR trends** from the five categories
 - „The individual and society“,
 - „Institutions and political environment“,
 - „Organisational forms and markets“,
 - „Innovation and technology“ and
 - „Natural resources“
- Likely to be significant for future economic growth => **21 trends**.
But too many possible links to the drivers
- Therefore we assessed the reciprocal effects among all 21 trends in a cross-impact matrix. The result is **6 consistent clusters**

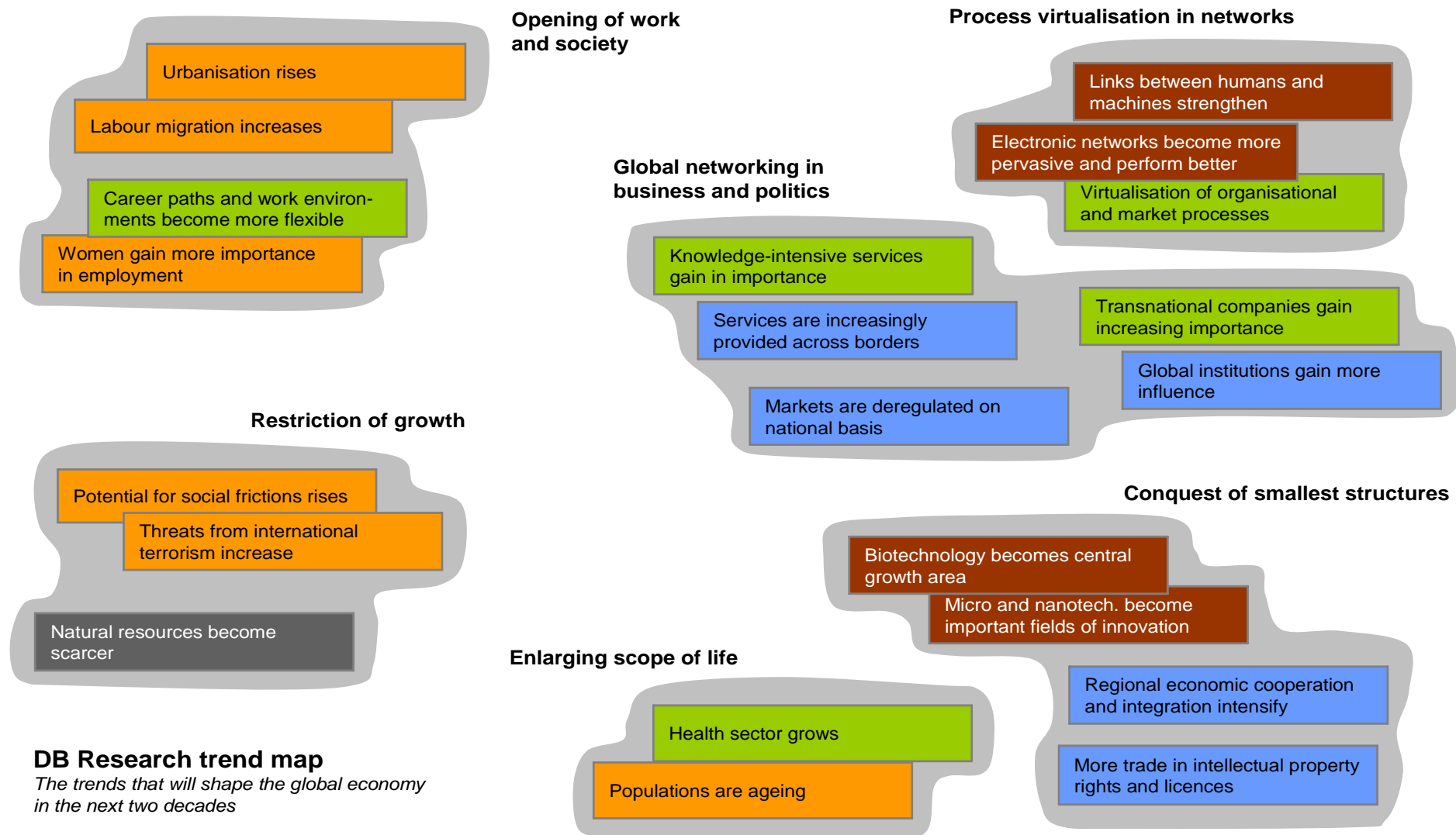


The cross-impact matrix

	Arbeitsmigration nimmt zu	Urbanisierung steigt	Frauen gewinnen im Erwerbsleben an Bedeutung	Potential für soziale Reibung steigt	Industrienationen überaltern	Bedrohung durch internationalen Terrorismus wächst	Gesundheitssektor wächst	Karrierewege und Arbeitsumfelder werden flexibler	Wissensintensive Dienstleistungen gewinnen an Bedeutung	Organisations- und Marktprozesse werden virtualisiert	Bedeutung transnationaler Unternehmen wächst	Einfluss globaler Institutionen wächst	Märkte werden national dereguliert	Mehr Dienstleistung aus Übersee	Mehr Handel mit geistigem Eigentum/Nutzungsrechten	Kooperation innerhalb regionaler Wirtschaftsräume wird intensiver	Elektronische Vernetzung wird breiter und besser	Annäherung von Mensch und Maschine	Biotechnologie wird zentrales Innovations- und Wachstumsfeld	Kleinste Strukturen werden zentrales Innovations- und Wachstumsfeld	Natürliche Ressourcen verknappen
Arbeitsmigration nimmt zu		3	0	2	-1	1	1	3	1	0	0	1	0	-1	1	1	0	0	0	0	0
Urbanisierung steigt	2		2	2	1	0	1	2	2	0	0	0	0	0	0	0	1	1	0	0	0
Frauen gewinnen im Erwerbsleben an Bedeutung	1	1		0	1	0	1	2	1	0	1	0	0	0	0	0	0	0	0	0	0
Potential für soziale Reibung steigt	0	-1	0		0	3	0	1	0	0	-1	2	0	0	0	1	0	0	0	0	0
