

# Long-term economic growth

Towards the deep sources of progress

Horizons Workshop  
Finland, June 2010

Dr. Stefan Bergheim  
stefan.bergheim@fortschrittszentrum.de

# The “Center for Societal Progress”

Independent, non-profit think tank with interdisciplinary approach.

Focus on analyzing and fostering progress in Germany. First German Correspondent to the OECD’s Project on “Measuring the Progress of Societies”

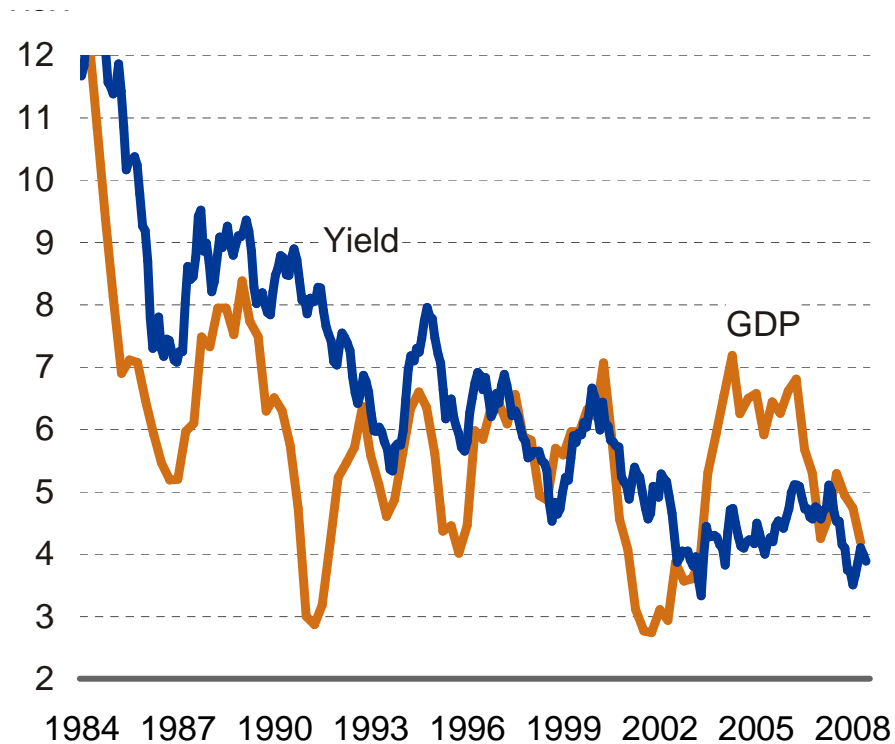
Build bridges between academia and global public knowledge on one side and German policymakers, press and society on the other side.

Financed by foundations and individuals.

# Real GDP + inflation rate = risk free rate

## US 10-year bond yields close to nominal GDP growth

10-year govt yield in %, Nominal GDP growth in %



Sources: BEA, Global Insight

US potential GDP growth 2 ½ to 3%. Inflation around 2 ½%. So around 5% yield.

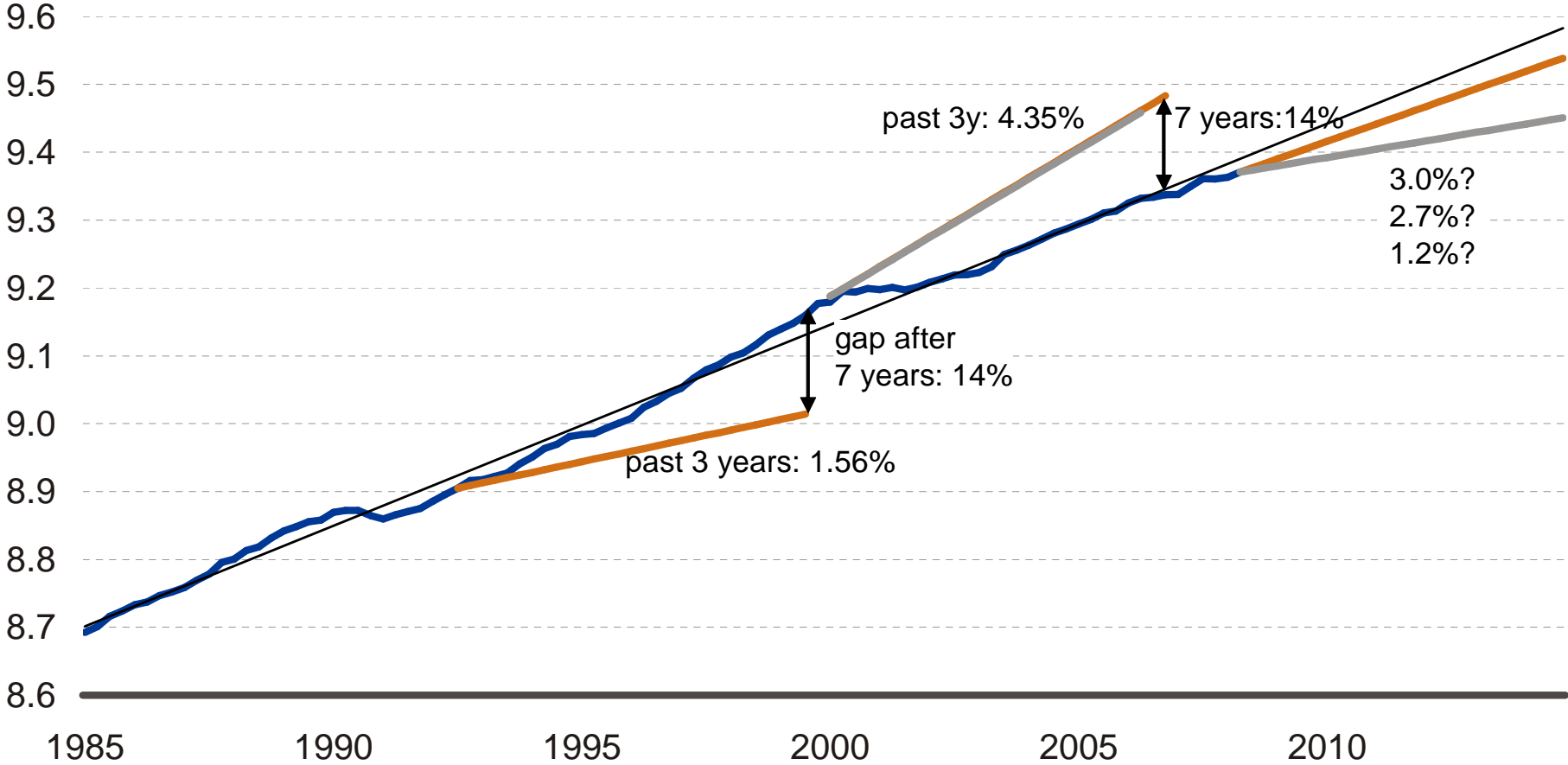
2003ff bubble easy to see.

Link between yield and GDP not as close in other countries because of dominant US market.

# Major forecasting errors in the past

## Where is US GDP going?

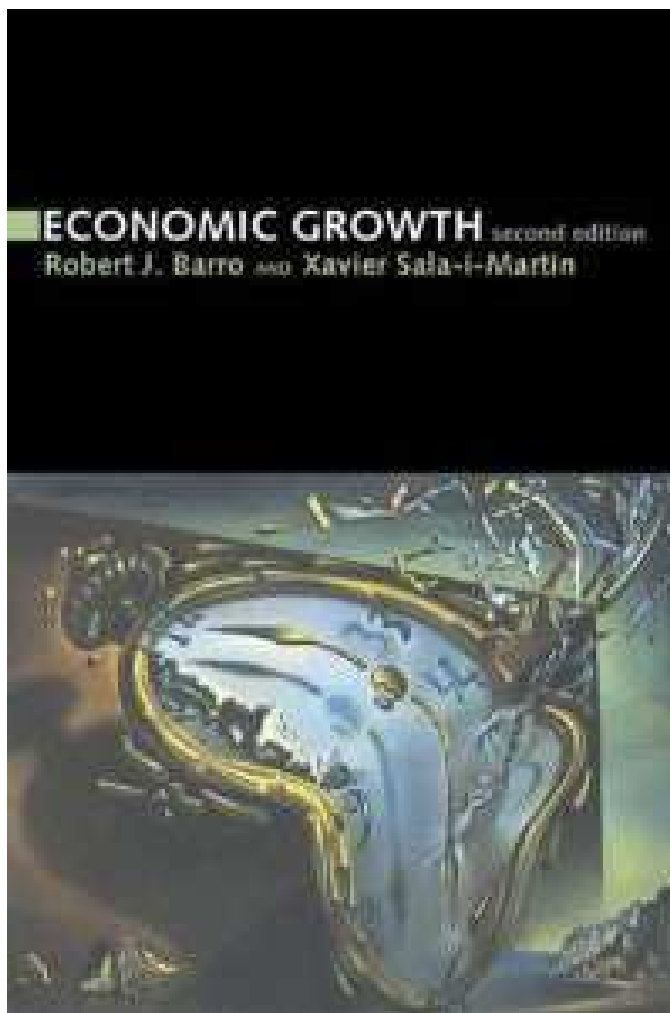
GDP chain weighted, natural log



# Agenda

1. A realistic model of economic growth
2. Digging deeper: progress

# Today's dominant framework for growth



Textbook „Economic Growth“  
by Robert Barro and Xavier  
Sala-i-Martin. First edition  
1995, second edition 2003.

