

Engineering and society: prospective remarks

Paulo M. S. T. de Castro

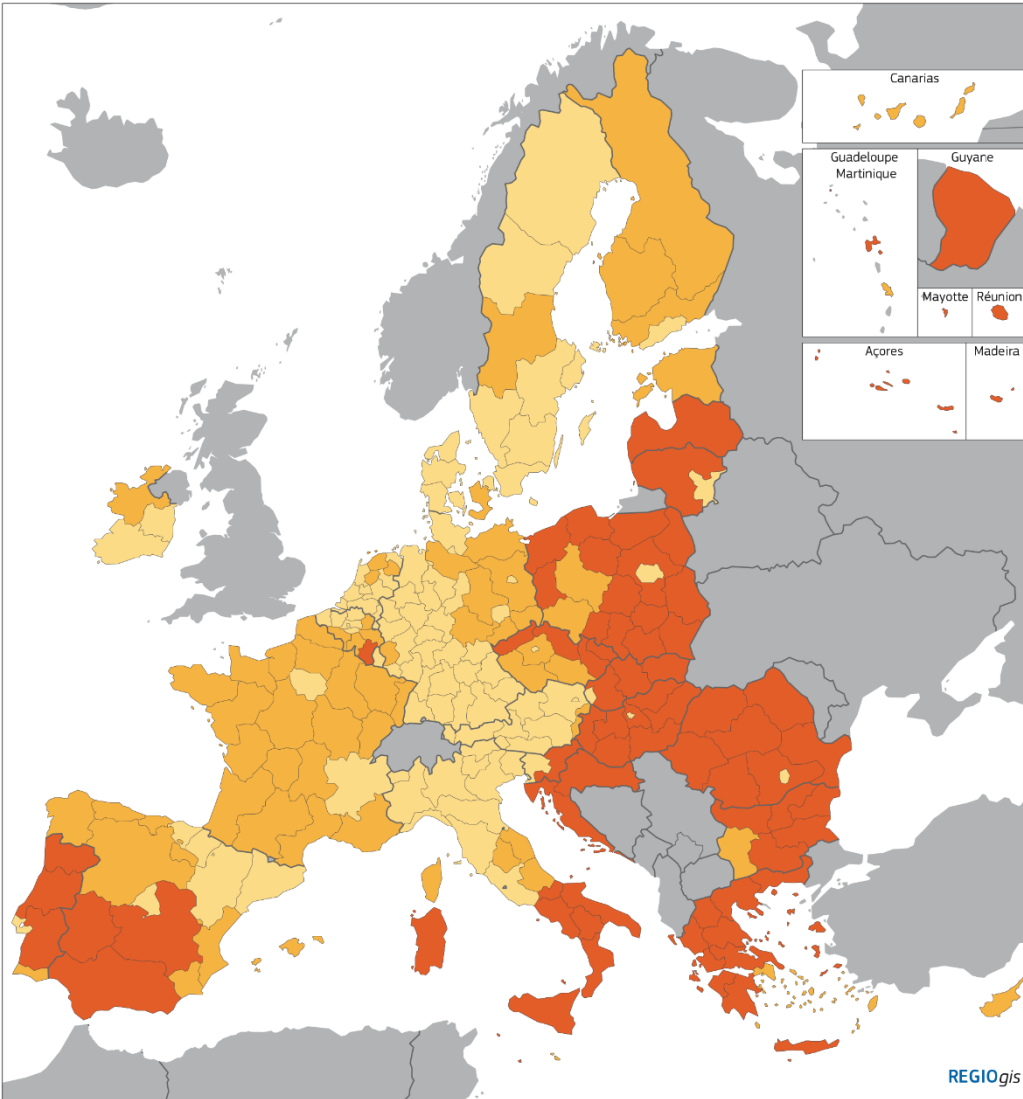
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Outline

- **Portugal**
- **Macroeconomy**
- **Inequality**
- **Innovation**
- **Skills**
- **Education**
- **R&D**
- **Sustainability**
- **Future**
- **Geopolitics**

Outline

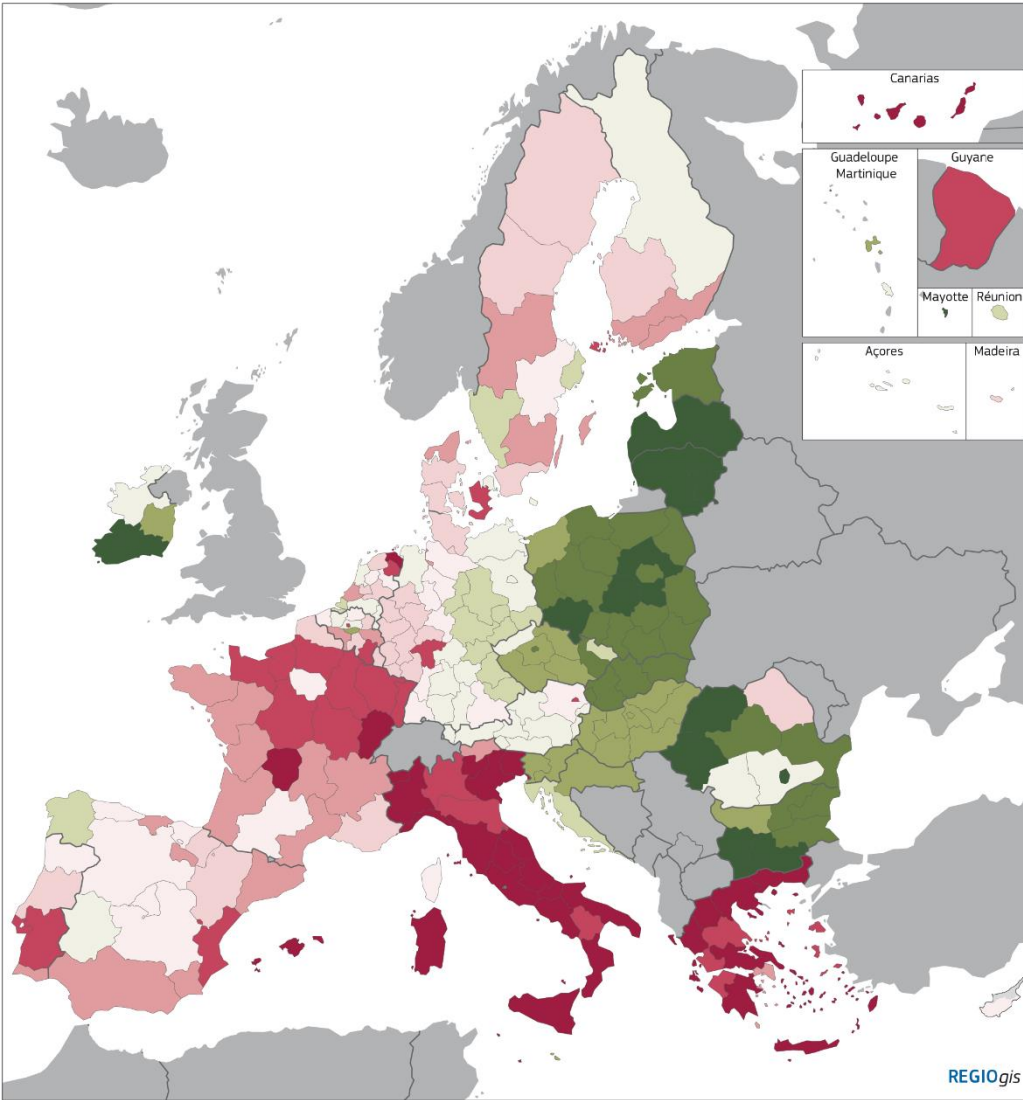
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Category of regions for cohesion policy (ERDF and ESF+), 2021–2027

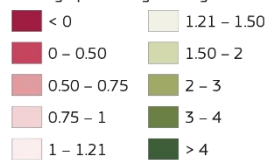
- Less developed regions (GDP per head (PPS) less than 75% of the EU-27 average)
- Transition regions (GDP per head (PPS) between 75% and 100% of the EU-27 average)
- More developed regions (GDP per head (PPS) above 100% of the EU-27 average)

GDP per head: average 2015–2016–2017.



Map 1 Growth of GDP per head, 2001-2019

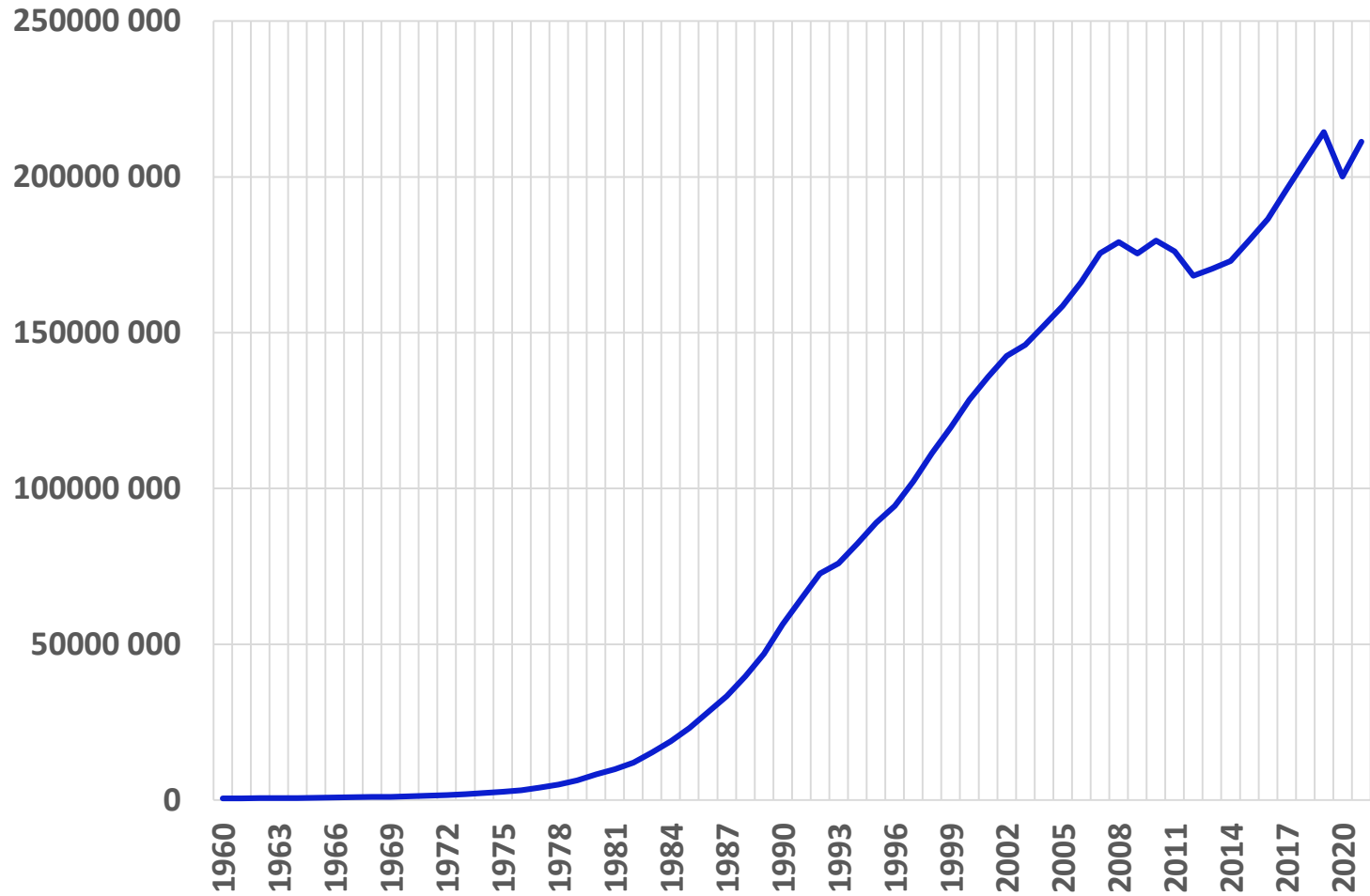
Average percentage change on the preceding year



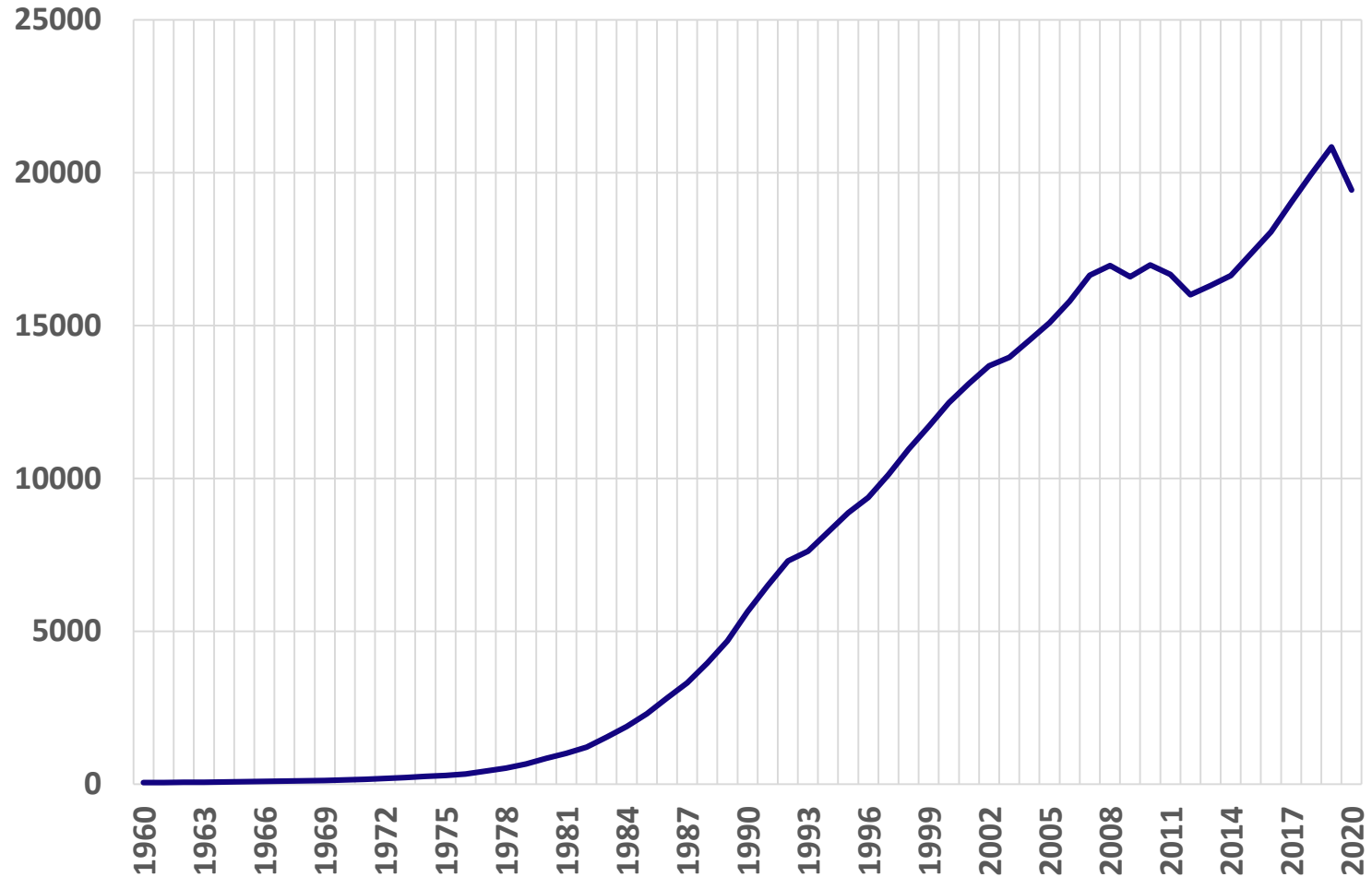
EU-27= 1.21

Source: DG REGIO based on JRC and Eurostat data.