Industrienationen überaltern	2	0	1	2		0	3	3	0	1	1	0	1	1	0	0	1	1	1	0	0
Bedrohung durch internationalen Terrorismus wächst	-1	-1	0	3	0		0	0	1	0	0	3	0	0	-1	1	-1	1	0	0	0
Gesundheitssektor wächst	1	1	2	0	2	0		0	1	1	2	1	1	0	1	0	0	1	2	1	0
Karrierewege und Arbeitsumfelder werden flexibler	2	1	3	0	-1	0	0		2	0	0	0	1	0	1	0	1	0	0	0	0
Wissensintensive Dienstleistungen gewinnen an Bedeutung	1	1	2	0	0	0	1	1		0	1	1	0	2	1	0	2	0	0	0	0
Organisations- und Marktprozesse werden virtualisiert	0	0	1	0	0	0	0	2	1		1	1	0	2	2	0	3	2	0	0	0
Bedeutung transnationaler Unternehmen wächst	-2	1	1	0	1	0	1	1	0	1		3	1	2	1	0	1	1	1	0	0
Einfluss globaler Institutionen wächst	-1	0	1	-1	0	-1	2	0	1	1	1		2	2	2	1	1	1	2	-1	-1
Märkte werden national dereguliert	2	0	1	1	0	0	2	3	2	1	2	0		1	2	1	2	1	3	1	0
Mehr Dienstleistung aus Übersee	-2	1	0	0	0	0	0	2	2	1	2	2	1		0	0	1	0	0	0	0
Mehr Handel mit geistigem Eigentum/Nutzungsrechten	0	0	0	0	1	0	2	0	1	1	0	1	0	0		1	0	1	1	1	0
Kooperation innerhalb regionaler Wirtschaftsräume wird intensiver	1	0	0	0	0	0	1	1	1	0	1	0	1	1	1		1	1	2	1	0
Elektronische Vernetzung wird breiter und besser	-1	0	1	0	0	0	1	2	3	3	2	1	0	1	2	1		3	0	1	0
Annäherung von Mensch und Maschine	-1	0	1	0	0	0	1	1	1	2	1	0	0	1	0	0	3		1	1	0
Biotechnologie wird zentrales Innovations- und Wachstumsfeld	-1	0	0	-1	2	1	3	0	0	0	0	1	1	0	1	2	0	1		3	-1
Kleinste Strukturen werden zentrales Innovations- und Wachstumsfeld	0	0	0	0	0	0	1	0	0	0	0	1	-1	0	1	1	2	2	3		0
Natürliche Ressourcen verknappen	1	0	0	2	0	2	0	0	0	0	1	1	0	0	2	2	0	0	3	0	



Deutsche Bank Research's trend map



DB Research trend map

The trends that will shape the global economy in the next two decades

Orange box: The individual and society
Green box: Organisational forms and markets