Used in almost every course  
on economic growth...

...and in much of the applied  
work by international  
organizations, banks, rating  
agencies and consultancies.

# The (strange) equation usually used

Equation derived and estimated:

$$\ln y_i = a_0 + gt + \frac{\alpha}{1 - \alpha - \beta} \ln s_{k,i} + \frac{\beta}{1 - \alpha - \beta} \ln s_{h,i} - \frac{\alpha + \beta}{1 - \alpha - \beta} \ln (n_i + g + \delta) + \epsilon_i$$

- Focus on population growth and investment ratios
- Subtract initial income to get convergence regression
- Inputs are substitutes

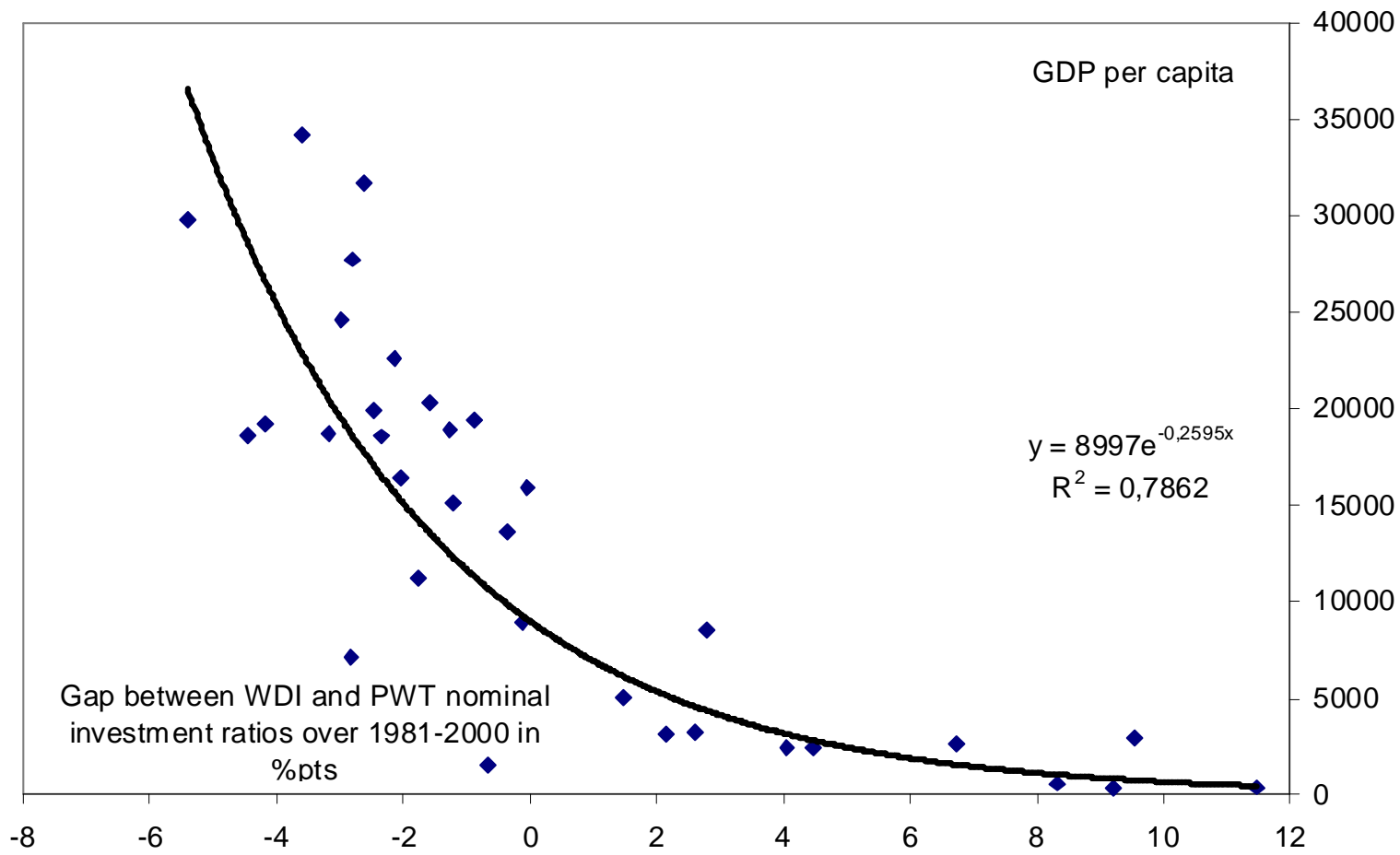
**However: Population growth is endogenous**

- Richer societies have fewer, but higher quality children

**And: Empirical result of influence of investment depends on data used**

- Penn World Tables give low investment ratios for poor countries

# Why there is a significant coefficient



# No growth accounting, please

$$Y_t \equiv w_t L_t + r_t K_t \quad \text{National accounts identity}$$

Assume: Constant labour share (and thus capital share  $a = rK/Y$ ) and differentiate:

$$\hat{Y}_t \equiv a\hat{r}_t + a\hat{K}_t + (1-a)\hat{w}_t + (1-a)\hat{L}_t$$

Rearrange/combine:

$$\hat{Y}_t \equiv a\hat{K}_t + (1-a)\hat{L}_t + \hat{b}_t \quad \begin{array}{l} \text{residual? TFP? distribution?} \\ \longleftarrow \uparrow \end{array}$$

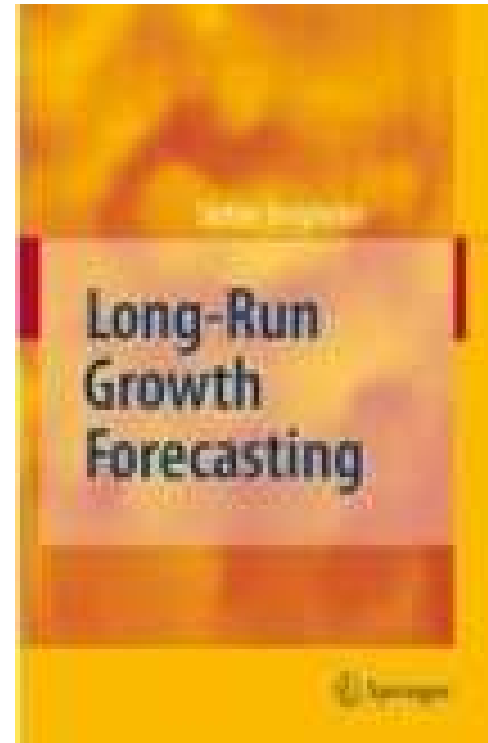
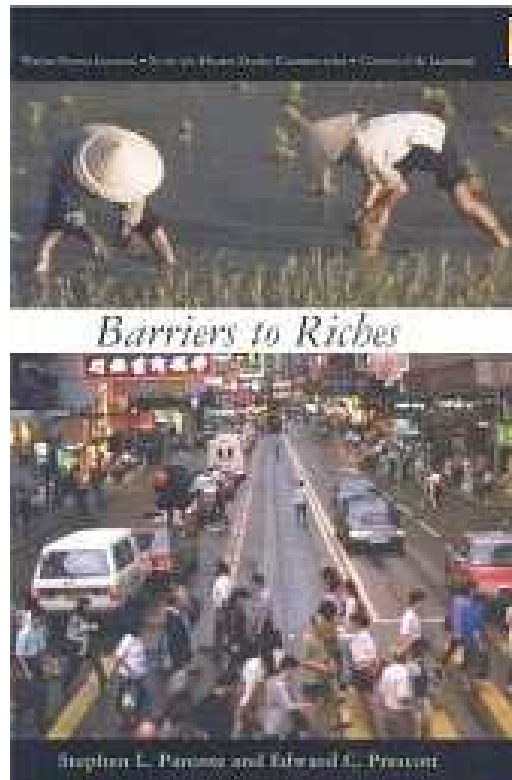
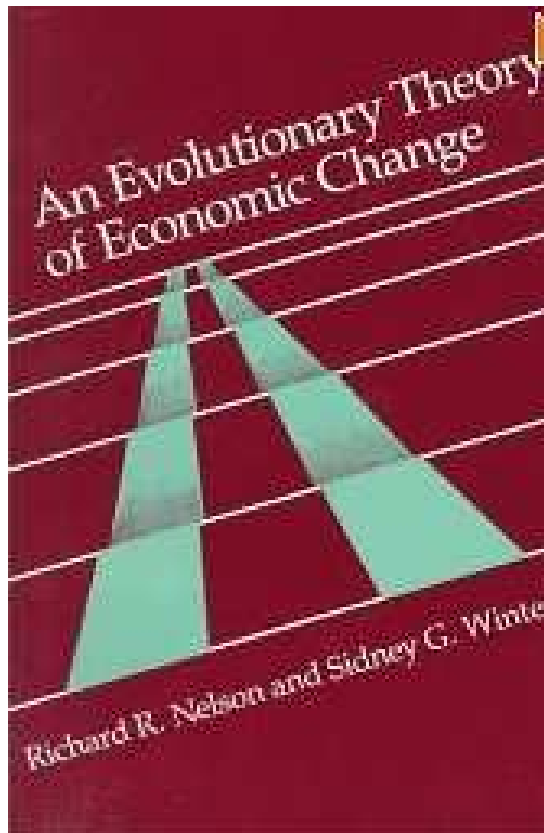
(No assumption made on competition or production function)