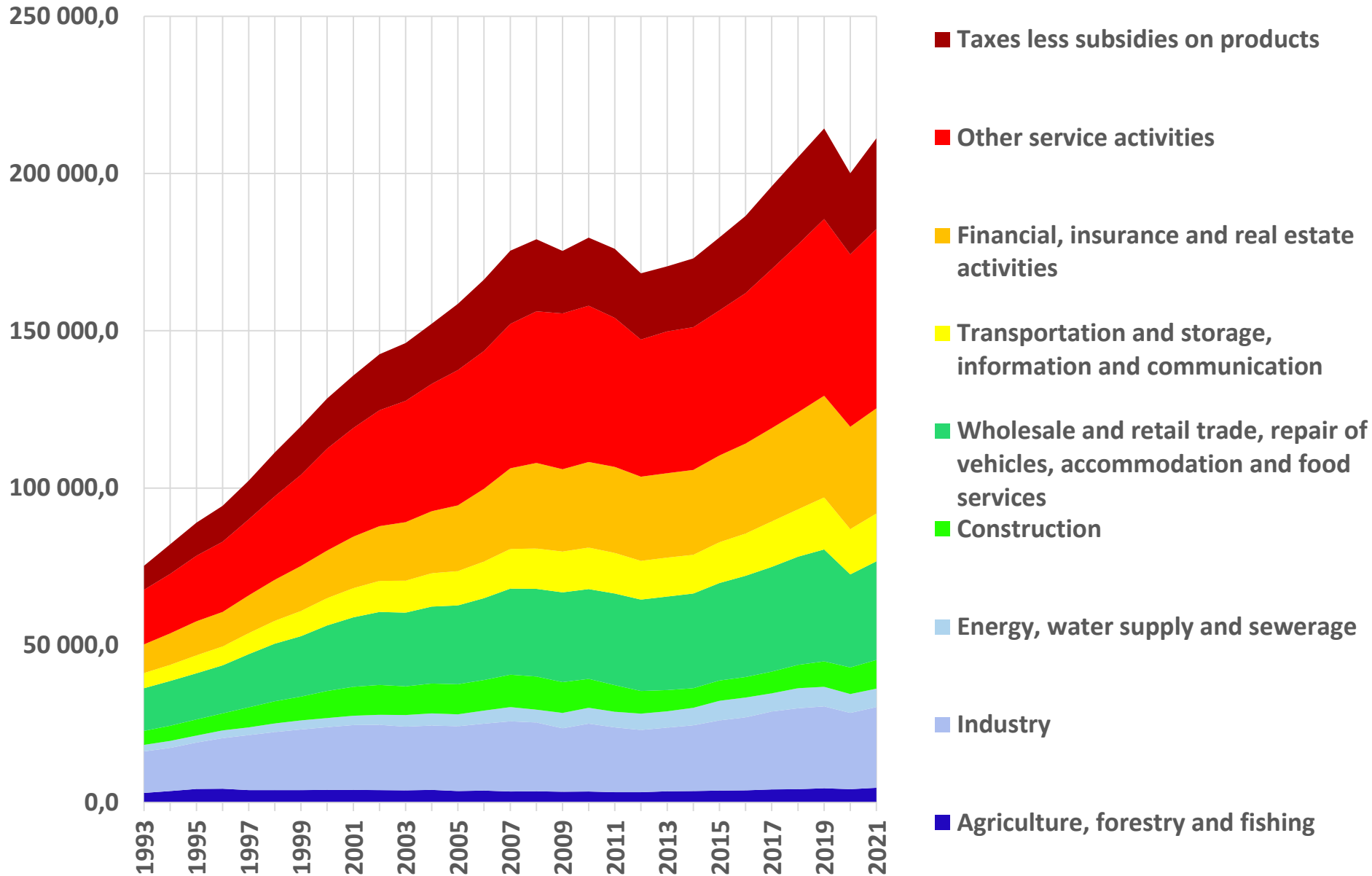
Portugal: GDP, Euro. Pordata



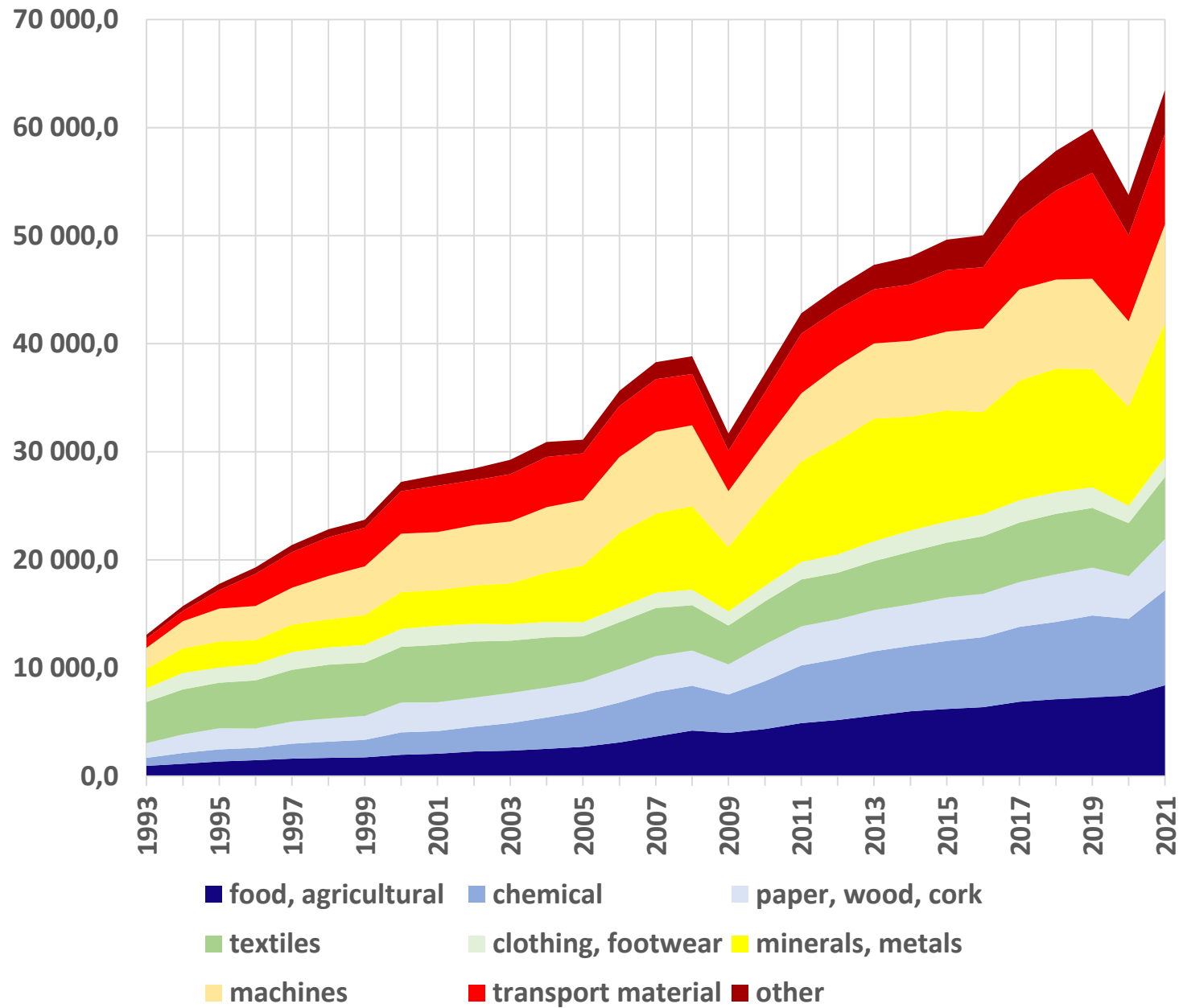
Portugal: GDP per capita, Euro. Pordata



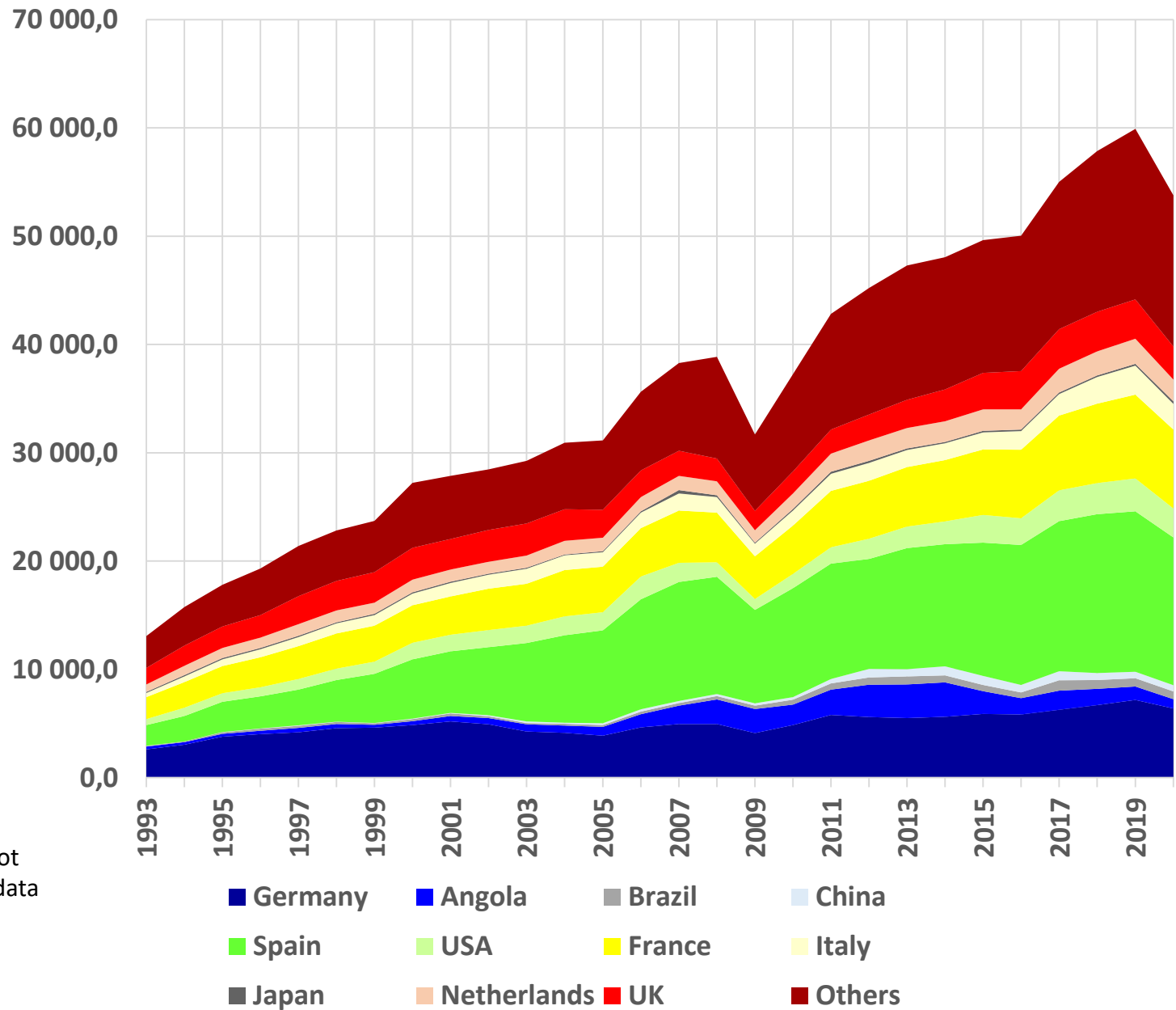
Portugal: GDP in terms of production, Euro. Pordata



Portugal: exports, goods, Euro. Pordata

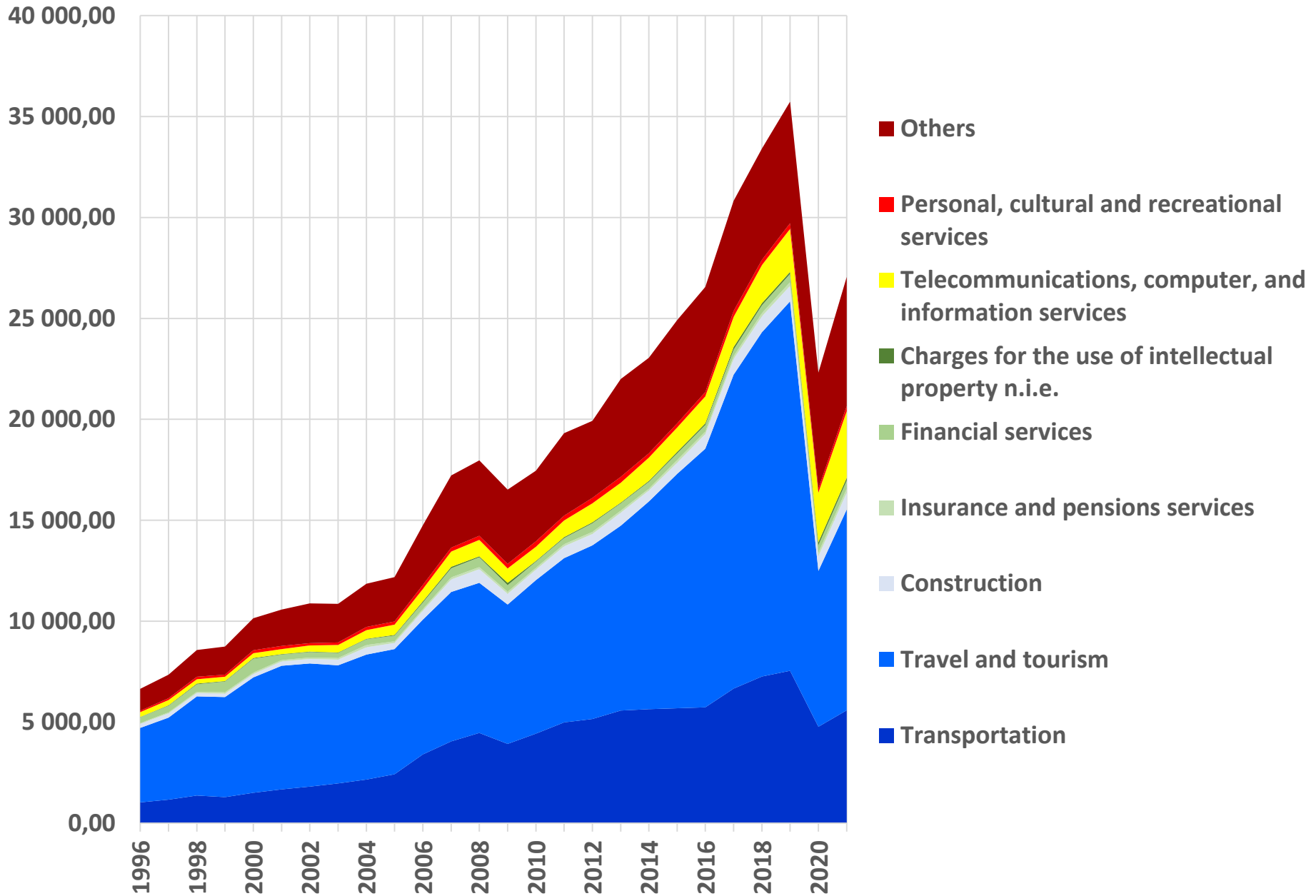


Portugal: exports, goods, Euro. Pordata



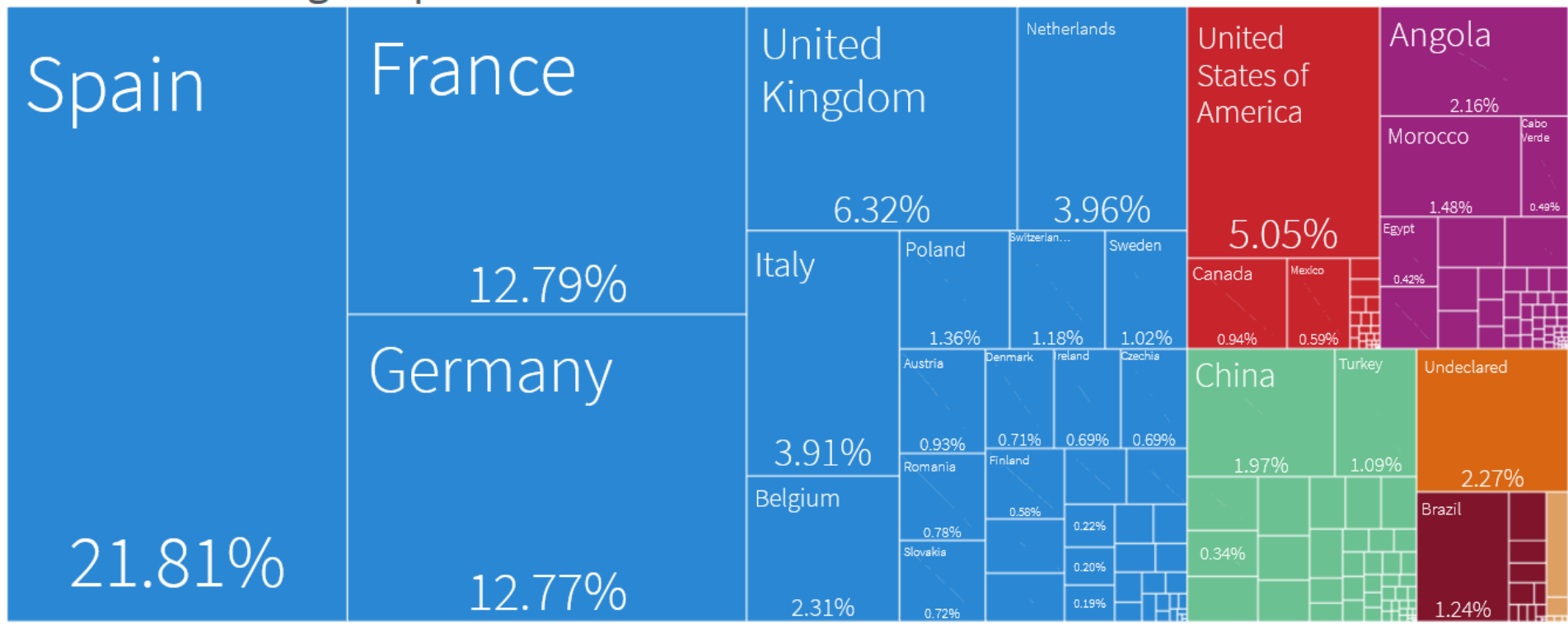
2021 UK data not available in Pordata
2022-05-01

Portugal: exports of services: total and by type, Euro. Pordata



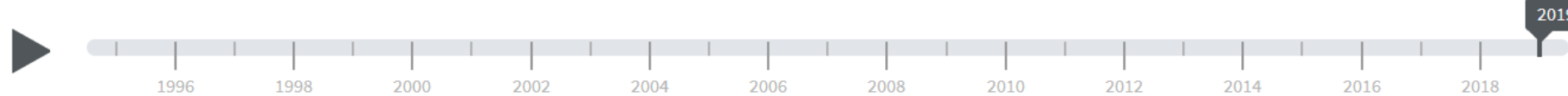
Where did Portugal export to in 2019?