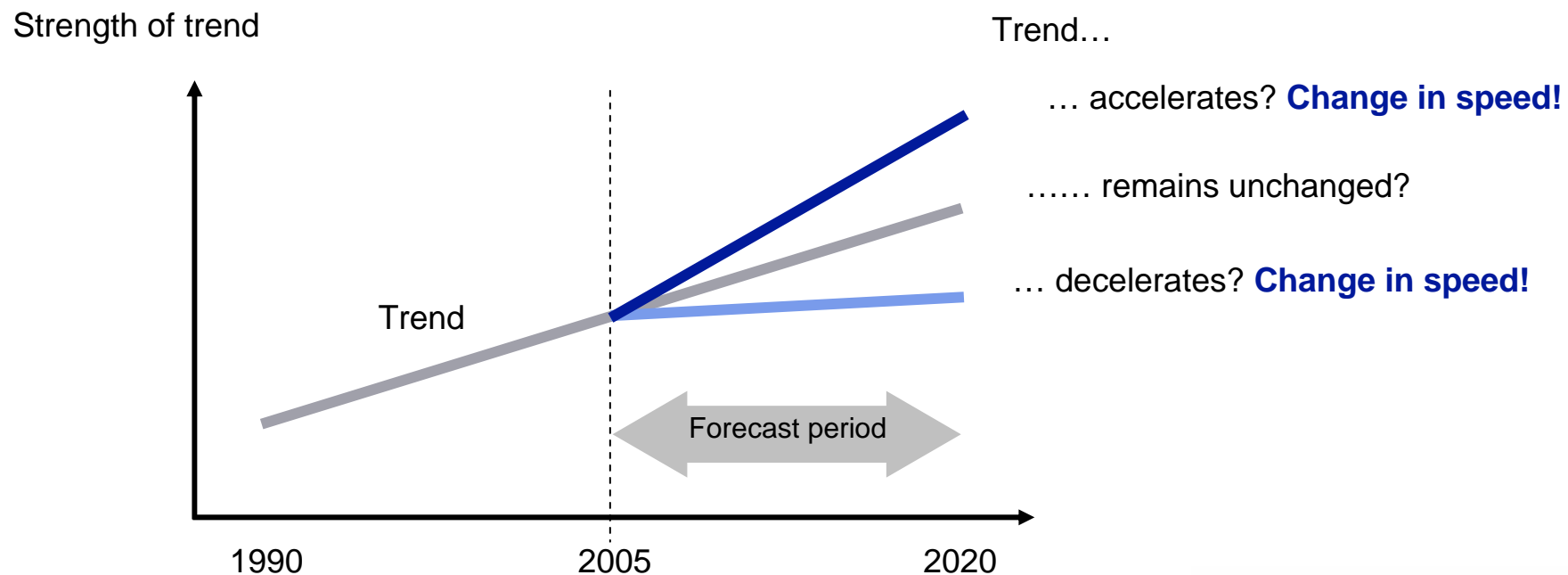
Blue box: Institutions and political environment
Brown box: Innovation and technology

Grey box: Natural resources
Grey shape: Trend cluster

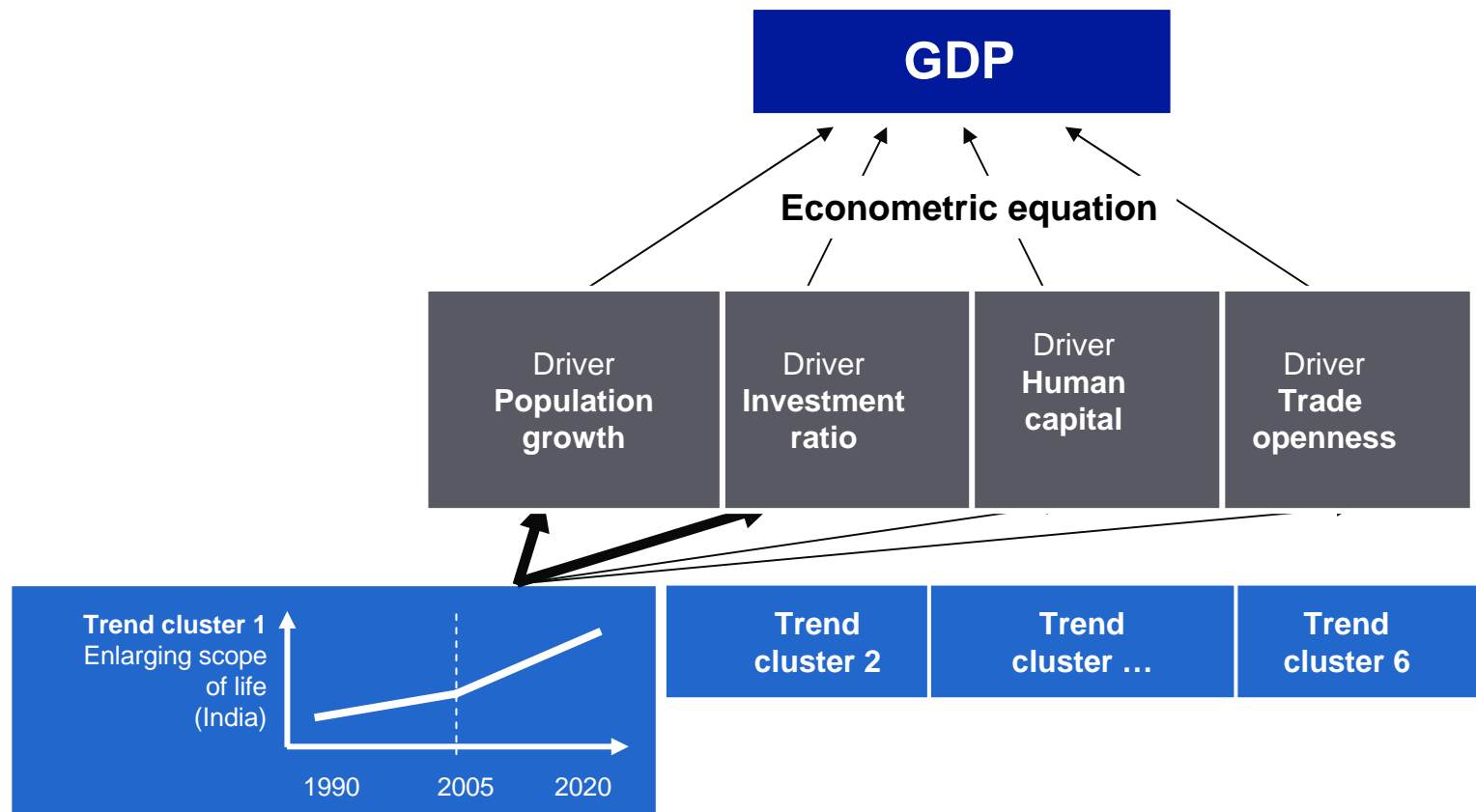


Trend analysis: changes in the speed of trend clusters

- Trends describe **long-term** changes in the environment
society, economy, technology; time horizon > 20 years
- **Country experts** assess speed of trends
- A relevant impact on our growth analysis comes from the **changes in the speed** of trend clusters *unchanged speed (1990-2020) included in the baseline forecast*