Sources:

Felipe, Jesus and John McCombie (2005): Why are some countries richer than others? A skeptical view of Mankiw-Romer-Weil's test of the neoclassical growth model. *Metroeconomica* 56(3), pp. 360-392.

Felipe, Jesus and John McCombie (2006): The tyranny of the identity: growth accounting revisited. *International Review of Applied Economics* 20(3), pp. 283-299.

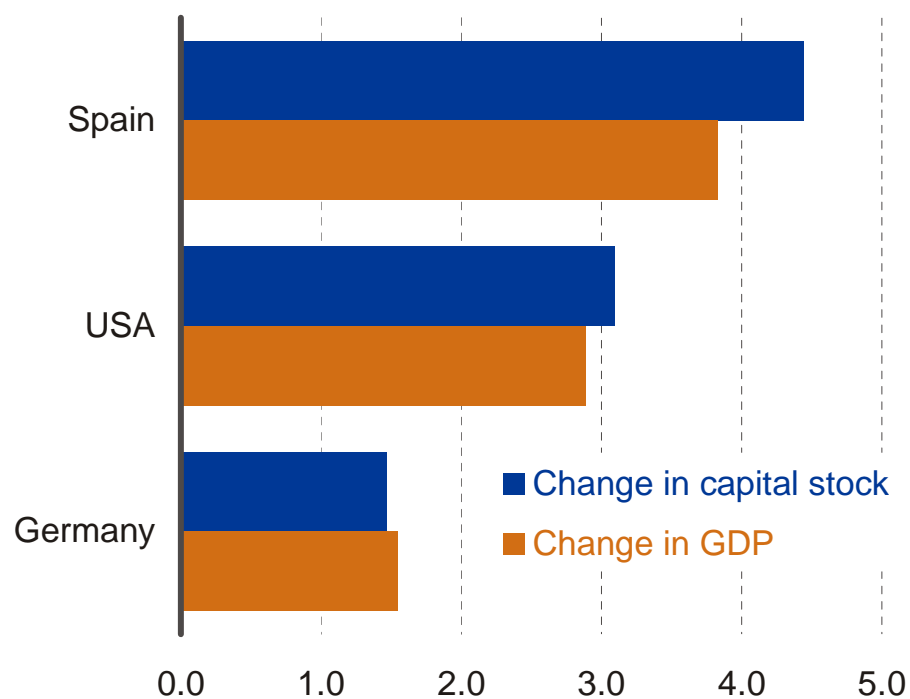
# There is a better, more realistic way



# Physical capital accumulation

## GDP and physical capital go hand in hand

Net capital stock and GDP in 2000 prices, annual % change 1997 to 2007



Sources: AMECO, DBR calculations

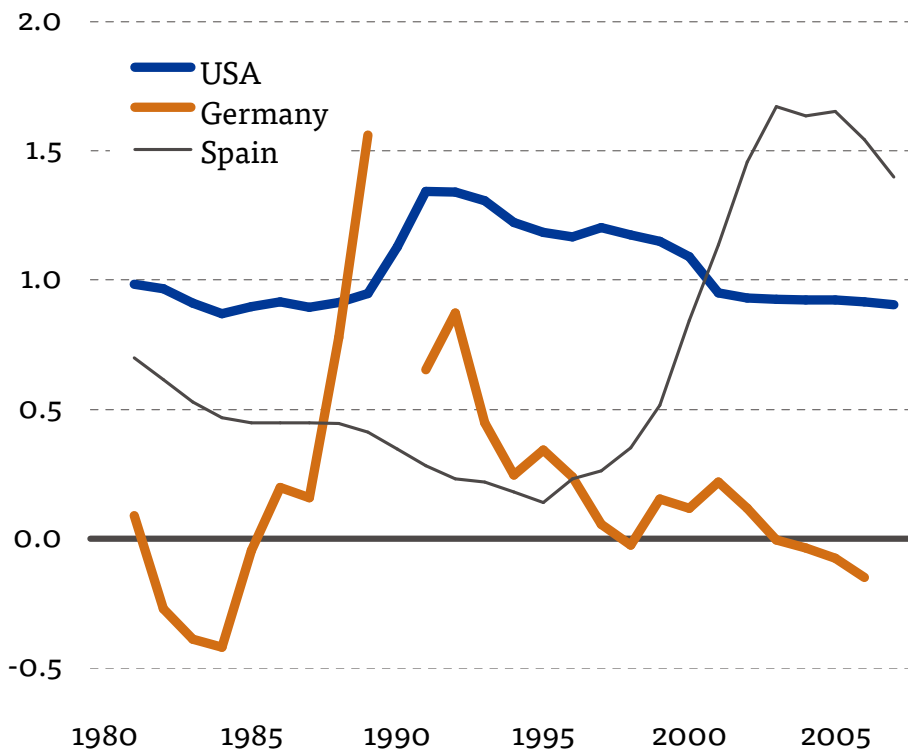
Kaldor-ratio still stands: GDP and physical capital are cointegrated with a coefficient of 1

Excessive investment in Spain?

Deeper drivers of GDP growth have to be found elsewhere

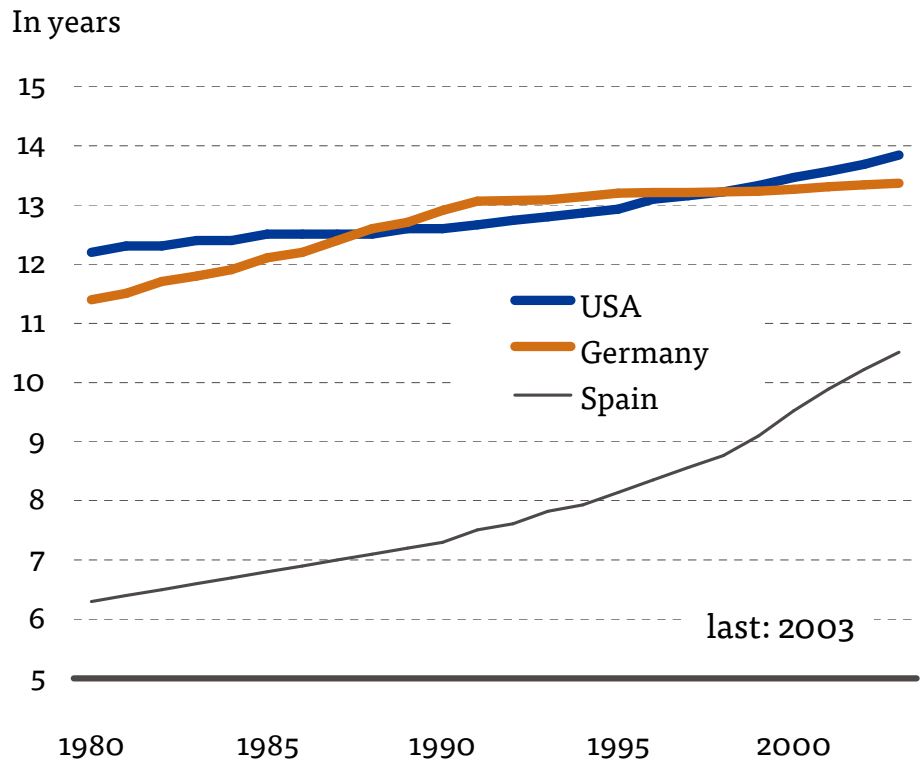
# Key role for human capital

## Population growth



Sources: The Conference Board and Groningen Growth and Development Centre, Destatis