Shown: \$64.3B | Total: \$64.3B



- Africa
- Asia
- Oceania
- Europe
- North America
- South America
- Other

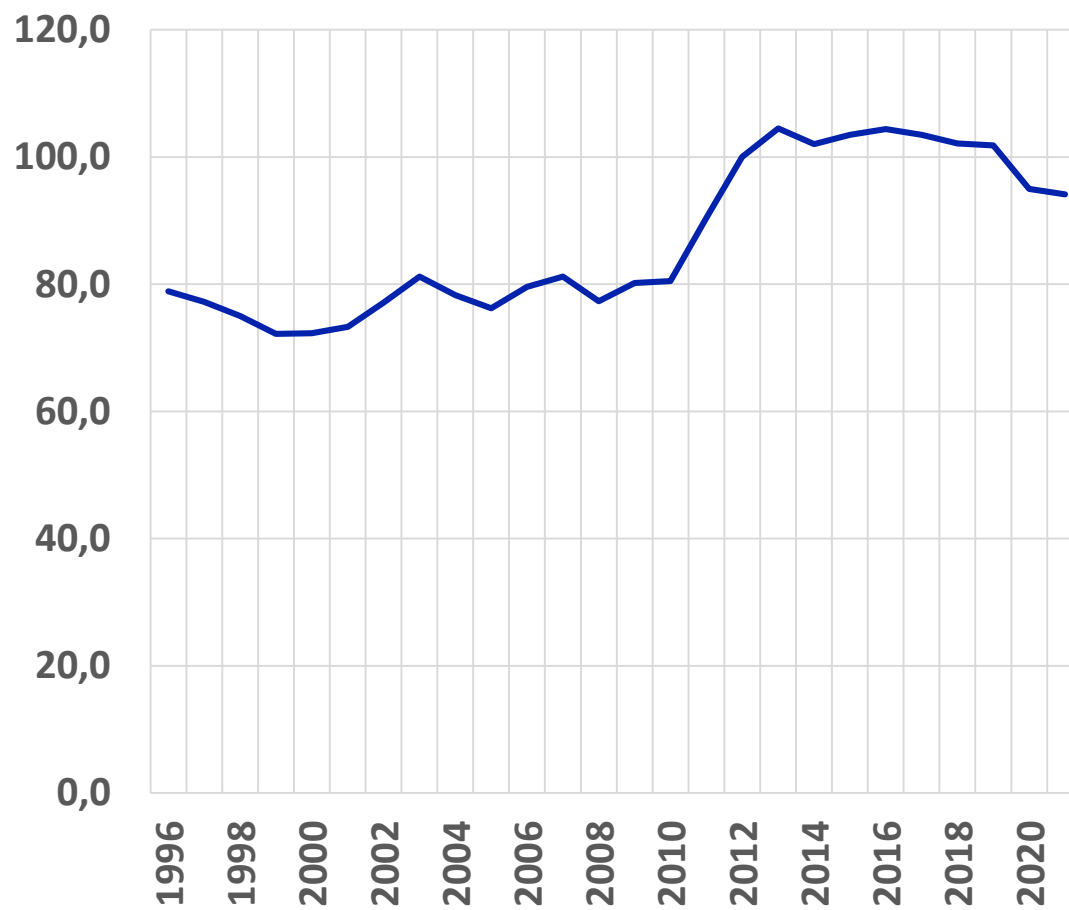
SEARCH IN VISUALIZATION



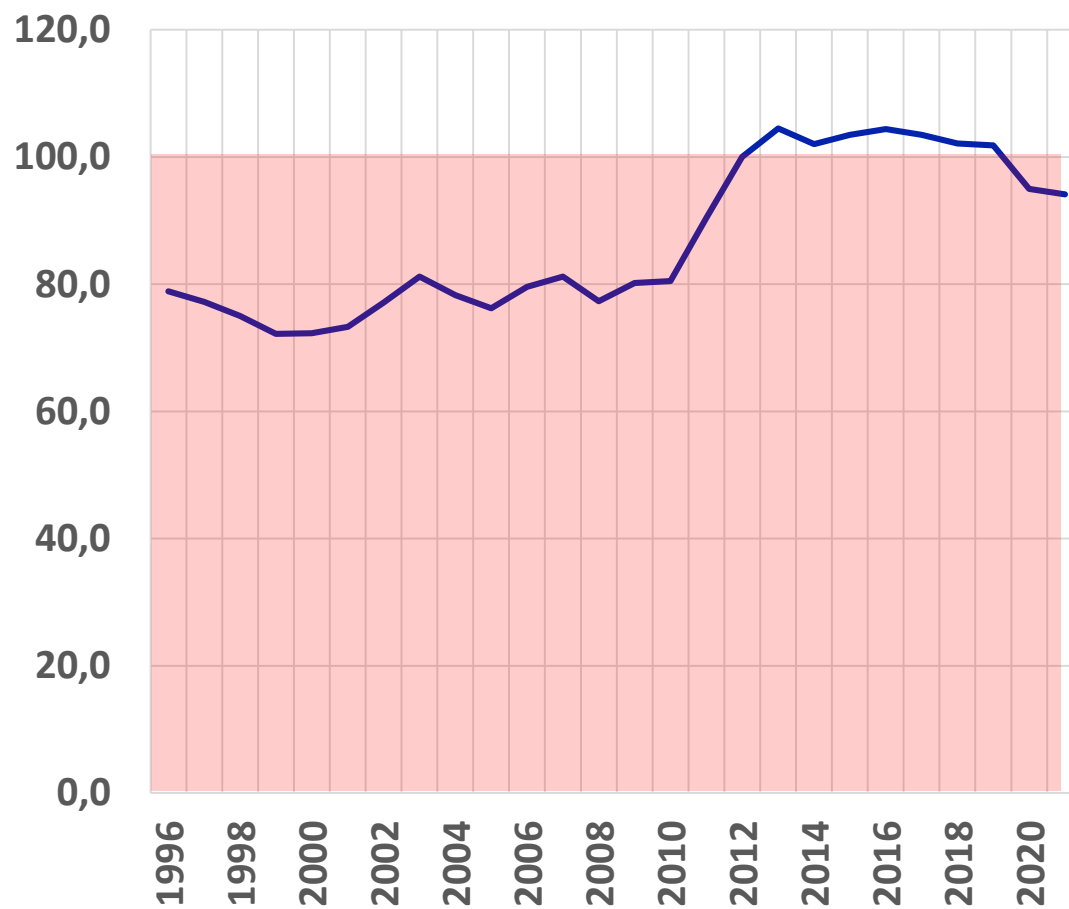
'Atlas of Economic Complexity'

Economic Complexity is a **measure of a society's productive knowledge**. Prosperous societies are those that have the knowledge to make a larger variety of more complex products.