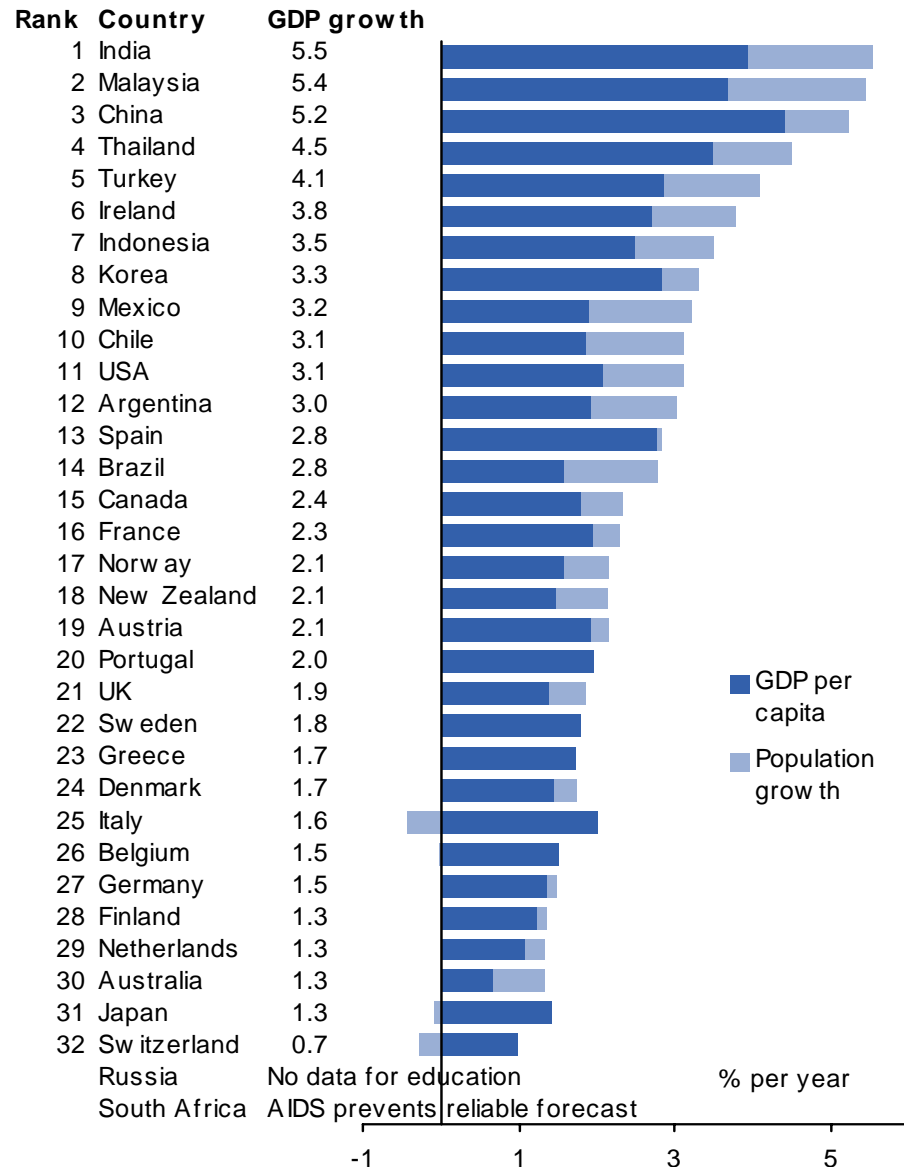
Impact of trends on drivers





The growth ranking for 2006 to 2020

Formel-G: Ranking of GDP growth 2006-20

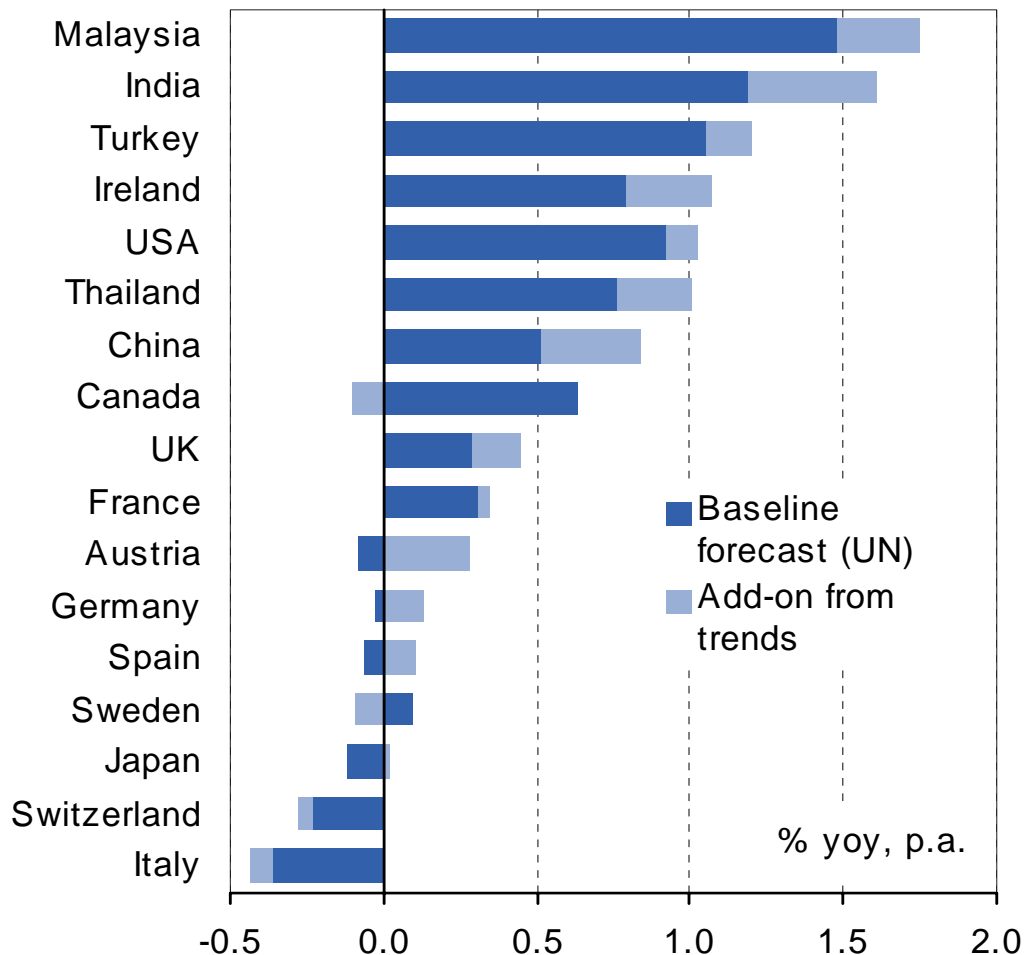


- Deutsche Bank Research's *Formel-G* "Foresight Model for Evaluating Long-term Growth"
- Asian economies lead the growth ranking: India, Malaysia and China