## Average years of education best measure of human capital



Sources: OECD und DBR calculations/interpolations

# Pair-wise cointegration in growth models

**Variables:** Real GDP, physical capital, human capital, trade openness (and probably many more).

**Insight:** Variables develop hand in hand over time in 21 rich countries in 1971-2003 (panel cointegration).

**Theory:** In line with growth theories – but not in line with what is usually done in growth empirics.

# Growth models in more detail

## The basic Solow model

Steady state result:  $\hat{y}_t = \hat{k}_t = \hat{A}_t = g$

## The augmented Solow model

Steady state result:  $\hat{y}_t = \hat{k}_t = \hat{h}_t = \hat{A}_t = g$

## The Lucas model without spillovers

Steady state result:  $\hat{y}_t = \hat{k}_t = \hat{h}_t = \frac{1}{\sigma} (B - \delta - \rho)$

**Evolutionary models:** Nelson (1981): "it may be fruitful to consider the several sources of growth as being like the inputs into a cake. All are needed."

"...where **complementarity** is important, it makes little sense to try to divide up the credit for growth, treating the factors as if they were not complements."

# Pair-wise cointegration in growth models

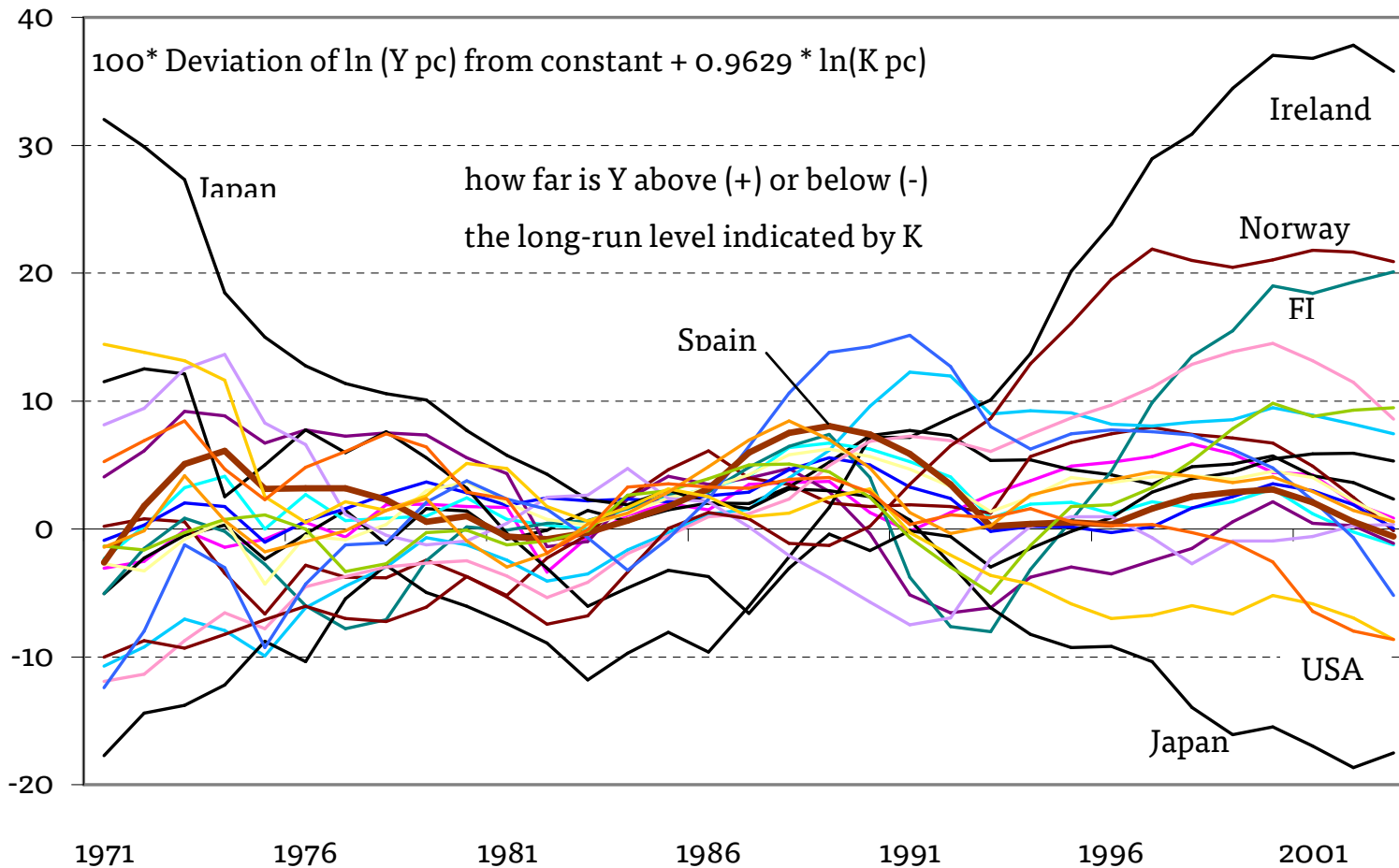
## Panel cointegration tests

		21 rich countries		
lhs	rhs	Pedroni	Breitung	
In GDP p.c.	In Capital p.c.	1,07	0,96	← Kaldor ratio
		76,3	29,2	
In GDP p.c.	Education	0,23	0,20	← 1 more year
		38,8	31,5	= 20% more GDP
In GDP p.c.	Openness	0,025	0,036	
		17,2	7,9	
<b>Other combinations:</b>				
In Capital p.c.	Education	0,22	0,20	← 1 more year
		40,3	23,0	= 20% more capital
In Capital p.c.	Openness	0,024	0,026	
		15,0	9,8	
Education	Openness	0,120	0,102	
		17,0	7,4	

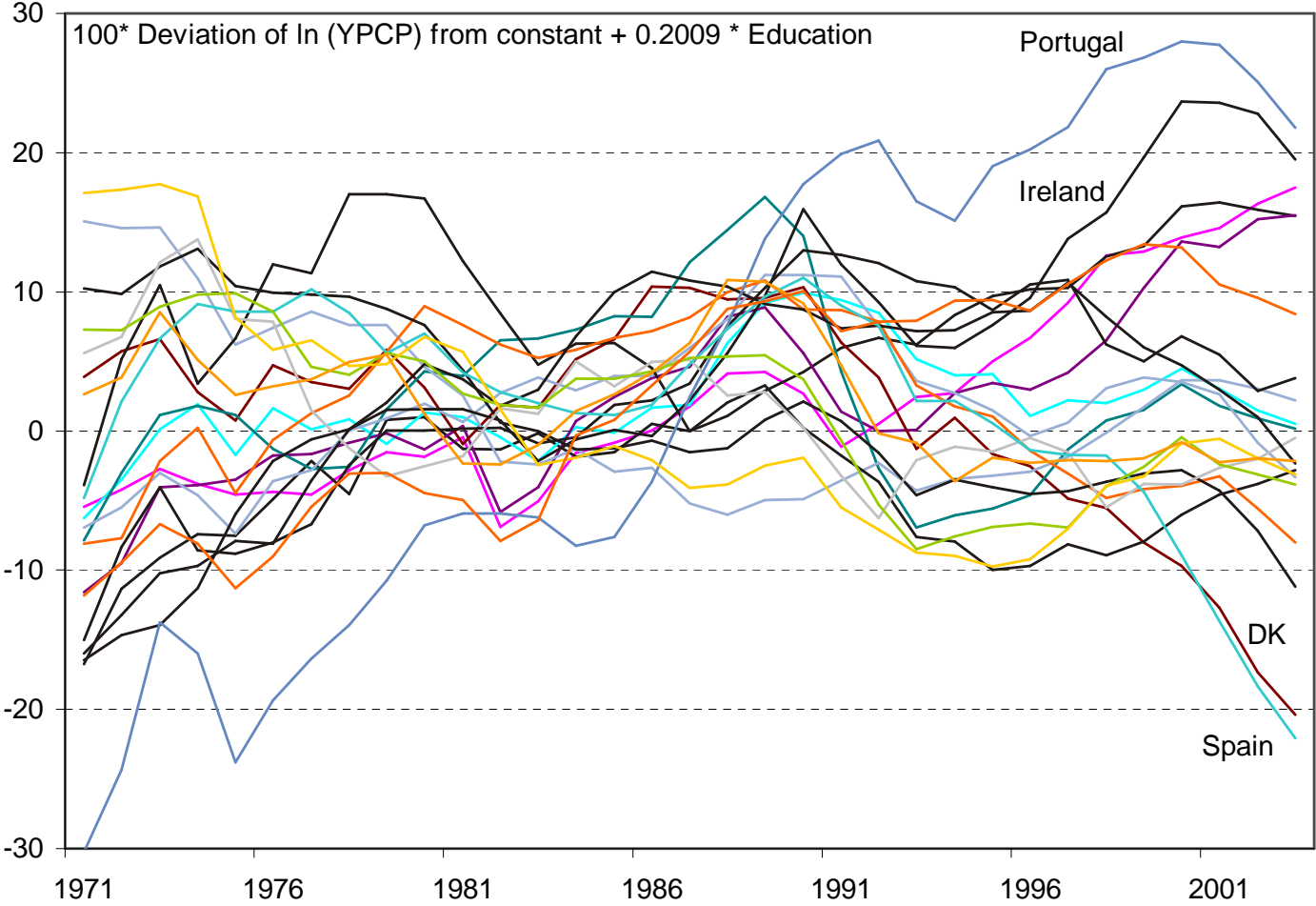
First line: coefficient from cointegration tests, Second line: t-stats  
 Null: No cointegration, i.e. residuals stationary