Portugal: exports / imports. Pordata

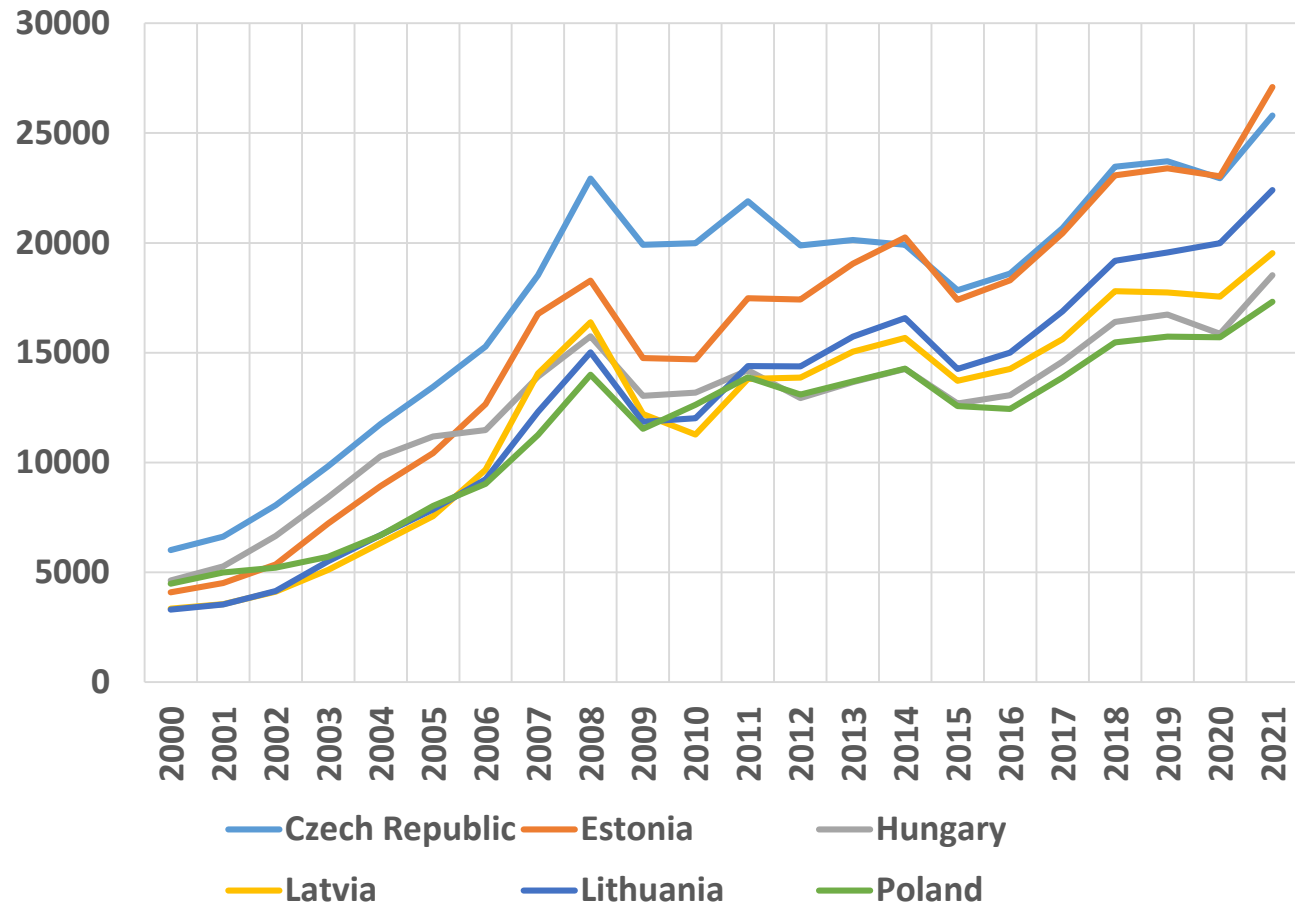


Portugal: exports / imports. Pordata



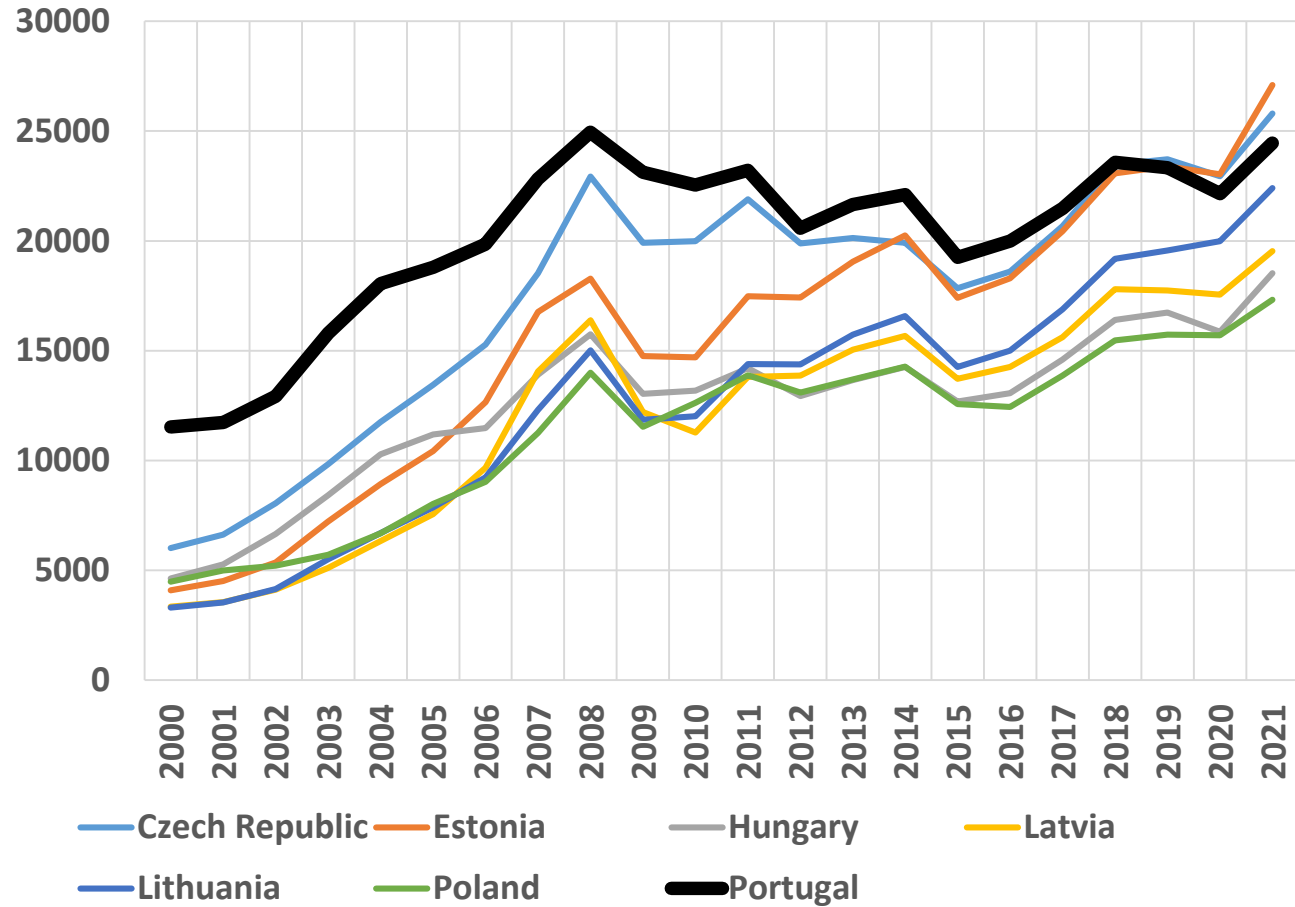
GDP per capita. IMF

current prices, USD

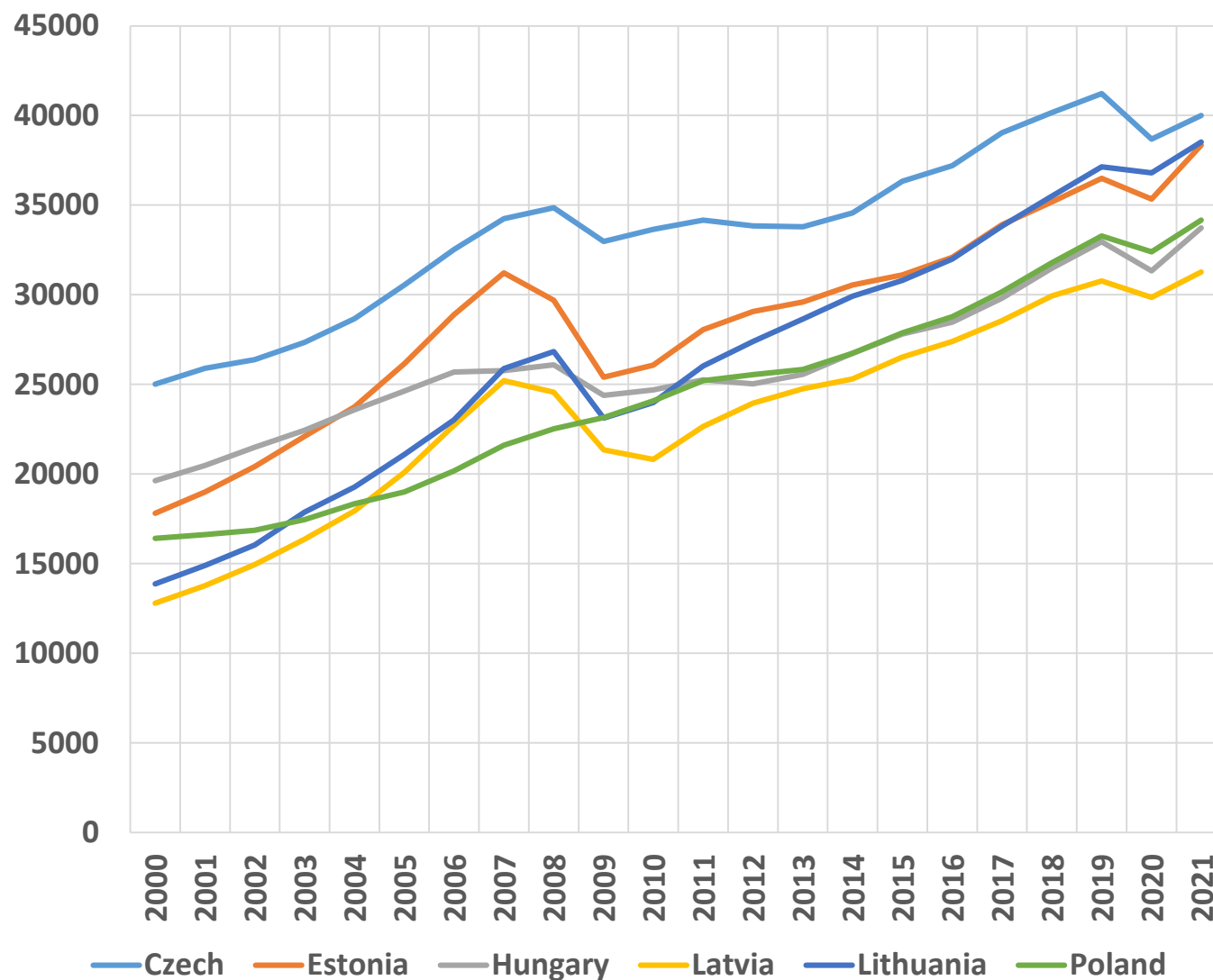


GDP per capita. IMF

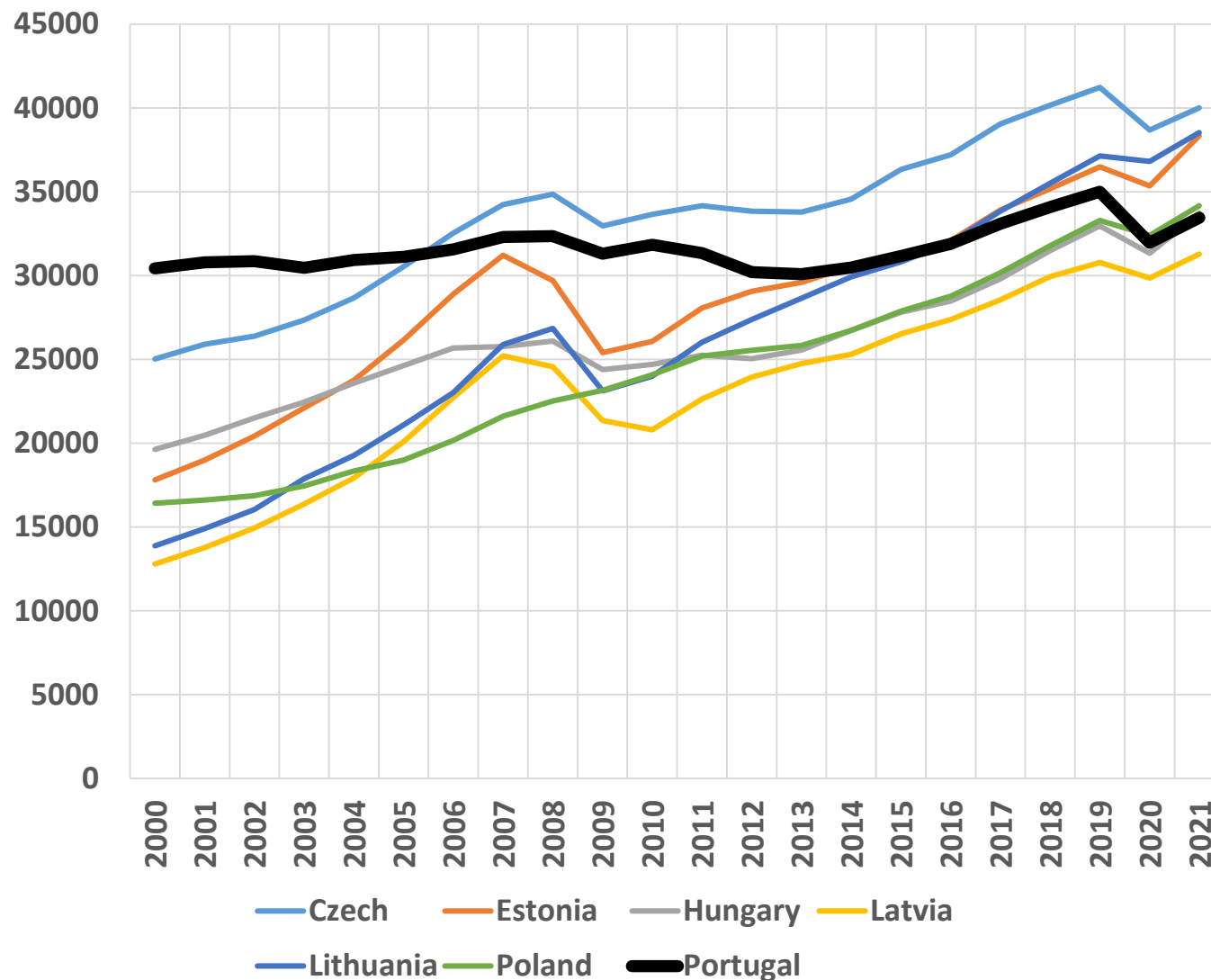
current prices, USD



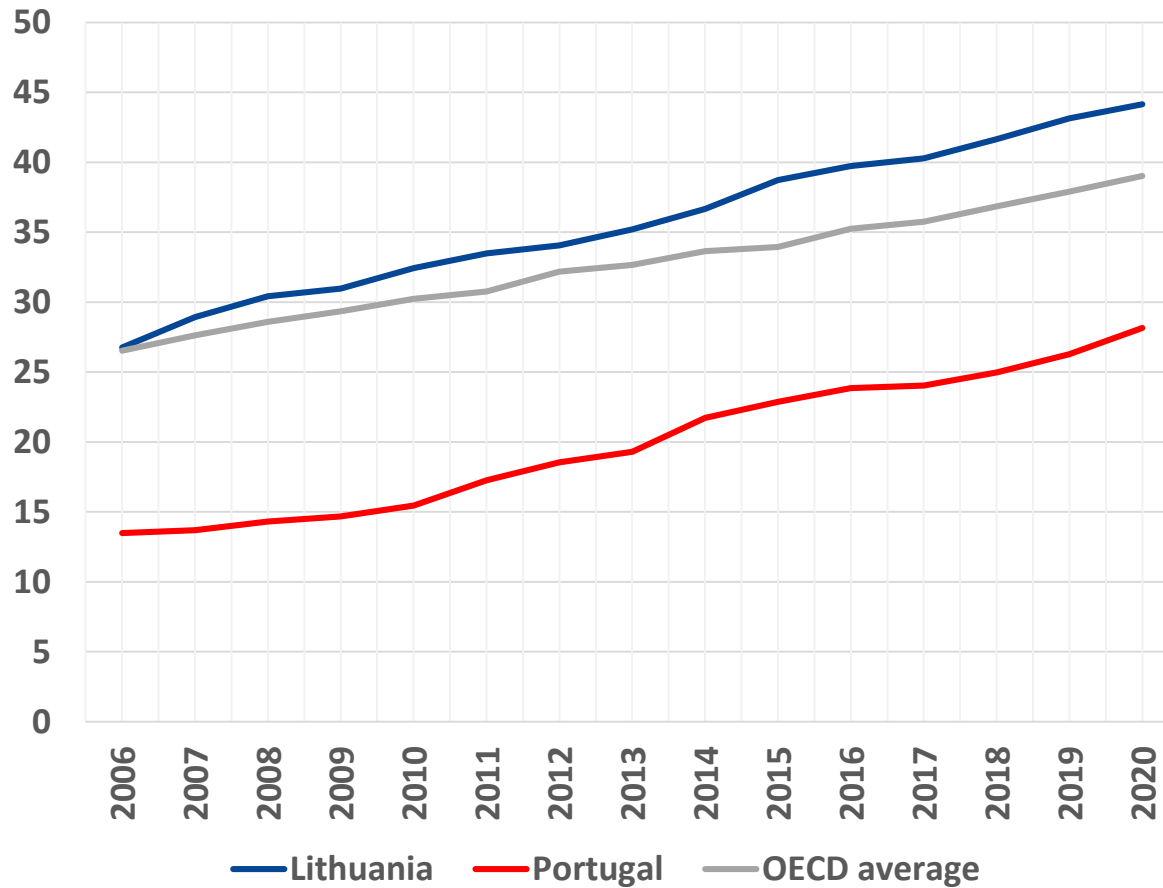
GDP per capita, int. dollars, PPP. IMF



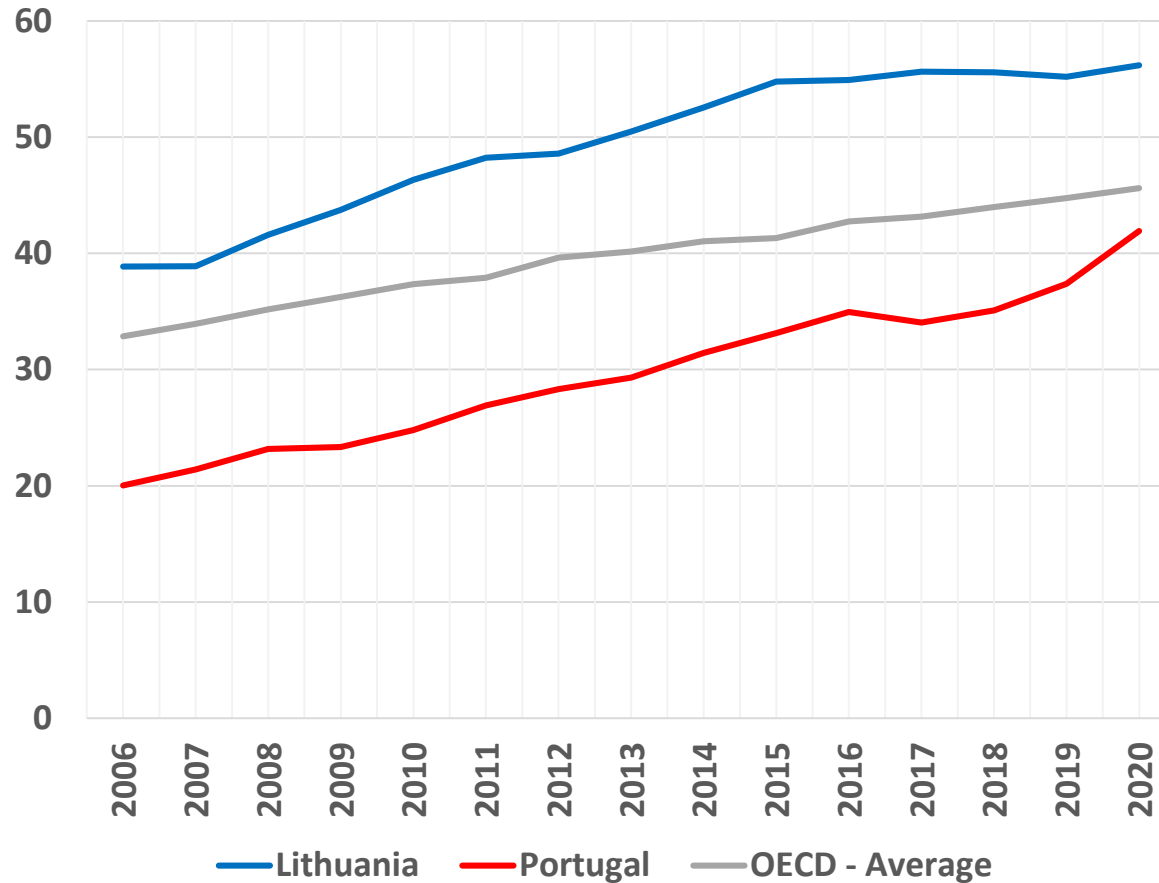
GDP per capita, int. dollars. PPP. IMF



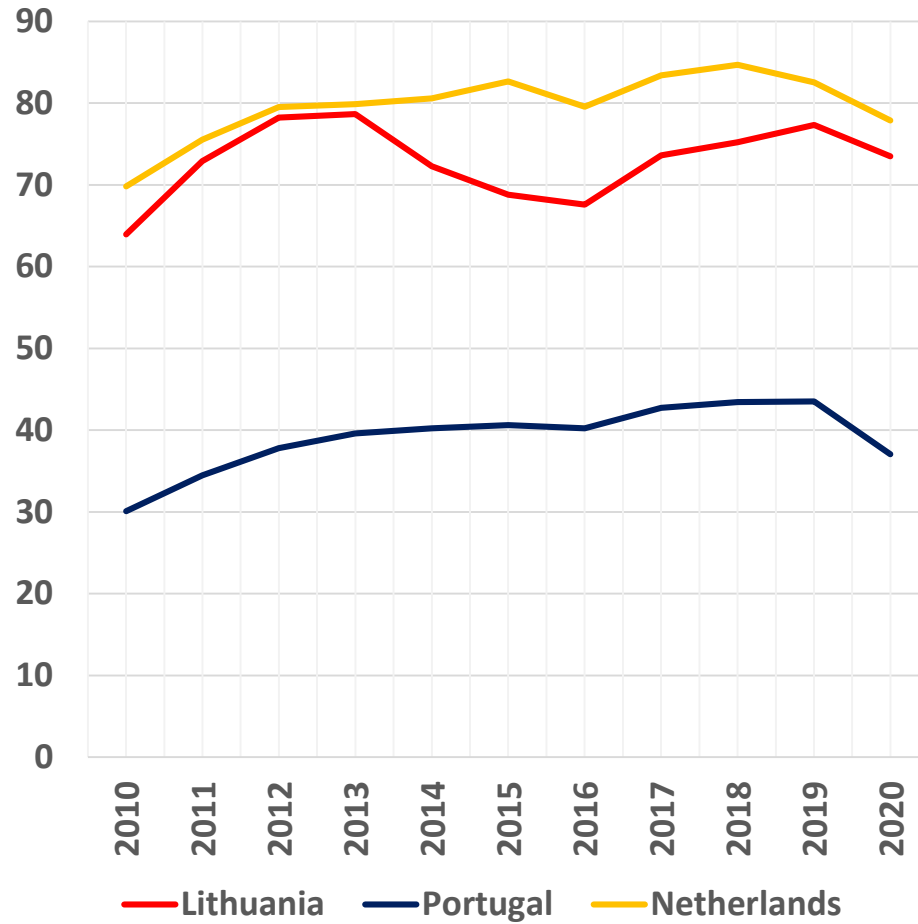
Share of population by educational attainment: tertiary education, 25-64 years. OECD



Share of population by educational attainment: tertiary education, 25-34 years. OECD