- Within the EU-15 range from 1.3% (Netherlands) to 3.8% (Ireland) average annual GDP growth in 2006-20



Population growth shows wide range of changes

Population growth 2006-2020



Sources: UN, Deutsche Bank Research

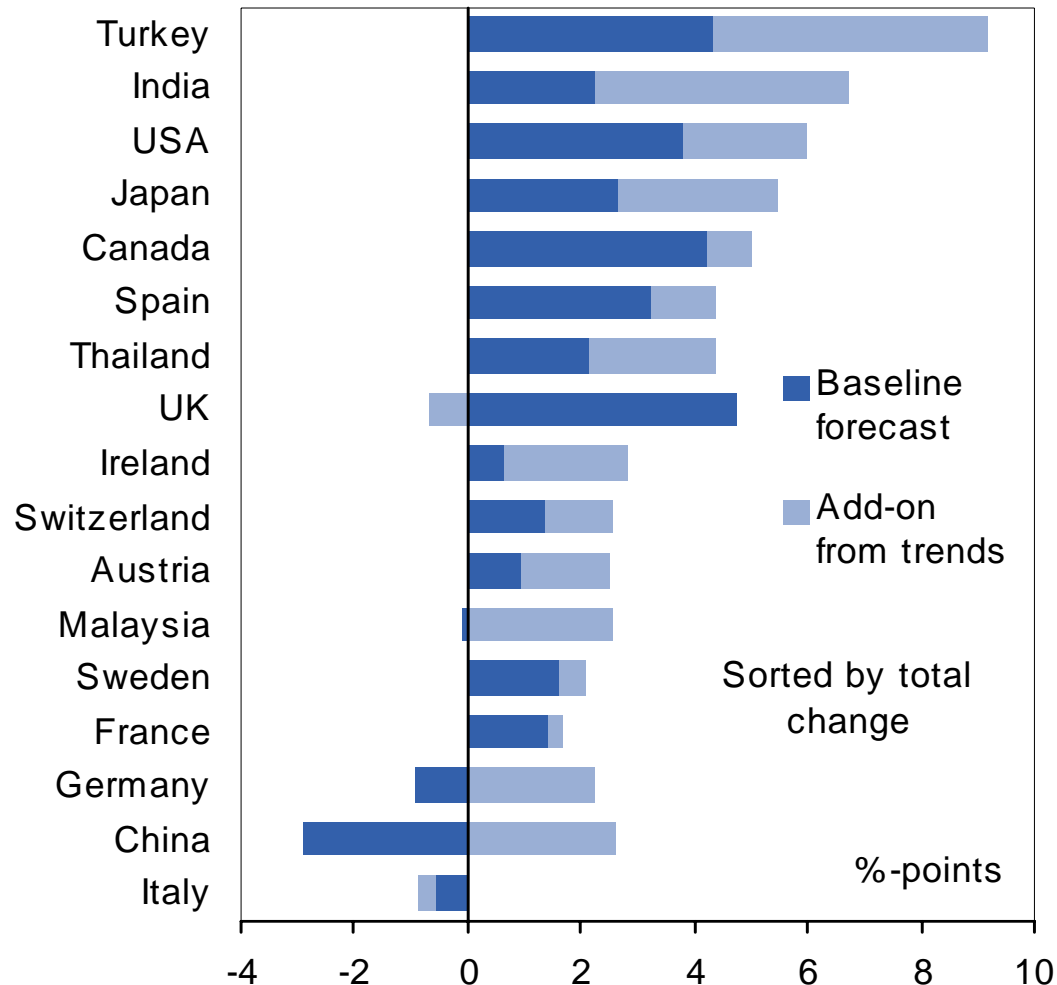
- Quantity of labour supply
- More people allow for higher levels of GDP overall
- Rapid growth in India and USA (partly immigration)
- Shrinking population in Italy, Switzerland and Japan