Source: Bergheim, Stefan (2008): Long-Run Growth Forecasting, Springer, Heidelberg. Page 143.

# Cointegration errors: GDP and capital



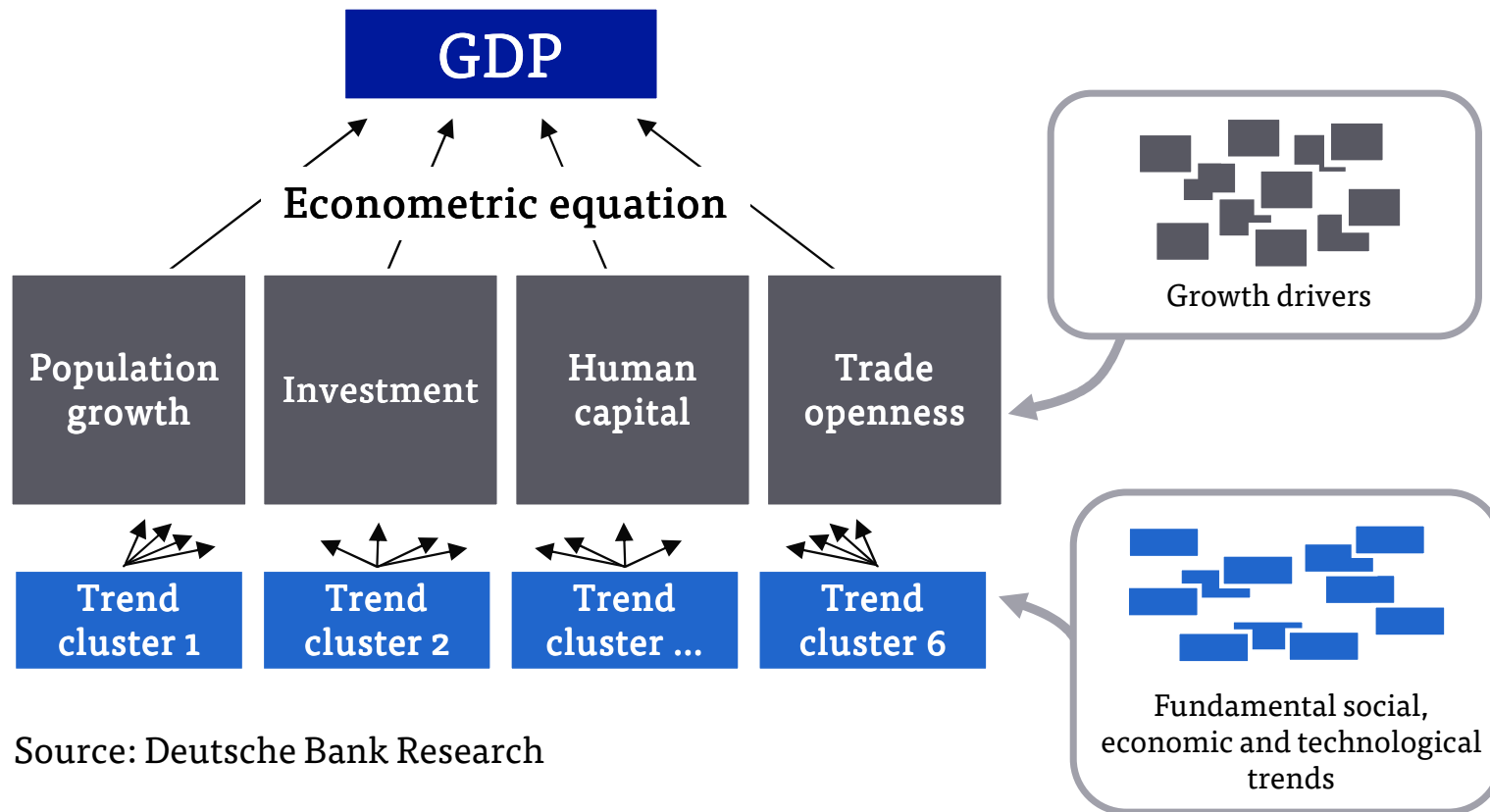
# Cointegration errors: GDP and education



# Agenda

1. A realistic model of economic growth
2. Digging deeper: progress

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



Source: Deutsche Bank Research

# The matrix of societal progress

Simple correlations for 20 countries ca. 2005	Happiness	Economic freedom	Locus of control	Trust	Tertiary edu.	GDP per capita	Employment 55-64	Fertility rate	Government effectiveness	Democracy index	Corruption perception	Tolerance	Nonprofits and voluntary	Broadband	Innovation scoreboard	Capital access
Happiness	1.0	0.7	0.5	0.7	0.8	0.6	0.6	0.5	0.9	0.7	0.8	0.6	0.6	0.7	0.6	0.7
Economic freedom	0.7	1.0	0.8	0.3	0.5	0.3	0.6	0.4	0.7	0.4	0.7	0.4	0.4	0.5	0.6	0.7
Locus of control	0.5	0.8	1.0	0.3	0.5	0.3	0.6	0.4	0.6	0.4	0.6	0.4	0.2	0.2	0.5	0.6
Trust	0.7	0.3	0.3	1.0	0.5	0.5	0.6	0.4	0.7	0.9	0.7	0.8	0.4	0.7	0.5	0.4
Tertiary edu.	0.8	0.5	0.5	0.5	1.0	0.6	0.5	0.5	0.7	0.5	0.5	0.5	0.6	0.5	0.4	0.6
GDP per capita	0.6	0.3	0.3	0.5	0.6	1.0	0.3	0.4	0.5	0.4	0.3	0.2	0.5	0.4	0.3	0.5
Employment 55-64	0.6	0.6	0.6	0.6	0.5	0.3	1.0	0.5	0.7	0.6	0.6	0.5	0.3	0.5	0.5	0.6
Fertility rate	0.5	0.4	0.4	0.4	0.5	0.4	0.5	1.0	0.5	0.3	0.5	0.2	0.5	0.4	0.4	0.5
Government effectiveness	0.9	0.7	0.6	0.7	0.7	0.5	0.7	0.5	1.0	0.8	0.9	0.7	0.5	0.8	0.7	0.8
Democracy index	0.7	0.4	0.4	0.9	0.5	0.4	0.6	0.3	0.8	1.0	0.8	0.9	0.4	0.6	0.5	0.5
Corruption perception	0.8	0.7	0.6	0.7	0.5	0.3	0.6	0.5	0.9	0.8	1.0	0.7	0.3	0.8	0.7	0.7
Tolerance	0.6	0.4	0.4	0.8	0.5	0.2	0.5	0.2	0.7	0.9	0.7	1.0	0.4	0.7	0.5	0.4
Nonprofits & vol.sector	0.6	0.4	0.2	0.4	0.6	0.5	0.3	0.5	0.5	0.4	0.3	0.4	1.0	0.5	0.3	0.5
Broadband	0.7	0.5	0.2	0.7	0.5	0.4	0.5	0.4	0.8	0.6	0.8	0.7	0.5	1.0	0.6	0.5
Innovation scoreboard	0.6	0.6	0.5	0.5	0.4	0.3	0.5	0.4	0.7	0.5	0.7	0.5	0.3	0.6	1.0	0.6
Capital access	0.7	0.7	0.6	0.4	0.6	0.5	0.6	0.5	0.8	0.5	0.7	0.4	0.5	0.5	0.6	1.0