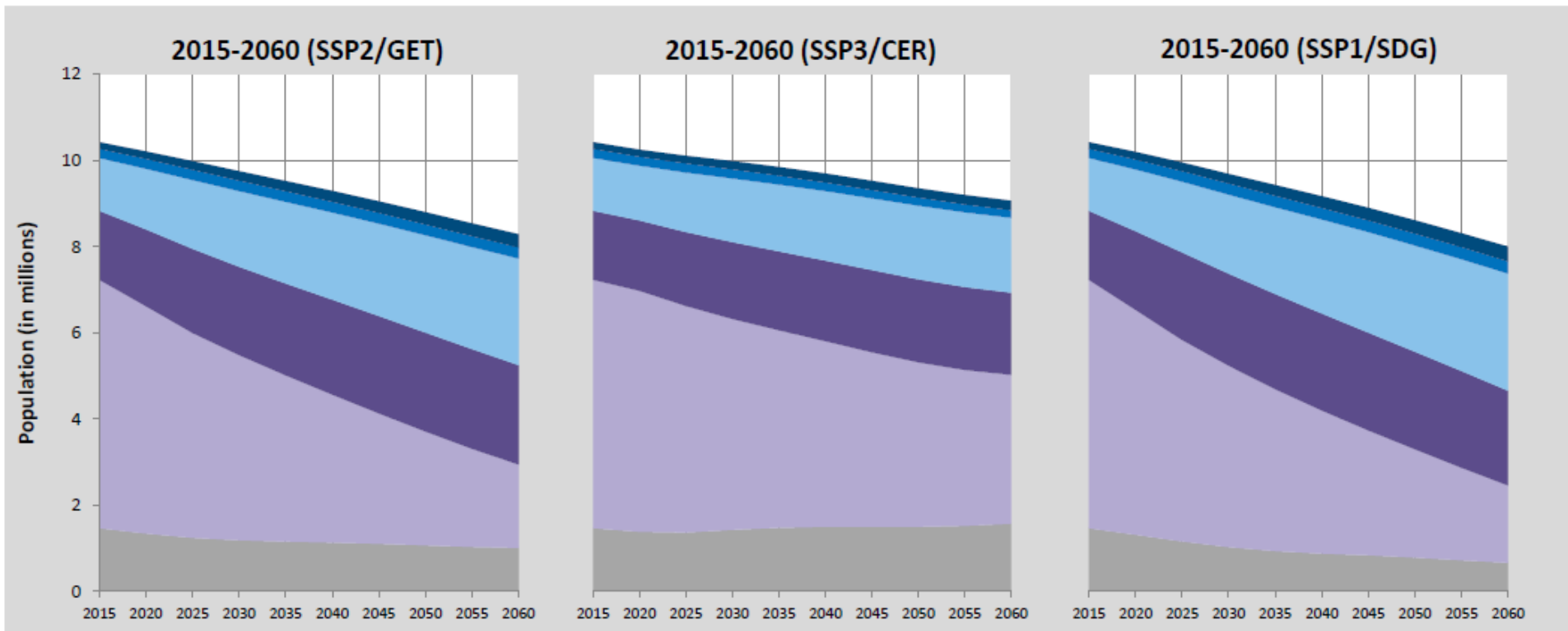
Exports of goods and services (% of GDP). The World Bank



Portugal demographics (three EU scenarios)



Population size by educational attainment according to three scenarios: SSP2/GET, SSP3/CER and SSP1/SDG



Colour legend as in pyramids above

Education scenarios

SSP2/GET : Global Education Trend Scenario (Medium assumption)

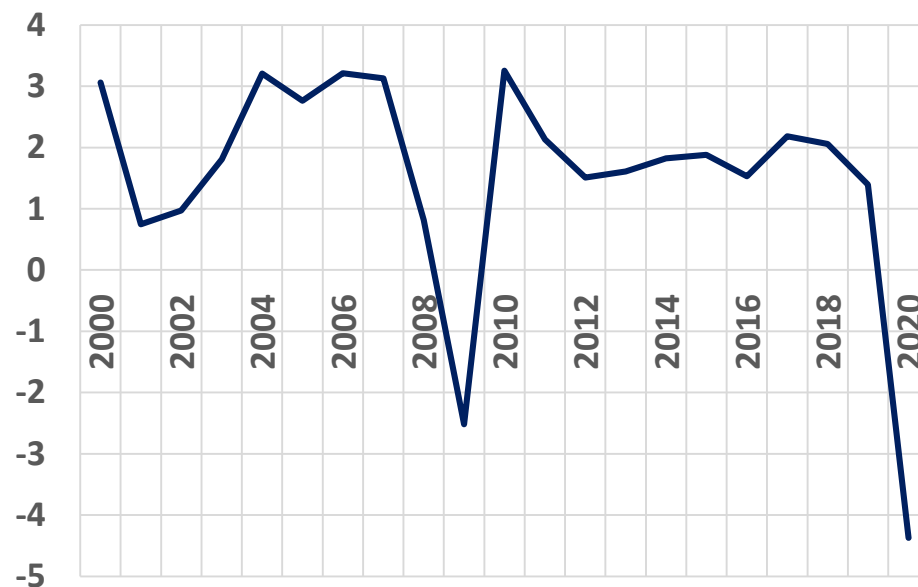
SSP3/CER : Constant Enrollment Rates Scenario (assumption of no future improvements)

SSP1/SDG : Sustainable Development Goal Scenario (universal primary and secondary education by 2030)

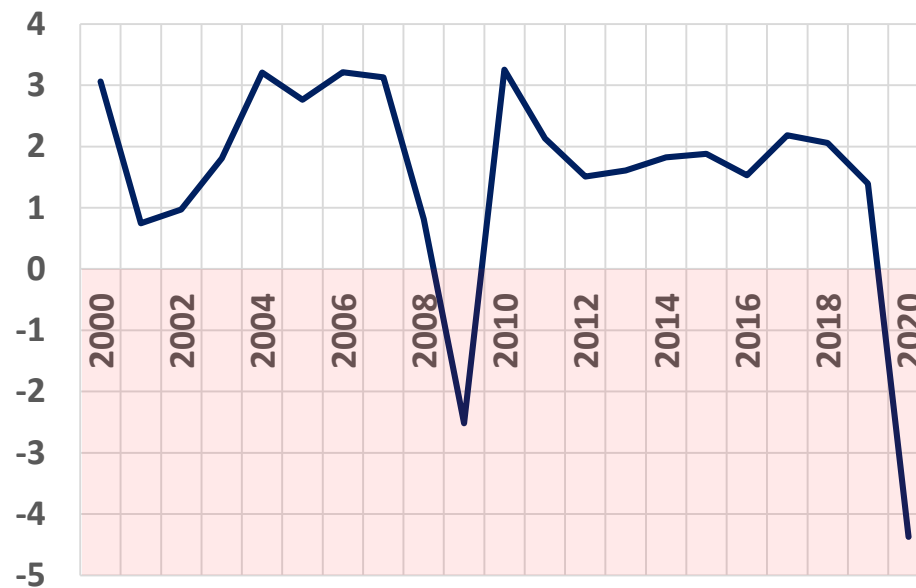
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**World: Real gross domestic product.
Total and per capita, growth rates.
UNCTAD**



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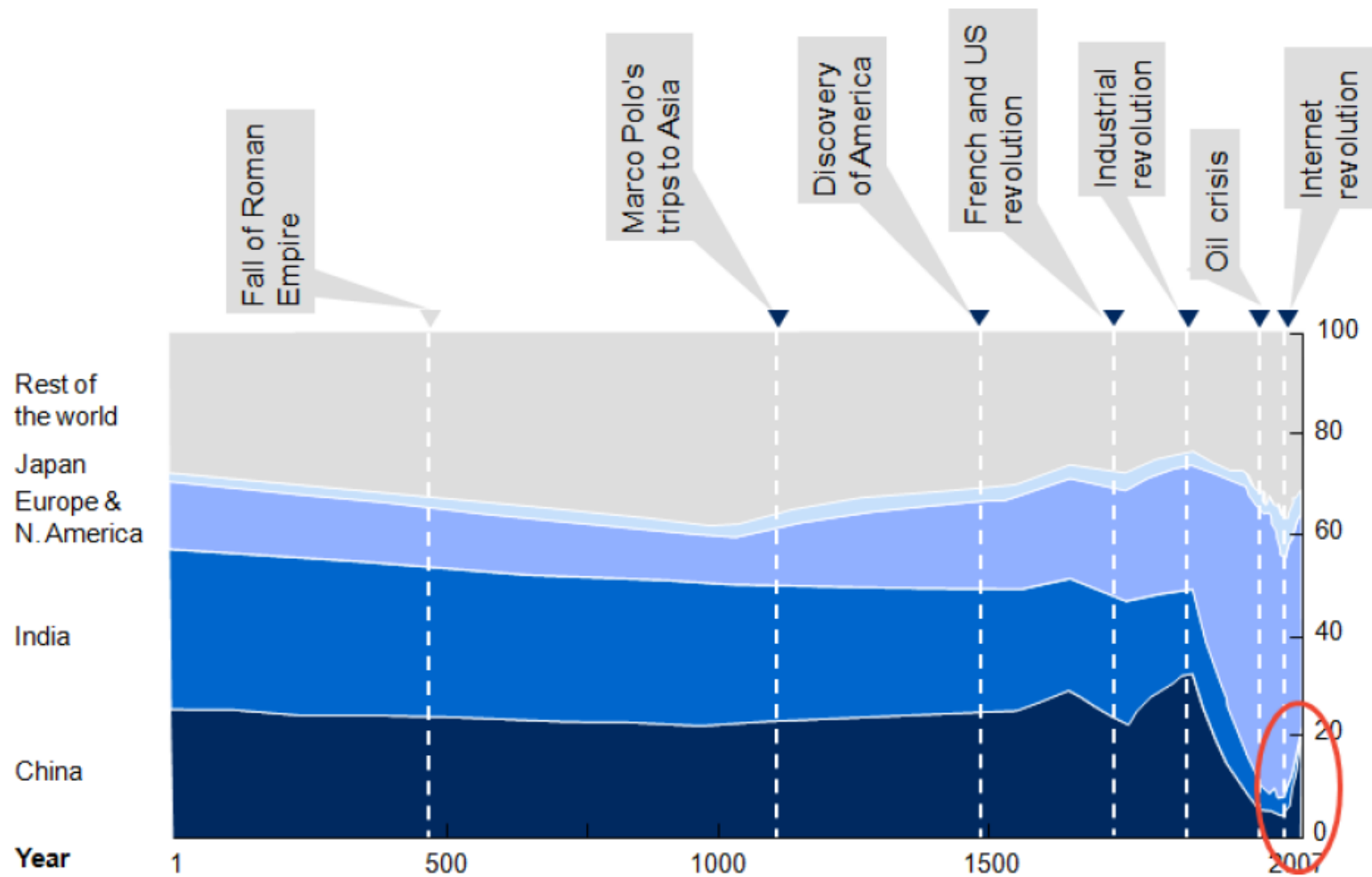
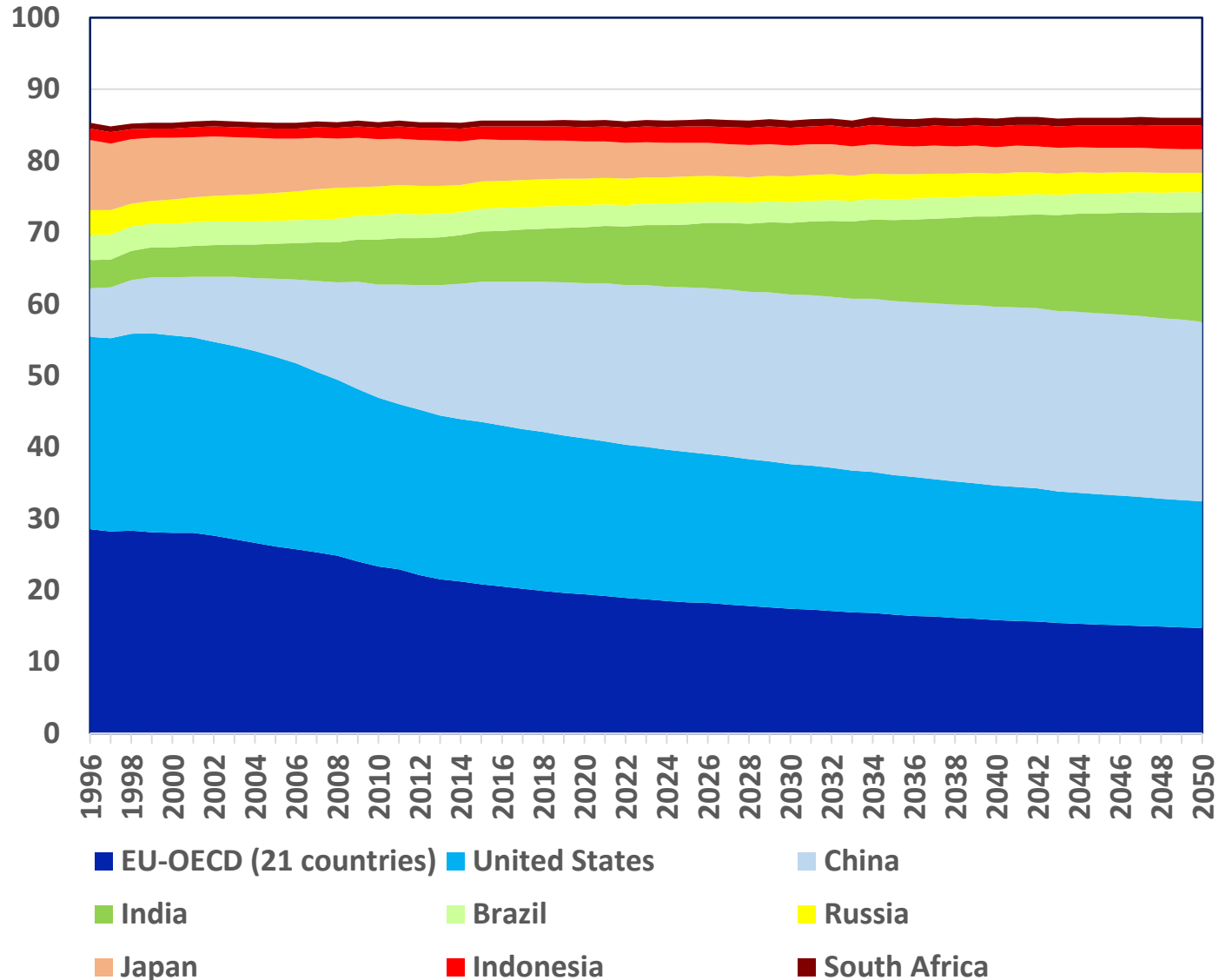


Figure 3.2: Share of total world GDP (1 AD-2007 AD), GDP share in percentage. Asia's GDP was more than half of the world's GDP.