Investment rates to decline from high level in China

Investment ratio: Change 2005-20



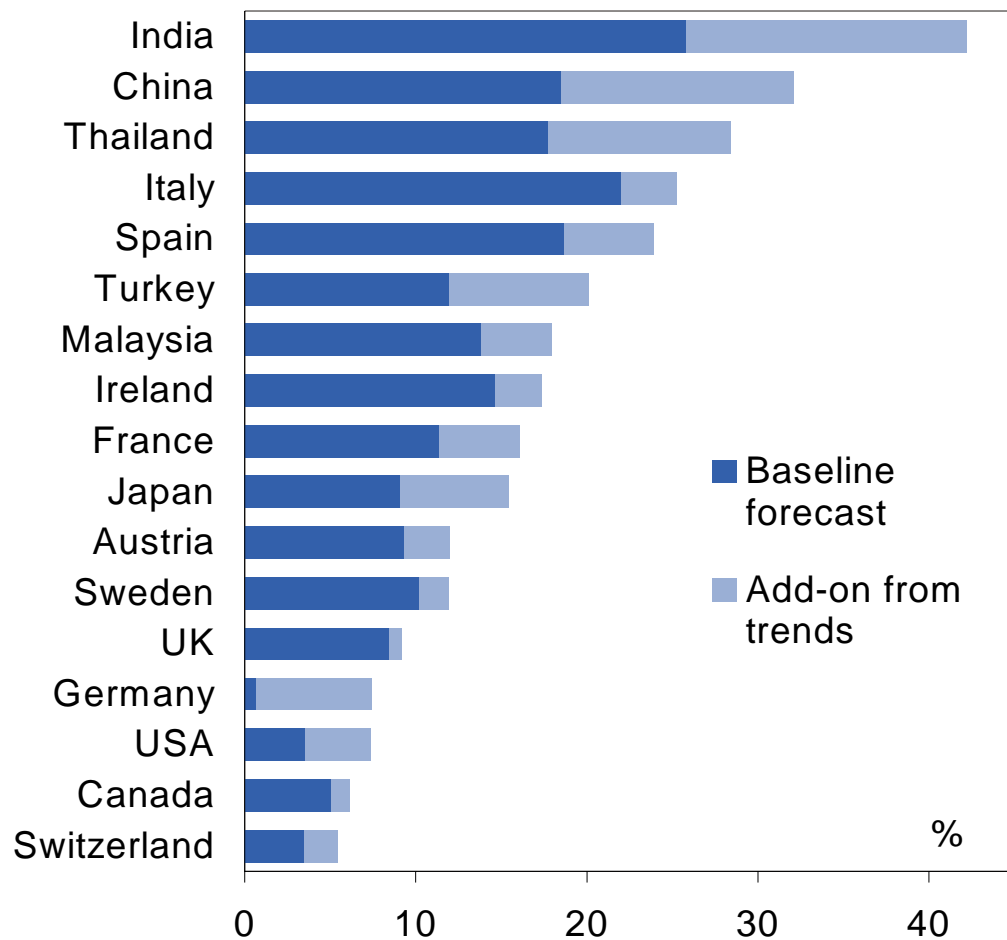
- India to see increases from low level; China downward adjustment
- Spain and UK witness solid upward momentum