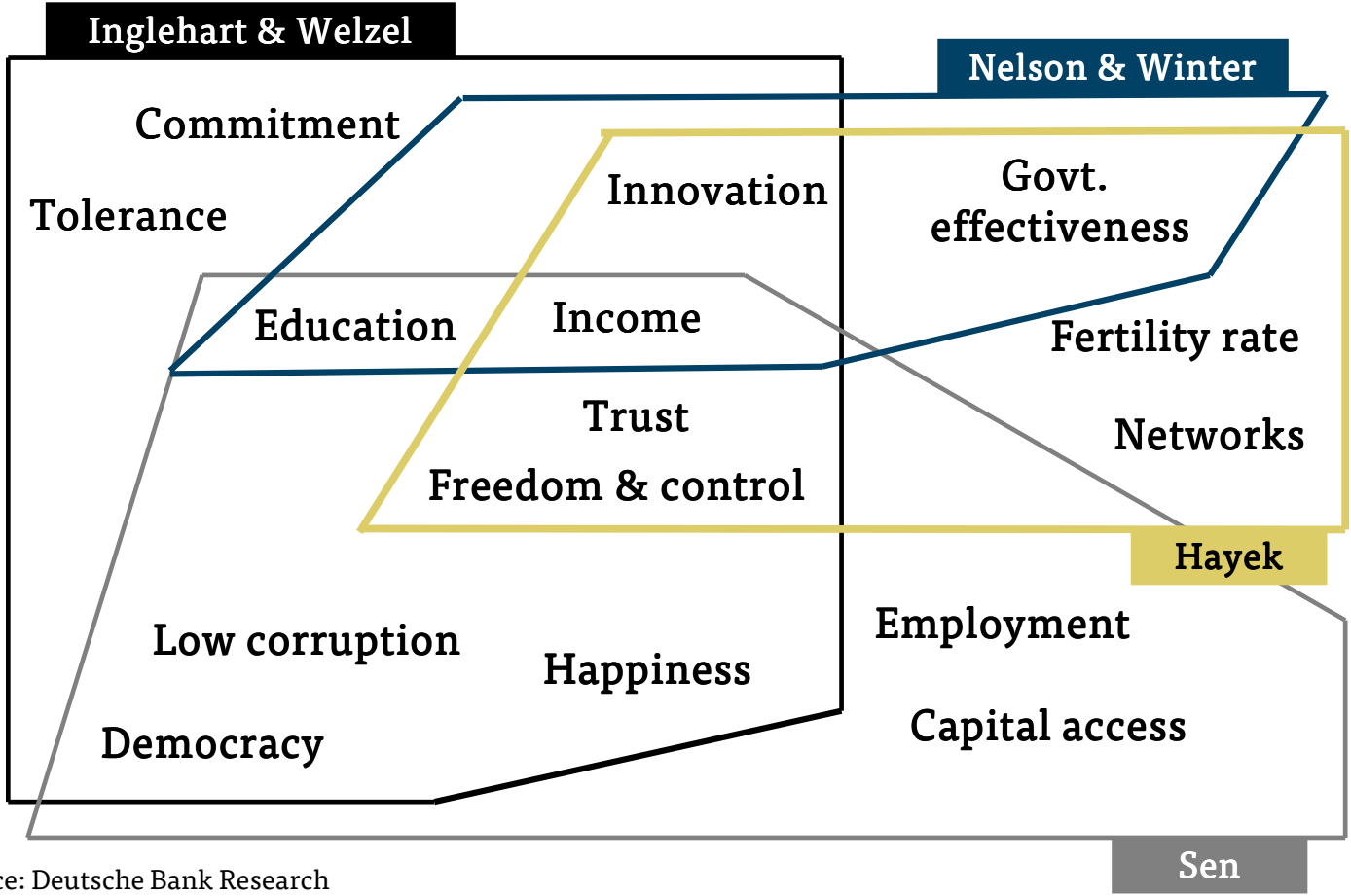
Happiness research

Social capital research

Growth empirics


Source: Deutsche Bank Research

# Many aspects of societal progress



Source: Deutsche Bank Research

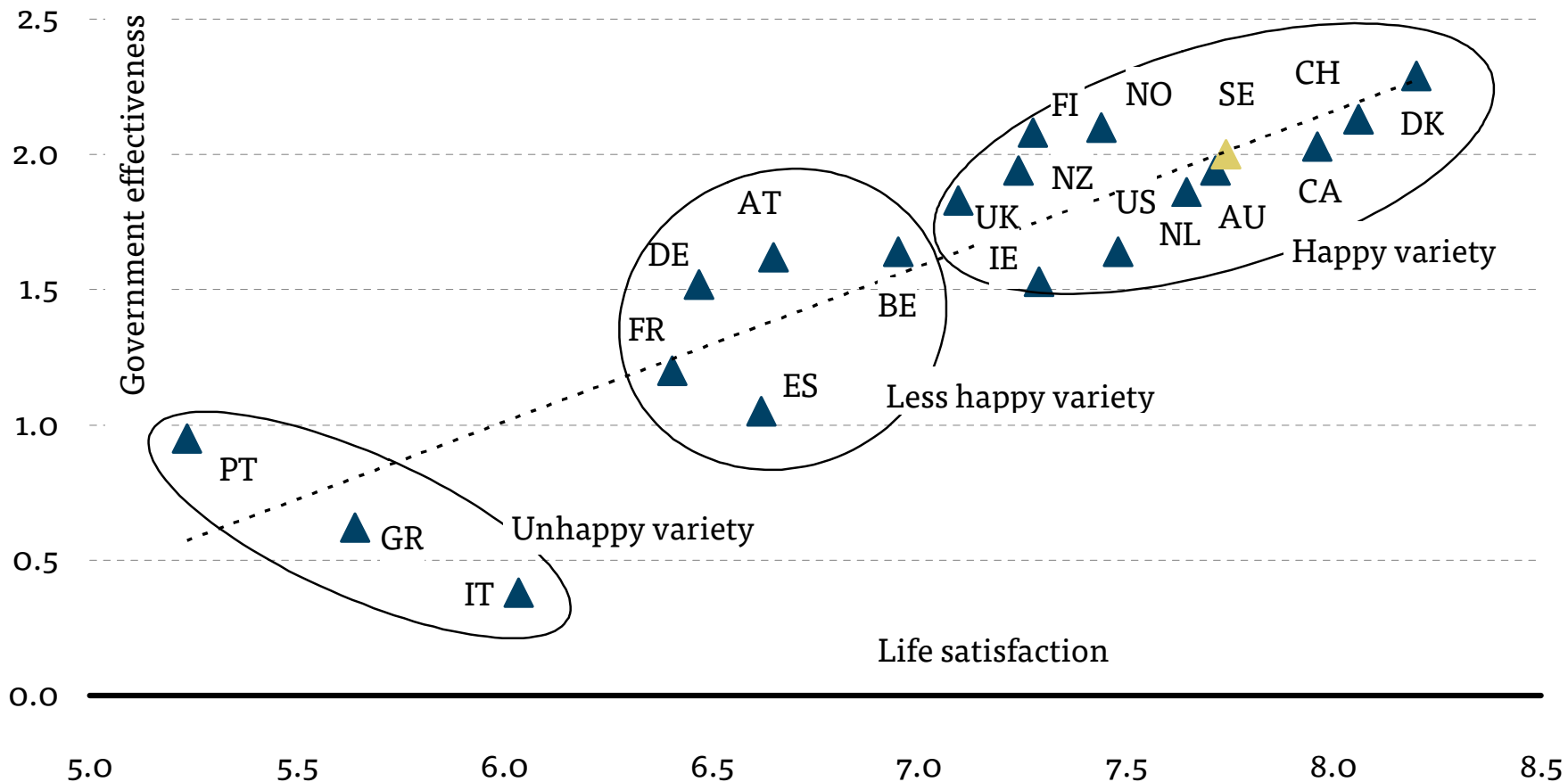
# The process of human development

	Economic	Cultural	Institutional
<b>Components</b>	Individual resources	Emancipative values	Freedom rights
<b>Process</b>	Economic development	Emancipative cultural change	Democratisation
<b>Effect</b>	Enhances capabilities	Increases priority to act	Broadens entitlements
<b>Causality</b>	<p>From resources to values to rules</p> 		
<p>Sources: Welzel, Inglehart &amp; Klingemann (2003) p. 346 and Inglehart &amp; Welzel (2005) p. 3,            Compilation by Deutsche Bank Research</p>			