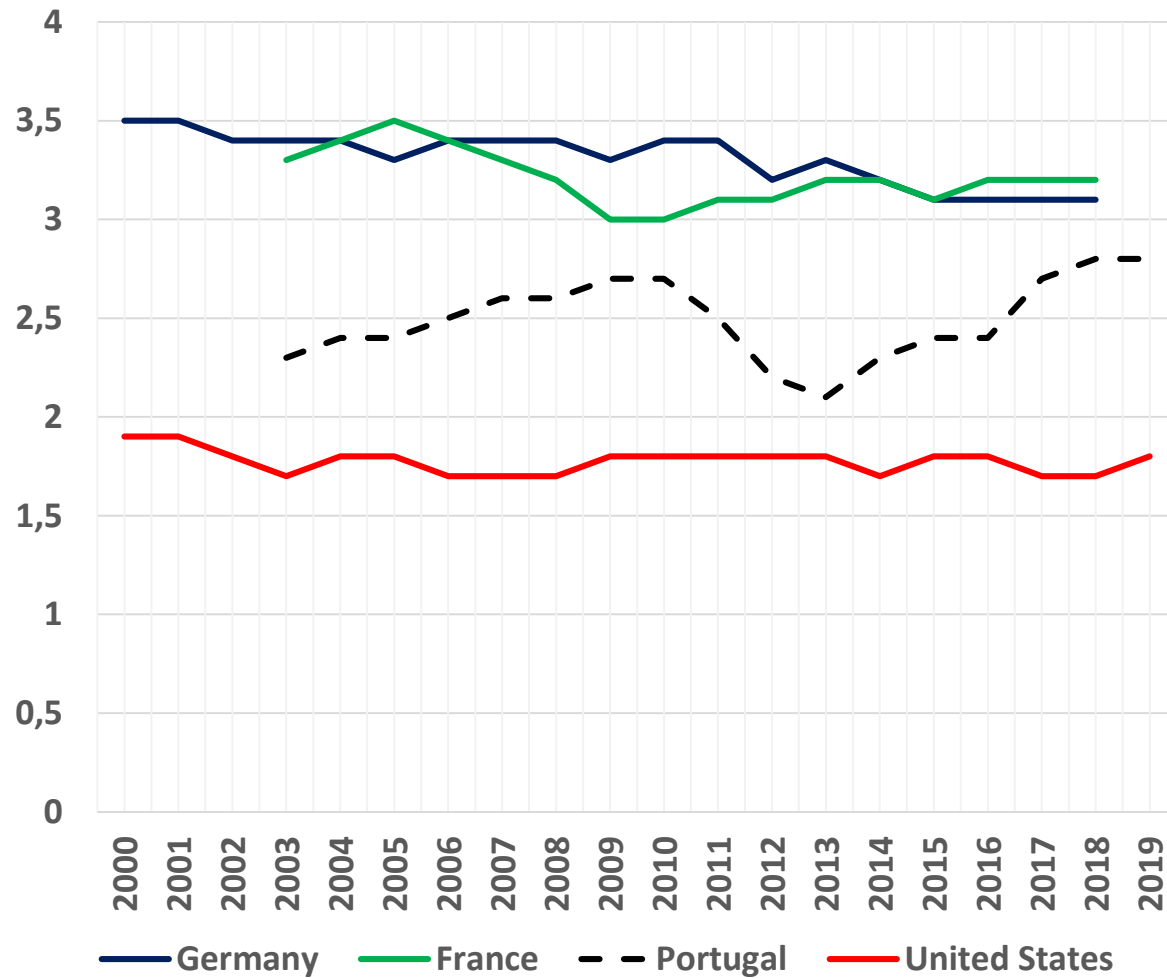
Contributions to global GDP. EEA database



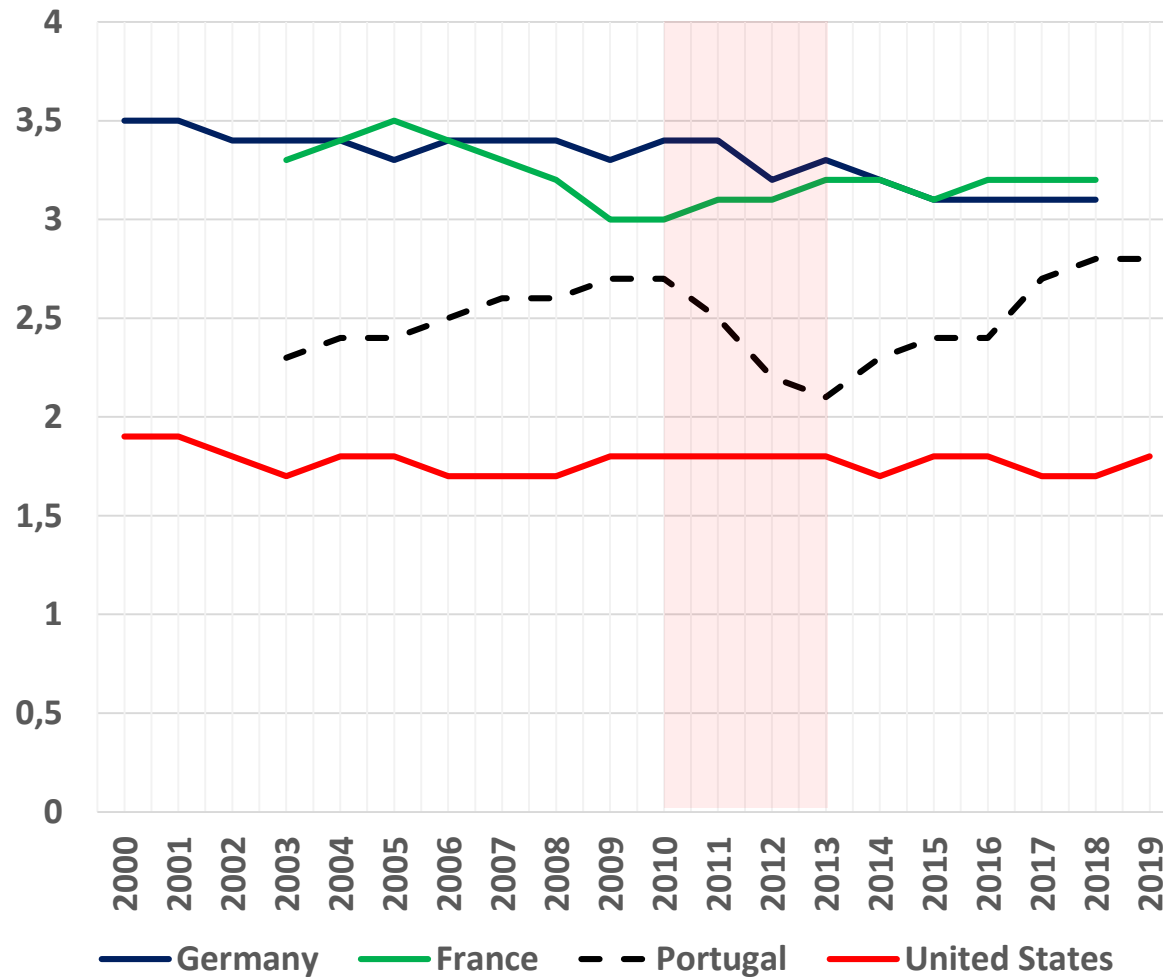
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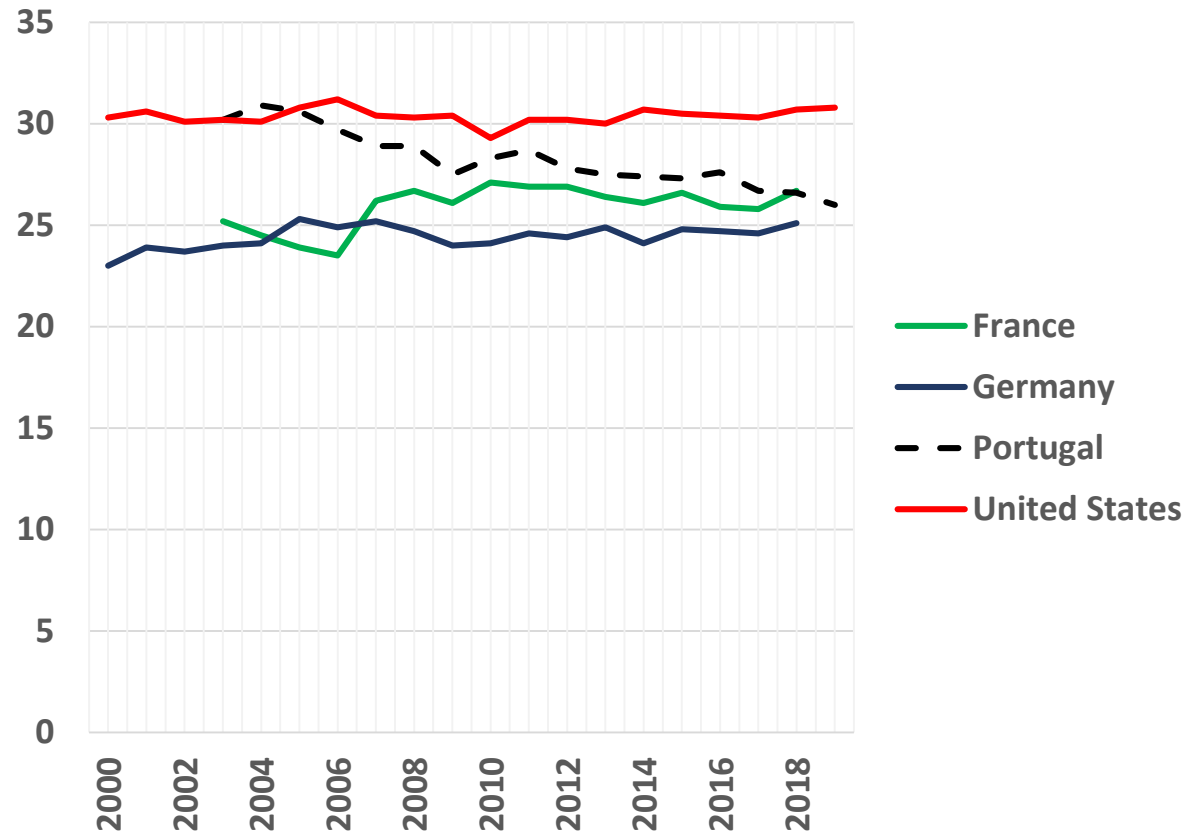
Income share held by lowest 10%. The World Bank



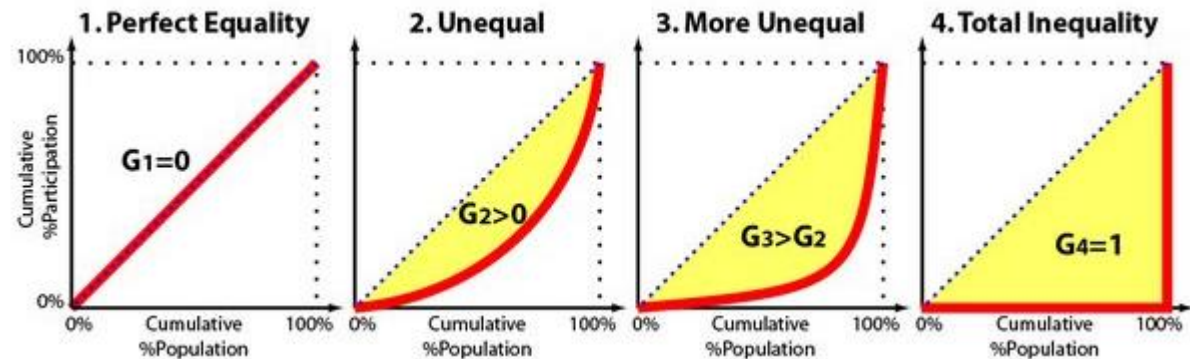
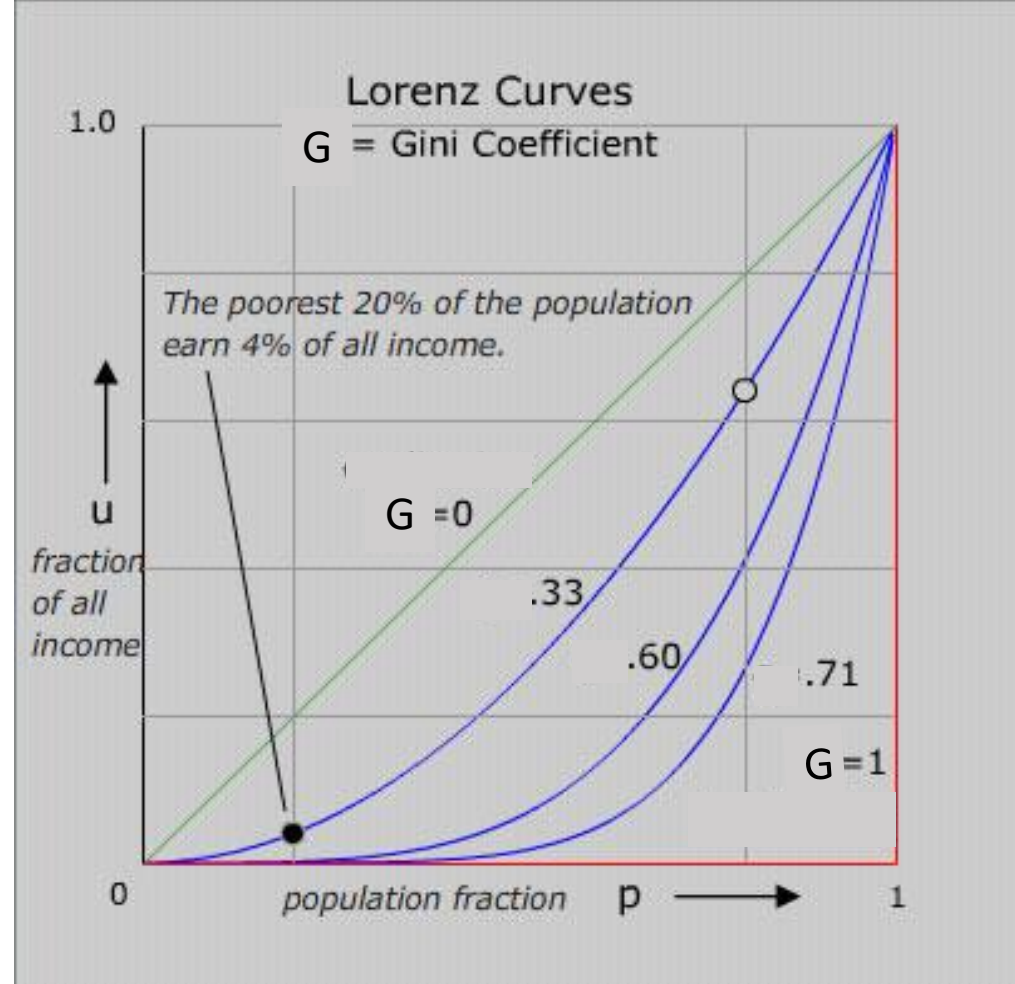
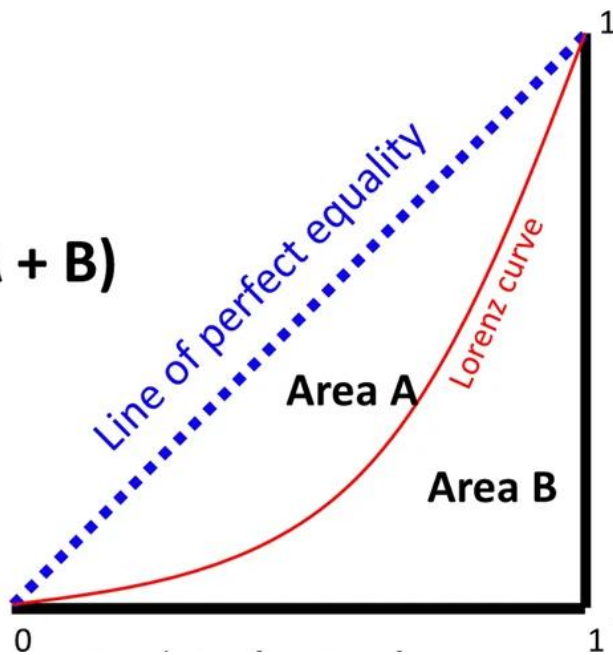
Income share held by lowest 10%. The World Bank



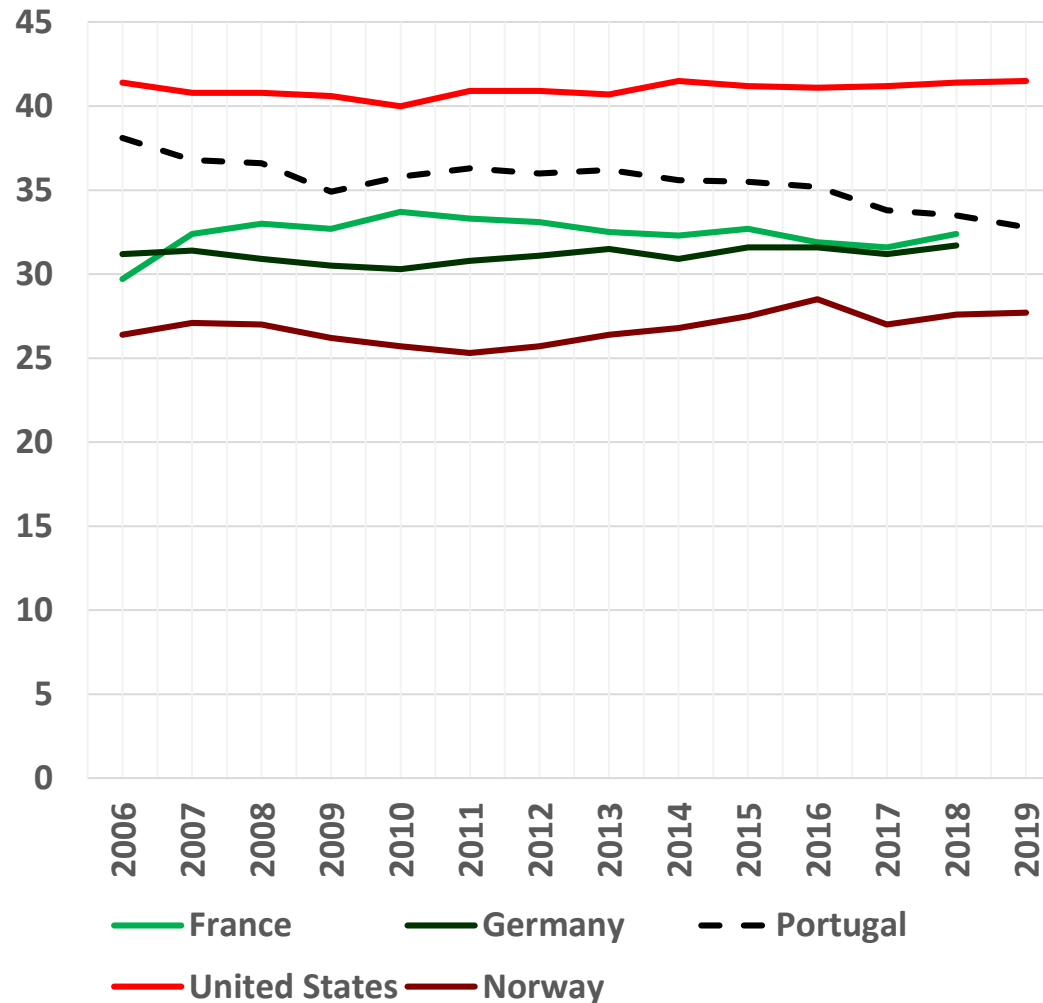
Income share held by highest 10%. The World Bank