Source: Deutsche Bank Research



Rising human capital is a key reason for Asia's growth

Years of education: Change 2005-20



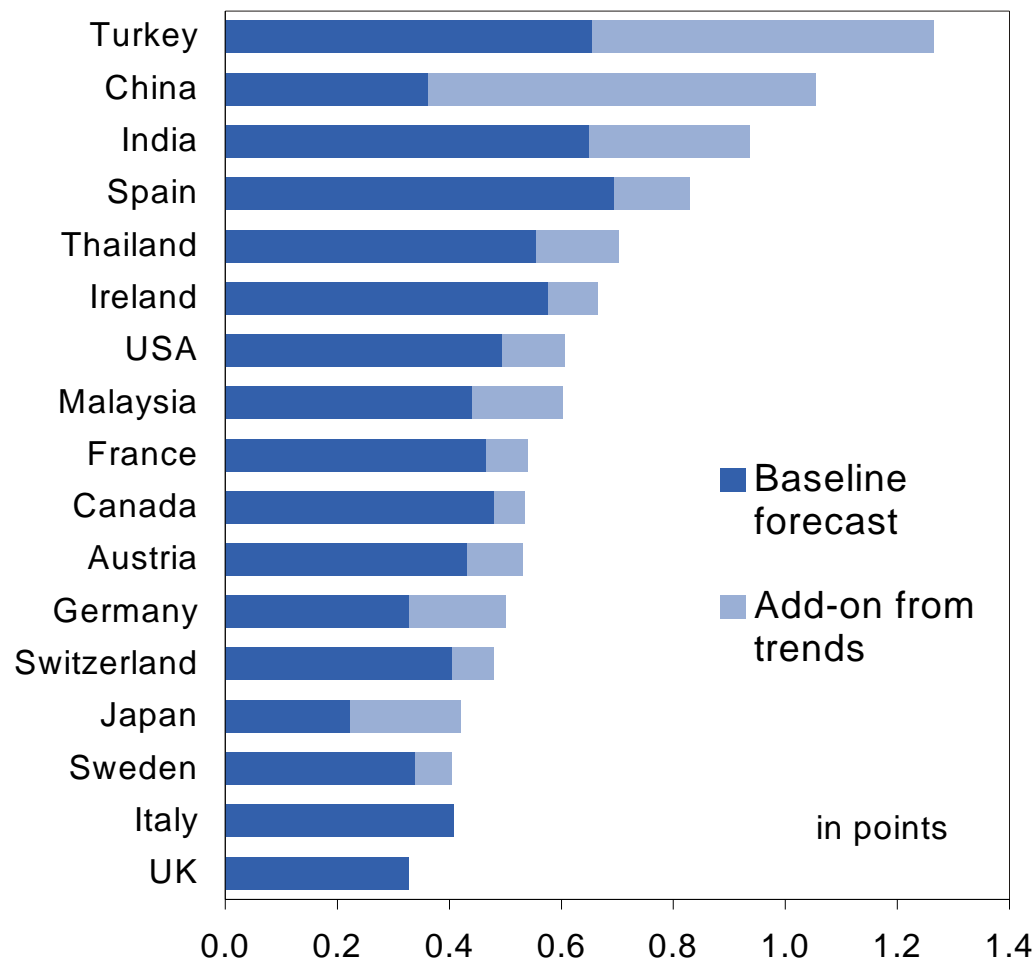
Source: Deutsche Bank Research

- Recall: **Growth** of human capital relevant for per-capita GDP **growth** (not: level of human capital)
- India and China see rapid growth from low levels
- Baseline shows near stagnation in Germany



Trade opening is second reason for Asian success

Openness: Total change 2005-20



Source: Deutsche Bank Research

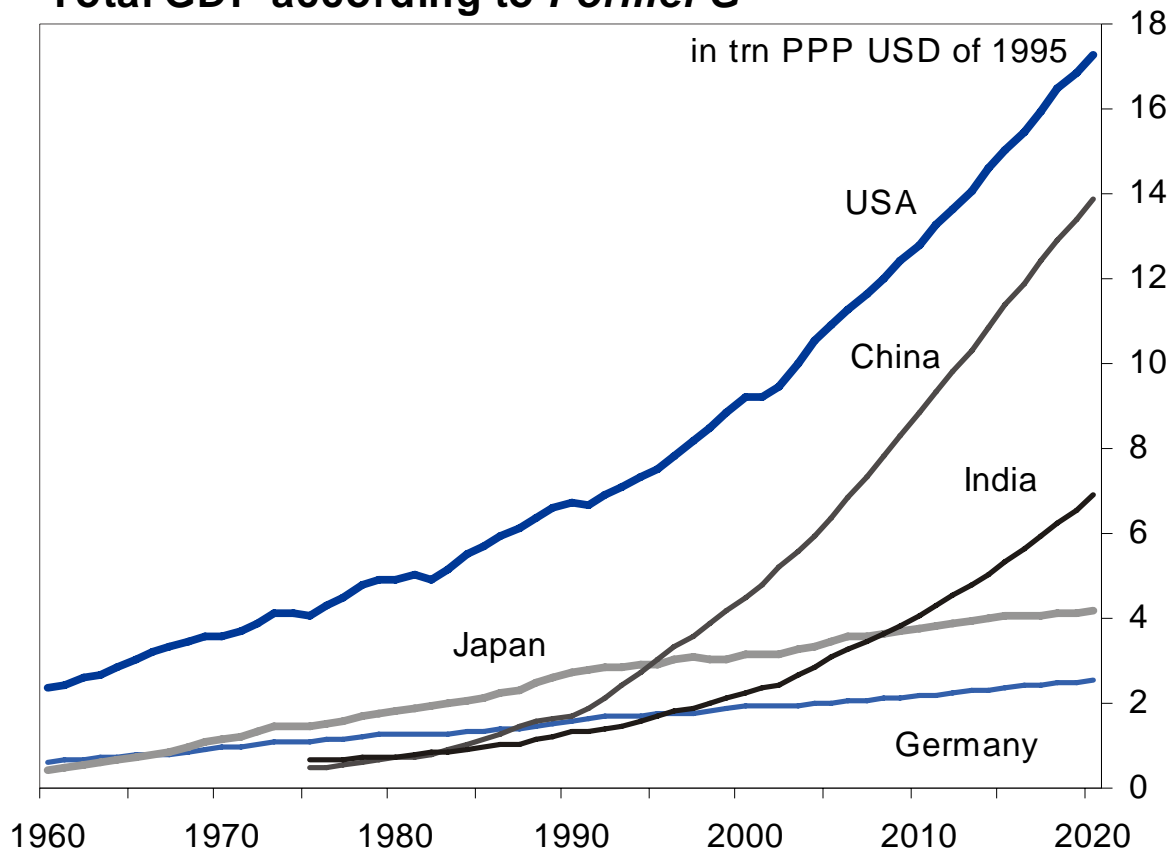
- Recall: Change in openness leads to **change** in GDP
- Rapid opening in China and India is crucial for their strong GDP growth