# The happy variety of capitalism

## Effective governments and high well-being

Horizontal: Life satisfaction in 2005 (scale from 0 to 10); Vertical: Government effectiveness in 2006

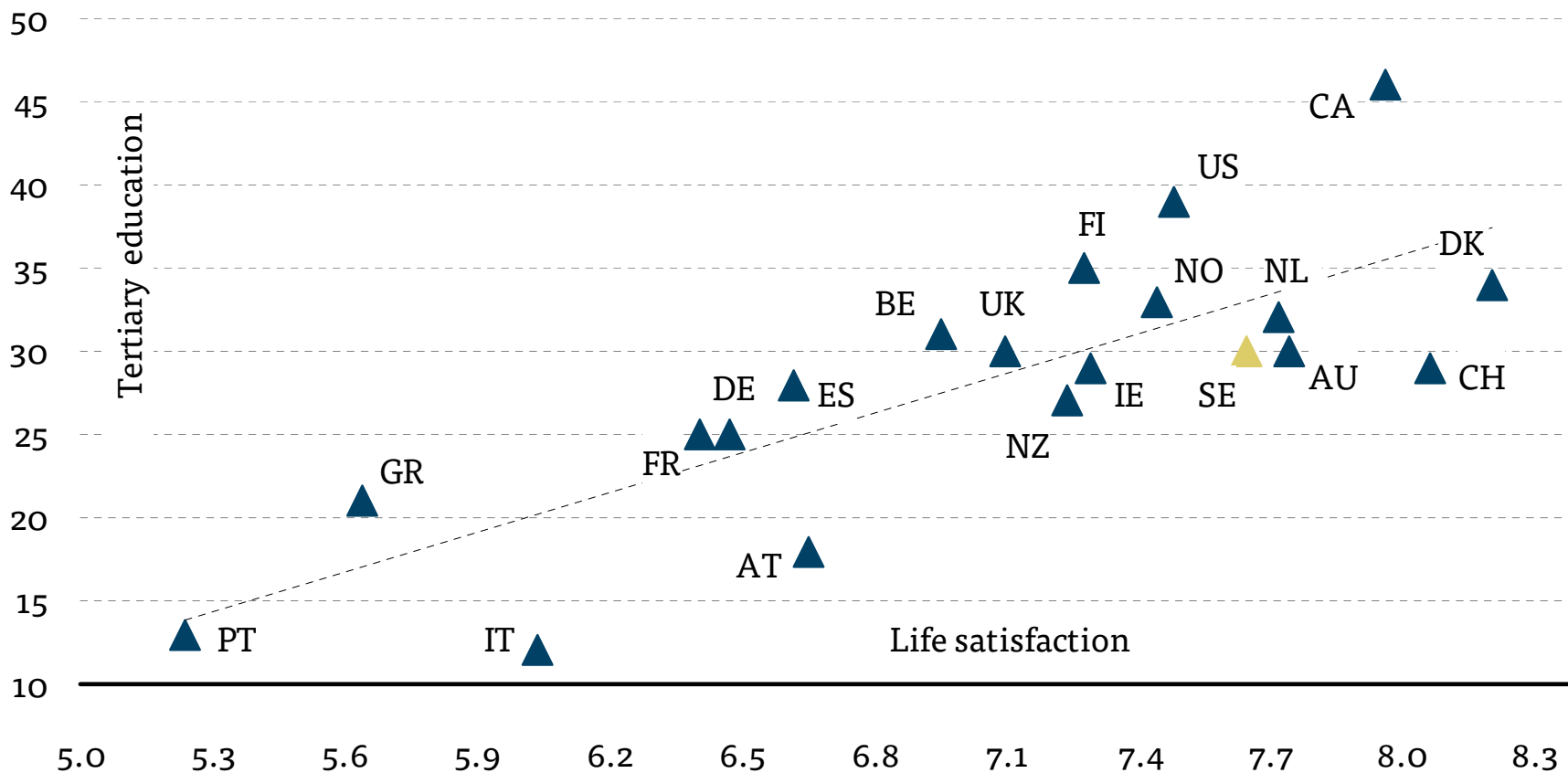


Sources World Bank, Eurobarometer & World Database of Happiness

# Education plays a key role

## Tertiary education has many side effects

Horizontal: Life satisfaction (scale 0 to 10) around 2005; Vertical: Tertiary attainment rate in 2005, in %

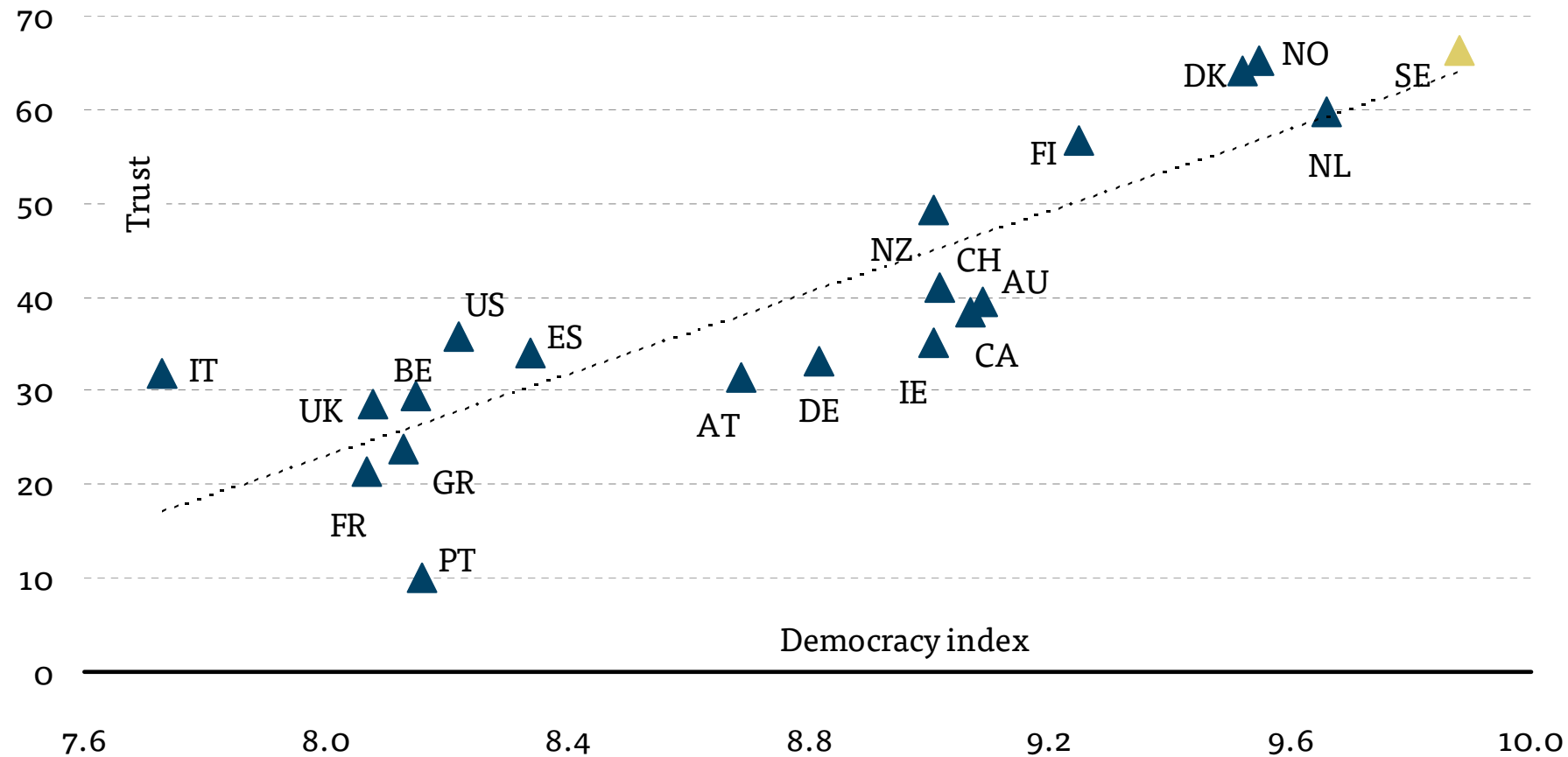


Sources: World Database of Happiness and OECD

# Trust matters

## A lot of trust in functioning democracies

Horizontal: Democracy index scale of 0 to 10; Vertical: Trust in others in %



Sources: World Values Survey and Economist Intelligence Unit

# Progress measurement – beyond GDP



## Beyond GDP

Measuring progress, tr

## Measuring the Progress of Societies



Global Project (Home)

- > WHAT we are doing
- > WHY is our work important
- > WHO are the partners
- > HOW to get involved
- > Frequently Asked Questions

*Is life getting better?* Are our societies making progress? “progress” mean to the world’s citizens? There can be few importance in today’s rapidly changing world. And yet how evidence to answer these questions?