$$G = A / (A + B)$$



Gini Index. The World Bank

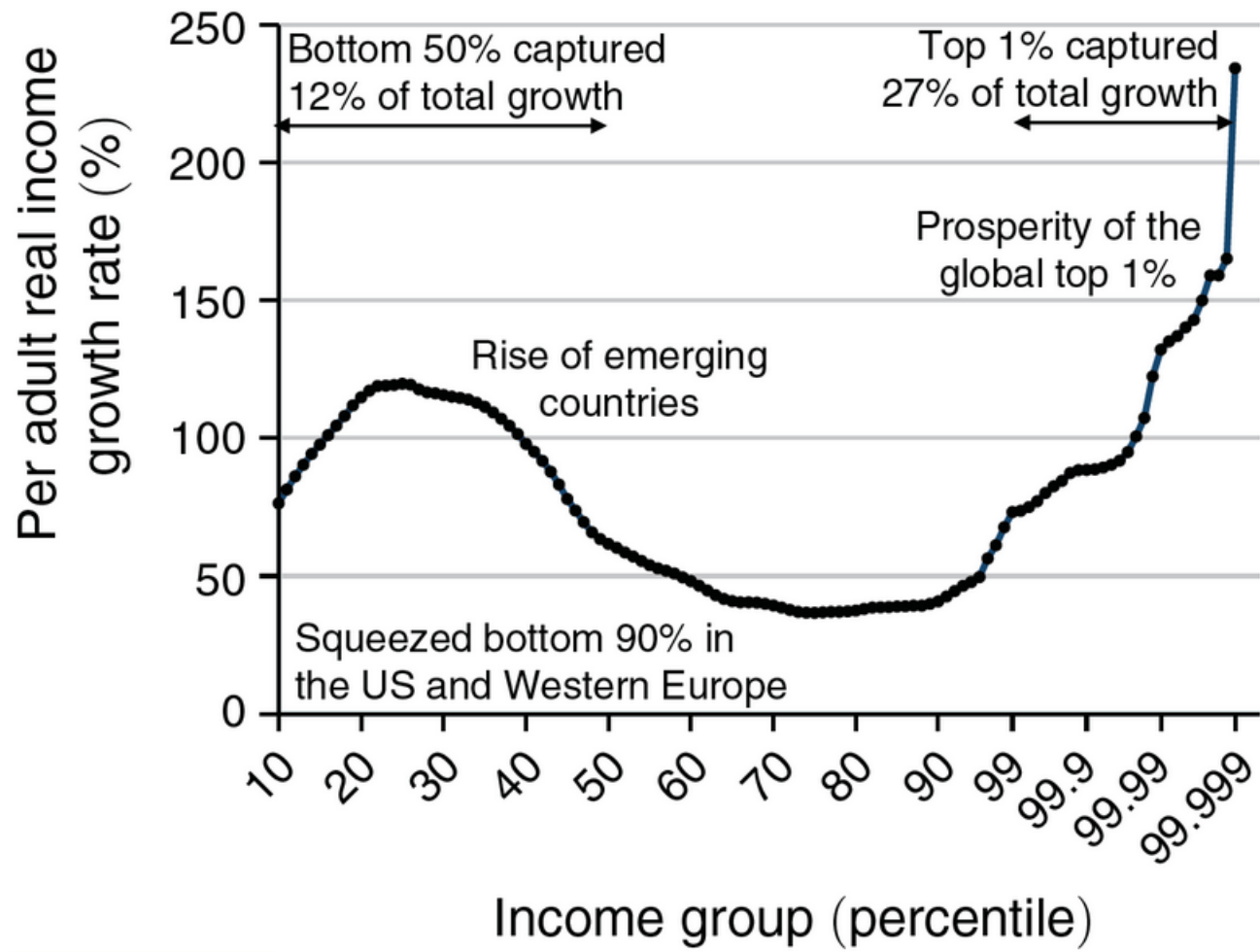


Alvaredo *et al.*, 'The Elephant Curve of Global Inequality and Growth', **American Economic Association – AEA Papers and Proceedings**, 2018, vol.108, pp.103–108
<https://doi.org/10.1257/pandp.20181073> ;
 also: <https://www.aeaweb.org/research/charts/elephant-curve-world-inequality>

The vertical axis shows the total real income growth between 1980 and 2016 for each percentile of the global distribution of income per adult.

The bottom 10 percentiles are excluded as their income levels are close to zero.

The top 1 % is divided into smaller groups (up to the top 0.001 %) so as to better account for its share in total global growth captured.



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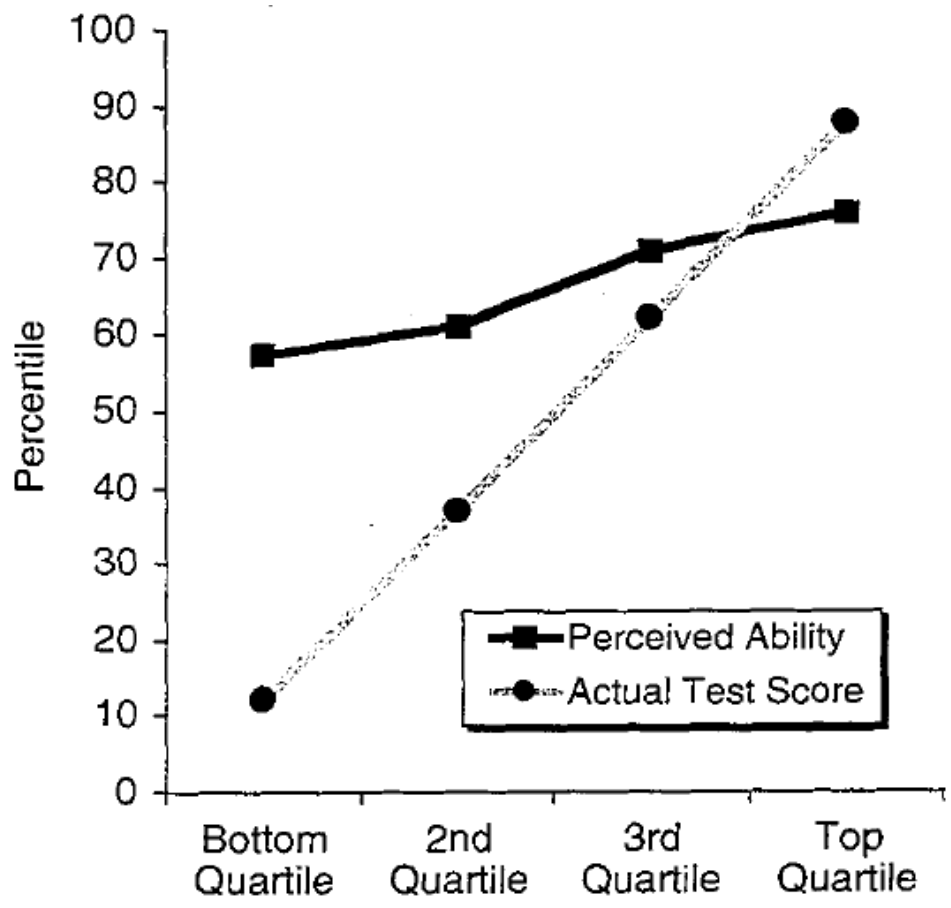
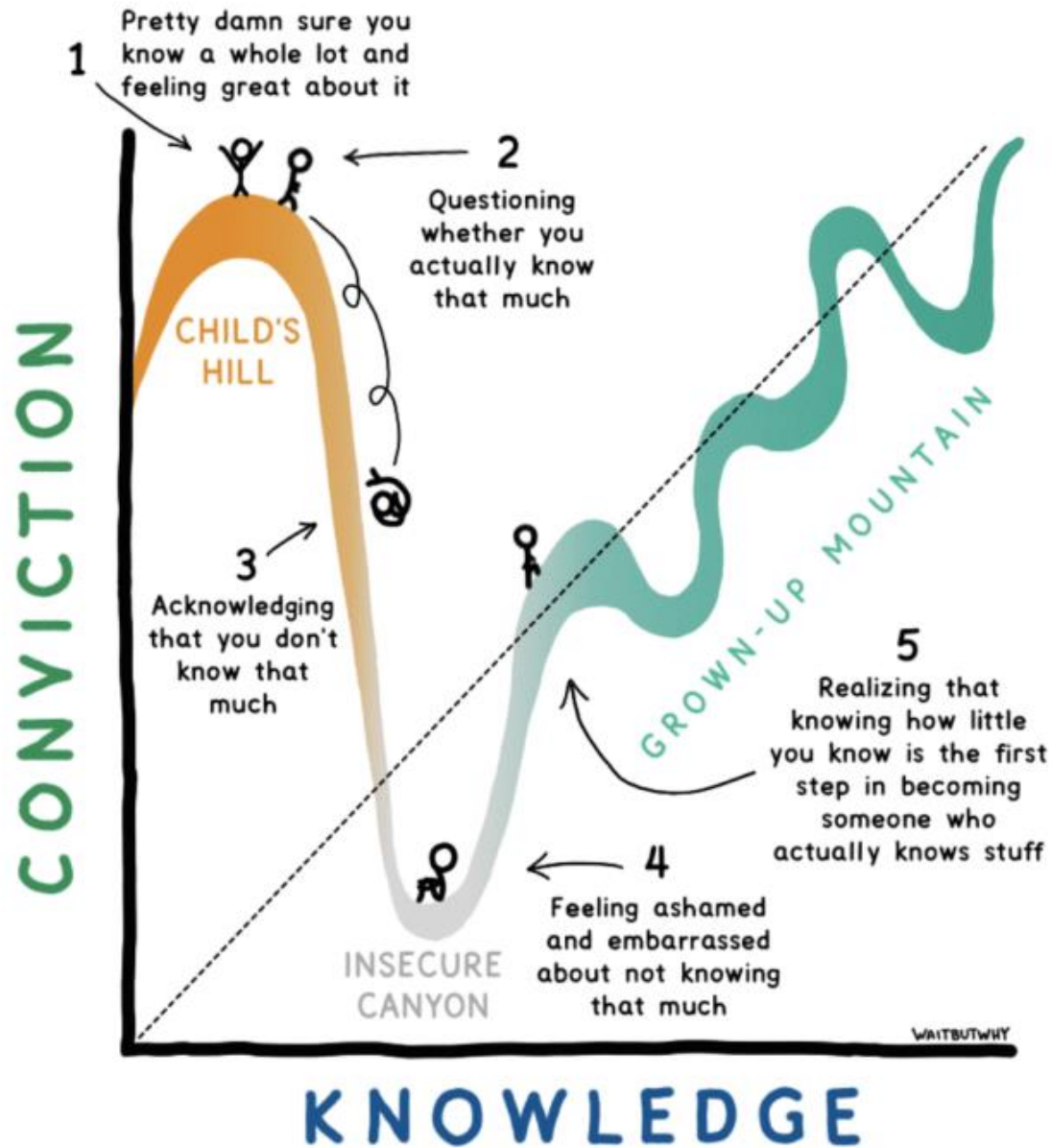
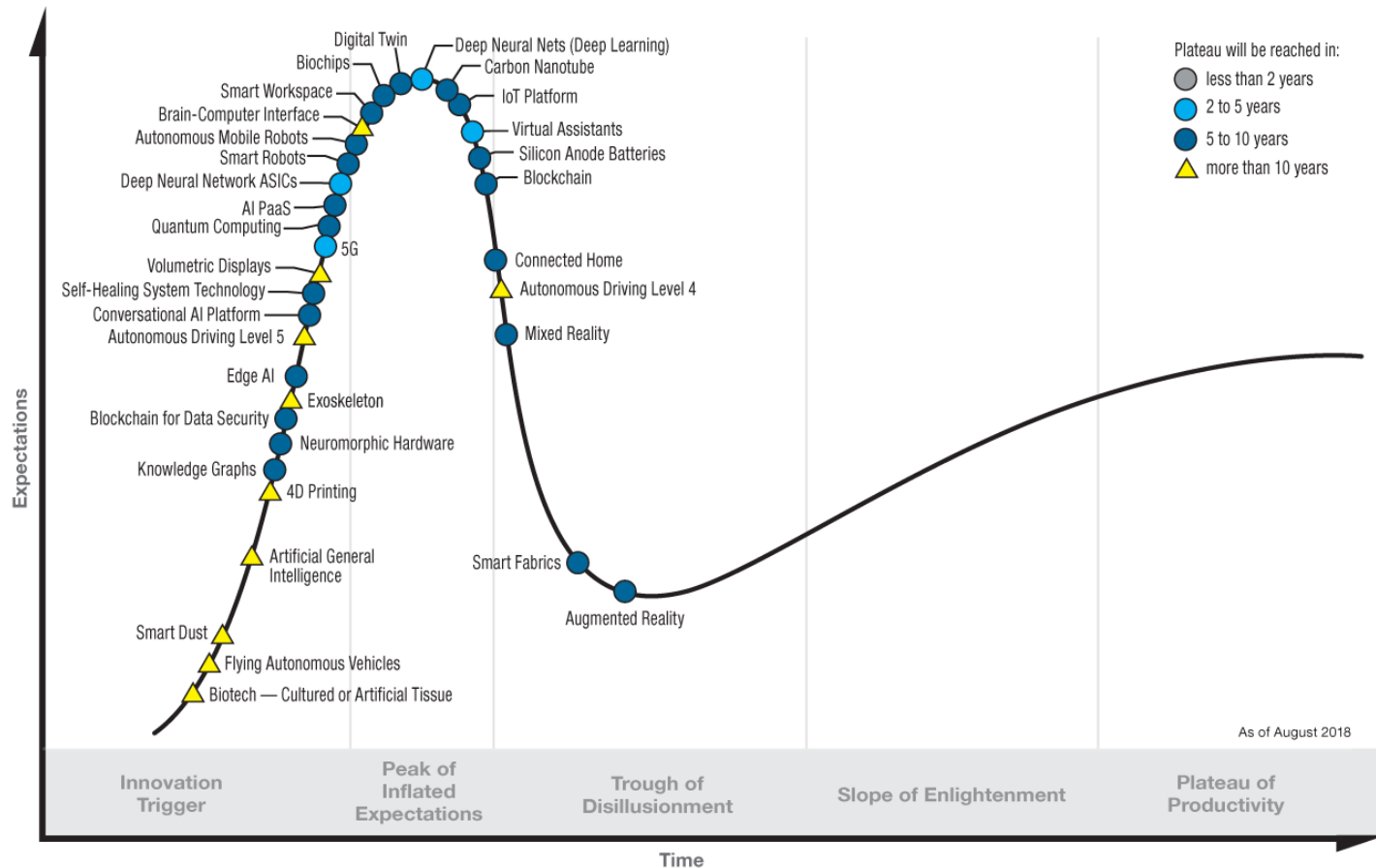


Figure 1. Perceived ability to recognize humor as a function of actual test performance (Study 1).