Centre of economic gravity moves to Asia

Total GDP according to *Formel-G*



Source: Deutsche Bank Research

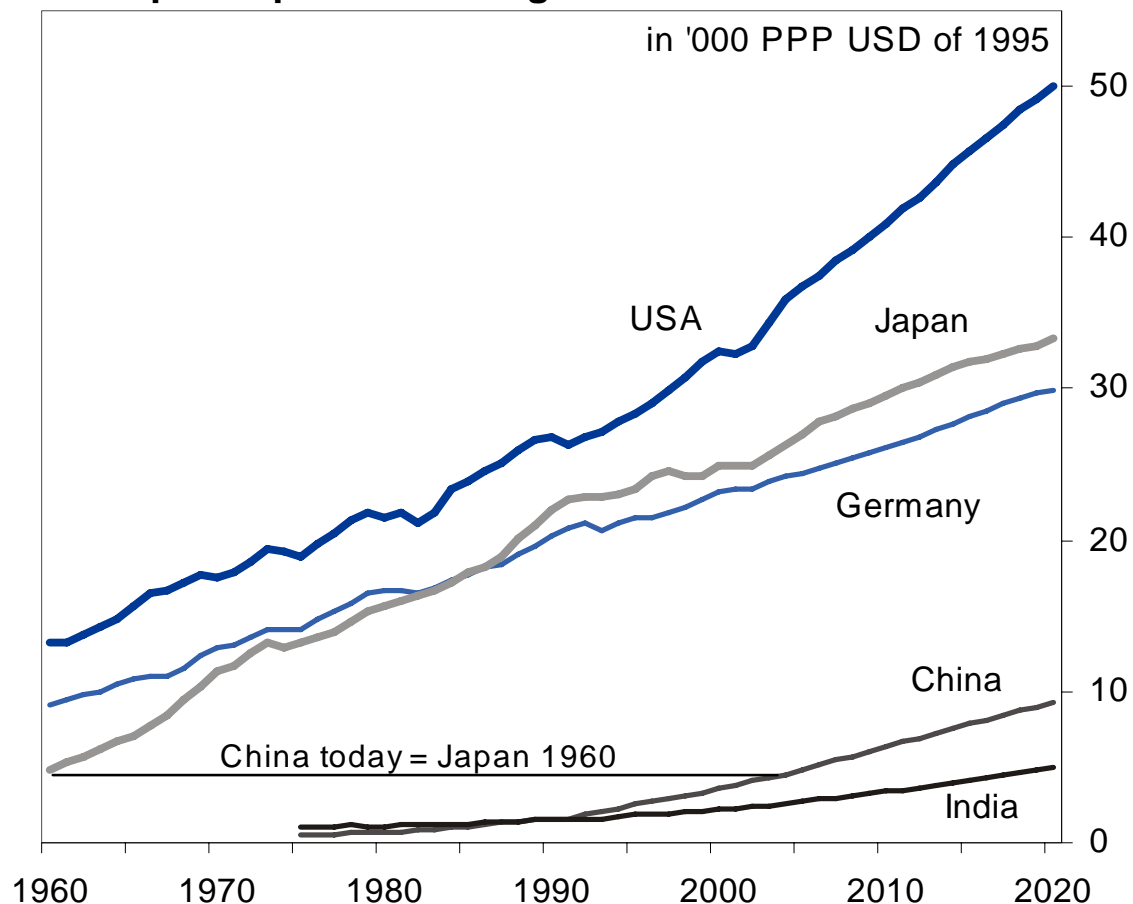
- China will close in on US GDP level by 2020 in PPP terms
- India to become third-largest economy around 2010, surpassing Japan
- Germany and Japan in relative decline





Still very low level of per-capita GDP in China and India

GDP per capita according to *Formel-G*



Source: Deutsche Bank Research

- China's level of GDP per capita is today roughly equal to that of Japan in 1960 – before Japan really started to conquer the global markets
- DBR's analysis suggests:
 - China and India will continue to narrow the gap
 - They will produce ever more sophisticated products



Thank you!

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