About the Institute   Wellbeing in Canada   Canadian Index of Wellbeing

It's about our wellbeing, not just our economy.

 THE HAPPY PLANET INDEX 2.0

Zentrum für  
gesellschaftlichen  
Fortschritt

# Two approaches at the country level...

## Stiglitz-Sen-Fitoussi

- Material living standards
- Health
- Education
- Environment (present and future conditions)
- Personal activities, including work
- Political voice and governance
- Social connections and relationships
- Insecurity, of an economic as well as physical nature

## Canadian Index of Wellbeing

- Living standards
  - After-tax median income
  - Income distribution (ratio of top to bottom quintil)
  - Incidence of low income (LICO)
  - CSLS Economic Security Index
  - Long-term unemployment
  - Employment rate
  - CIBC Employment Quality Index
  - Housing affordability
  - Wealth distribution
  - Persistence of low income
  - Food security
- Healthy populations
  - Self-rated health (core)
  - : Life expectancy at birth (core)
  - : Infant mortality rate (core)
  - : Diabetes prevalence (core)
  - : Health adjusted life expectancy (core)
  - : Probable risk of depression (core)
  - : Smoking rate (core)
  - : Patient satisfaction with overall health services (
  - : Proportion of population with a regular family do
  - : Influenza immunization rate (65 years and over)
- Community vitality
  - Participation in group activities
  - Volunteering
  - Number of close relatives
  - Direct acts of support
  - Property crime
  - Violent crime
  - Walking alone after dark
  - Trust
  - Experience of discrimination
  - Caring for others
  - Belonging to community

- Education
- Environment
- Time use
- Civic engagement

# ...and two more

## Measures of Australia's Progress

	Indikator
Individuals	Health
	Education and training
	Work
The economy	Unemployment rate
	GDP
	National income
	Economic hardship
	National wealth
	Housing
	Productivity
The environment	Multifactor productivity
	Biodiversity
	Land
	Inland waters
	<b>Air quality</b>
Living together	Atmosphere
	Oceans and estuaries
	Family, community and
	Crime
	Democracy, governance

Indikator
Life expectancy
Proportion of people aged 25–64
Unemployment rate
GDP
Net national disposable income
Real income of less well-off
Real national net worth per capita
Investment in dwellings
Multifactor productivity
Number of terrestrial bird and ma
Surface water management area
Days on which fine particle health
Net greenhouse gas emissions
% of children <15 years living with
Victimisation prevalence rates for
Proportion of women in the Parliam

## OECD

Human wellbeing: out	Physical and mental health
	Knowledge and understanding
	Work and leisure
	Material wellbeing
Economy	Freedom and self-determination
	Interpersonal relationships
Ecosystem Condition:	National income
	National wealth
Governance	Land
	Freshwater
	Oceans and seas
	Biodiversity
	Atmosphere
Culture	Human rights
	Civic engagement
	Security and crime
Resource, use, develop	<b>Access to services</b>
	Cultural heritage
	Arts and leisure
Pollution	Resource extraction and consu
	Pollution

# Vancouver Foundation's Vital Signs

## 12 Key Areas

### Arts and Culture

## Indikatoren (Auswahl)

employed in the cultural sector  
household spending on culture  
ethnic media outlets  
pieces of approved or installed works of public art

### Belonging and Leadership

charitable donation  
moving address  
immigration from China, India, Philippines  
seniors living alone  
sense of belonging  
score in Composite Learning Index  
Corporate Philanthropy

### Changing Demographics

birth rates  
workers between the ages of 15 and 24 years  
population growth  
participation rate for women in labour force

### Environment

ground level ozone  
waste; recycling  
greenhouse gases  
**programmable thermostats**  
**use tap water as their primary source of drinking water**  
garbage and litter lying around

### Gap Between Rich and Poor

Child Pre-tax Poverty Rates  
Pre-Tax Poverty Rates  
Consumer Bankruptcies  
Elderly Pre-tax Poverty Rates

### Getting Around

kilometers of designated cycling routes  
Mode of transportation  
number of registered vehicles  
**commuting distance**  
Perceived safety of cycling  
trips taken on public transit system

### Getting Started

Monthly Child Care Fees  
unemployment rate for immigrants  
youth unemployment rate  
Proportion of Population with Immigrant Status

### Health and Wellness

life expectancies  
Levels of life stress  
Proportion (%) of the Population Moderately or Severely Stressed  
deaths from alcohol  
consume the recommended daily portion of fruit and vegetables  
Infant mortality rates  
years lost as a result of early deaths  
Low birth weight  
number of homeless people  
Real Estate Sales

### Housing

**ratio of housing costs to median incomes**  
vacancy rate

### Learning

Rent for 2 bedroom apartments as a Percent of Median Income  
Proportion of the Population with Access to Internet  
Population (15 Years and Older) that have not read the newspaper

### Safety

Composite Learning Index (CLI) score  
Class sizes in the elementary schools  
criminal code traffic offences  
property crime rate  
**perceptions of safety in school**

### Work

violent crime incidents  
Employment growth  
employment rate  
**Number of Self-Employed**  
median annual earnings  
unemployment rate

# How to make progress on progress

Change is possible in spite of strong path dependencies.

Progress has to be fostered jointly at different levels: Federal and state, municipal and local, business, individuals.

Filter for recommendations:

- (1) What is relevant and important for progress?
- (2) Where does a country/company/city underperform?
- (3) Where are specific changes possible in practice?
- (4) Where do strong linkages suggest progress in other areas as well (use complementarities)?

# References

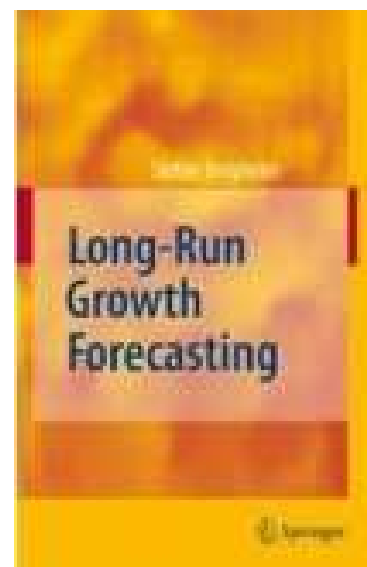
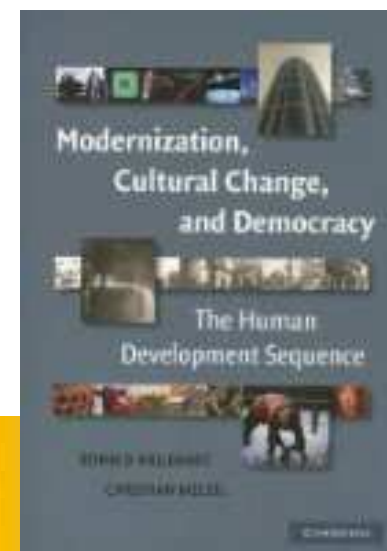
## The broad basis of societal progress

Freedom, trust, tolerance, education and much more

## The happy variety of capitalism

Characterised by an array of commonalities

**Global growth centres 2020**  
*Formel-G for 34 economies*



Thank you!

[stefan.bergheim@fortschrittszentrum.de](mailto:stefan.bergheim@fortschrittszentrum.de)

[www.fortschrittszentrum.de/en/](http://www.fortschrittszentrum.de/en/) 