Hype Cycle for Emerging Technologies, 2018



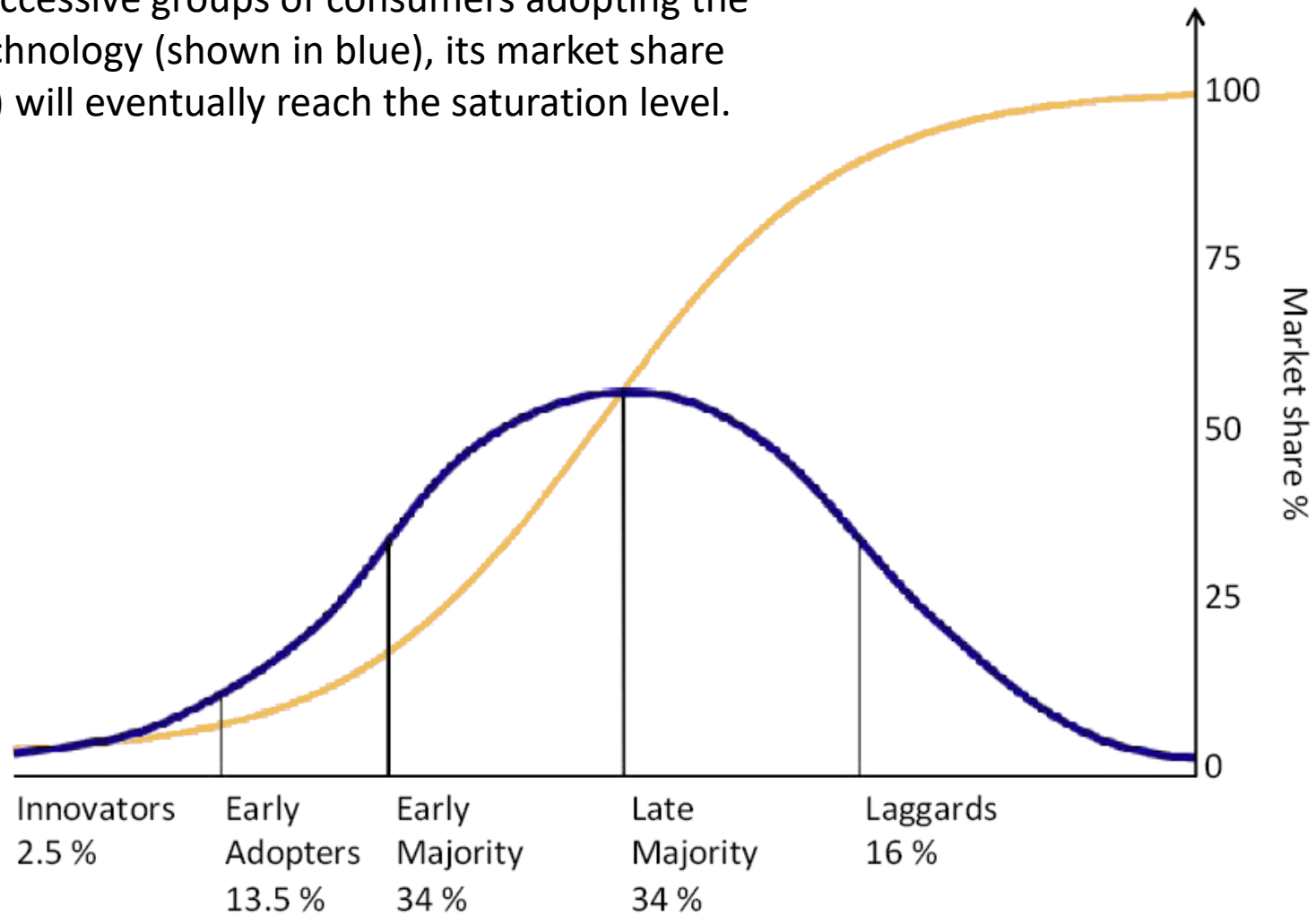
gartner.com/SmarterWithGartner

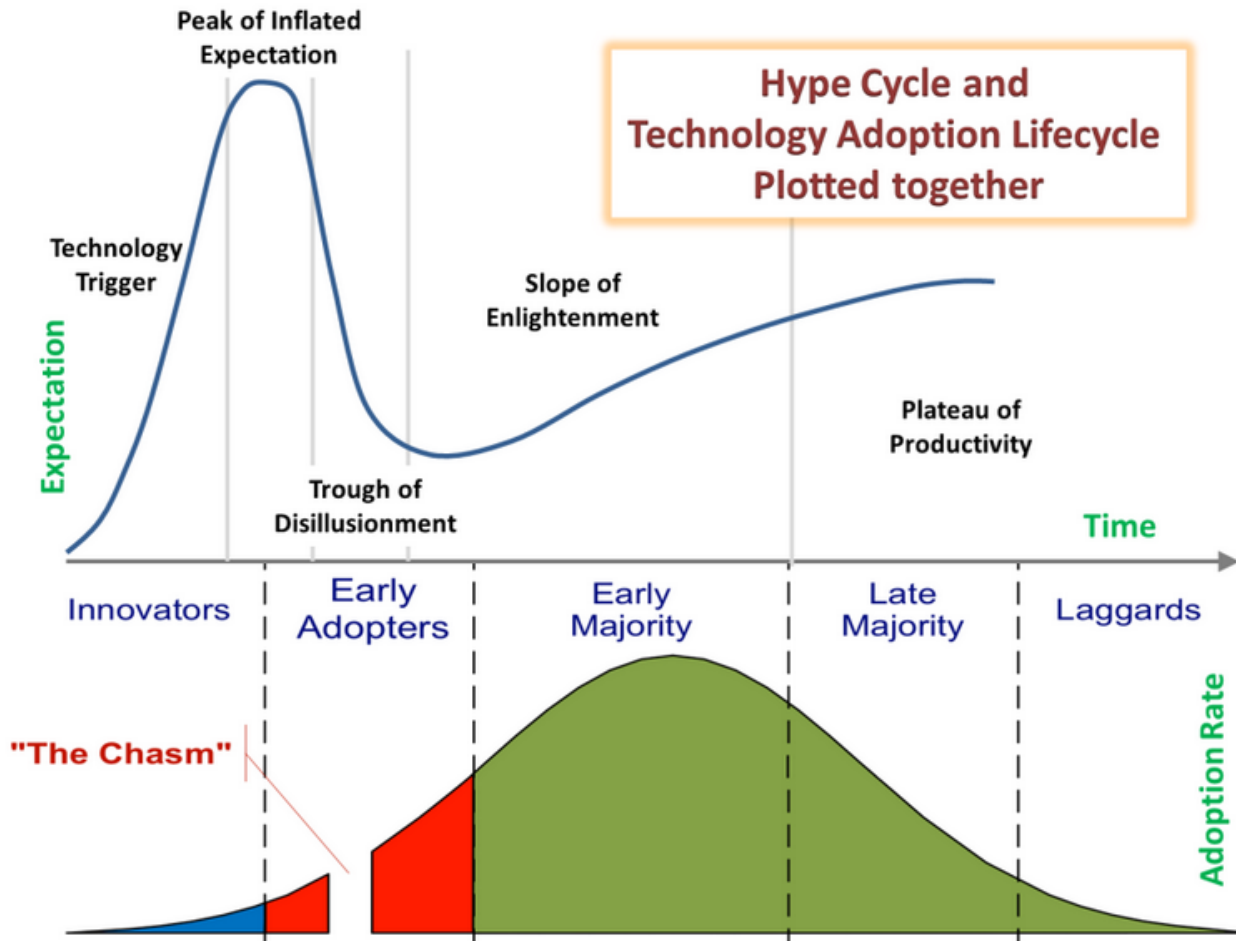
Source: Gartner (August 2018)
 © 2018 Gartner, Inc. and/or its affiliates. All rights reserved.



<https://www.gartner.com/smarterwithgartner/5-trends-emerge-in-gartner-hype-cycle-for-emerging-technologies-2018>

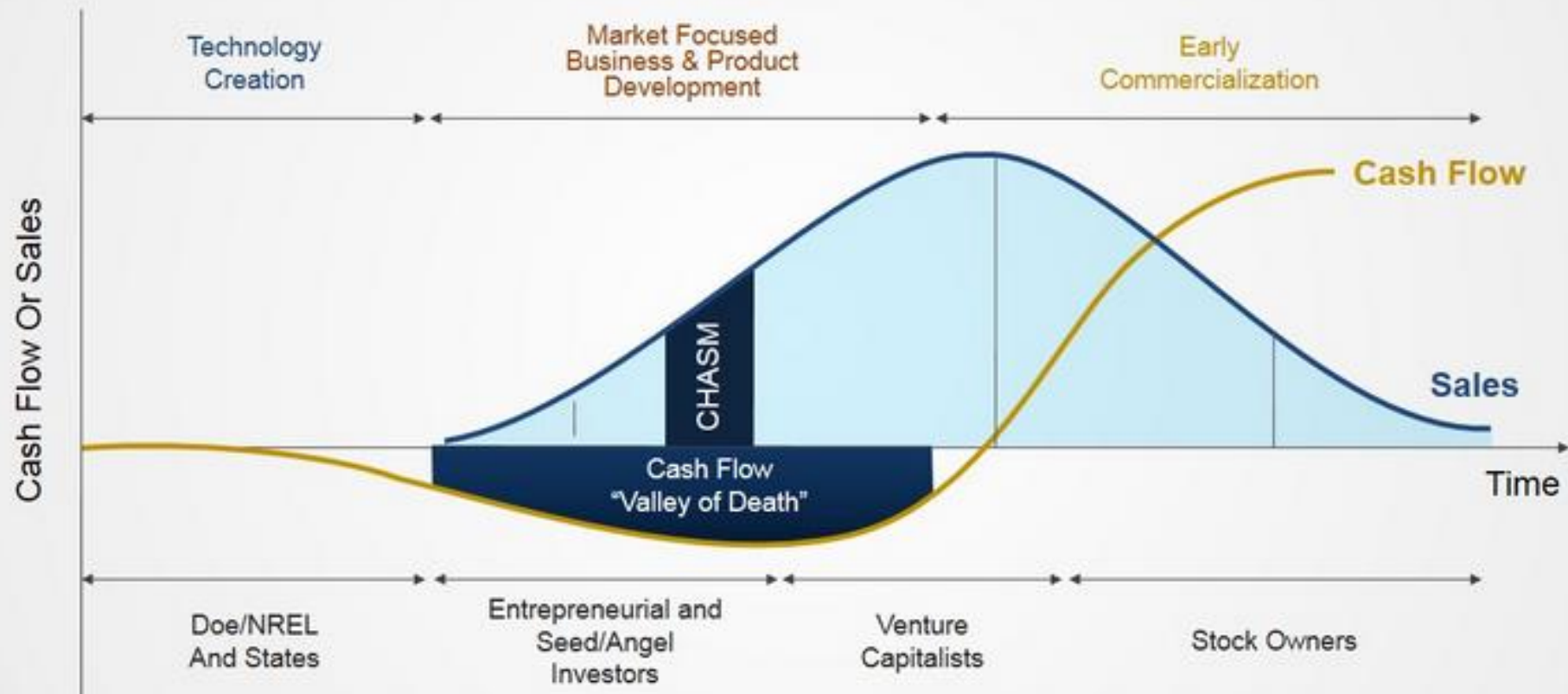
The diffusion of innovations according to Rogers. With successive groups of consumers adopting the new technology (shown in blue), its market share (yellow) will eventually reach the saturation level.





Though the curve looks different and one is plotting “Expectation” and the other is plotting “Adoption Rate”

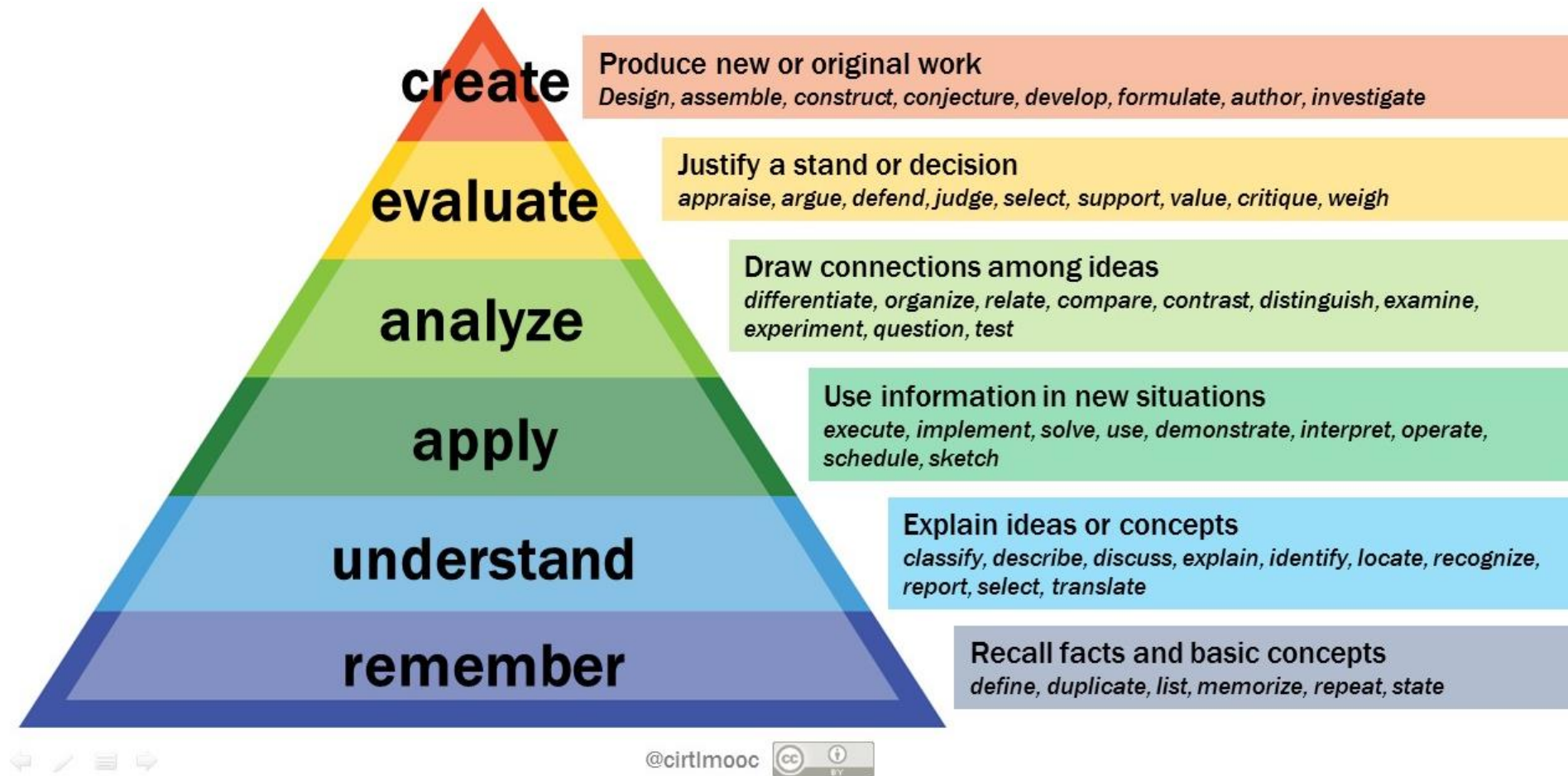
Vallecillo, ‘On the industrial adoption of model driven engineering. Is your company ready for MDE?’, **International Journal of Information Systems and Software Engineering for Big Companies**, vol. 1, 1, pp.52-68, 2014
<https://setandbma.wordpress.com/2012/05/28/technology-adoption-shift/>



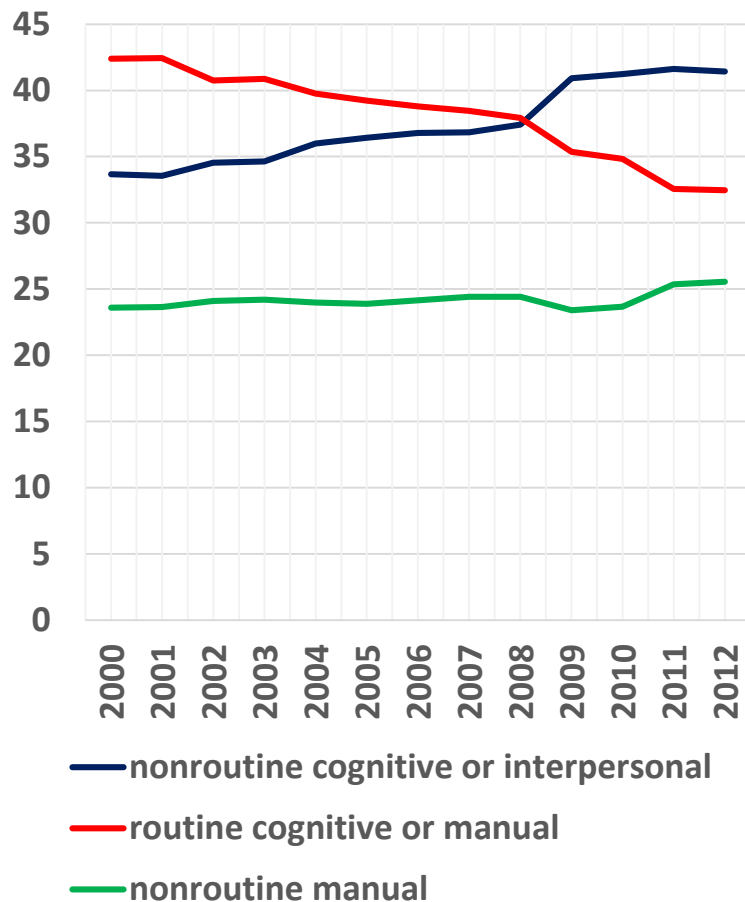
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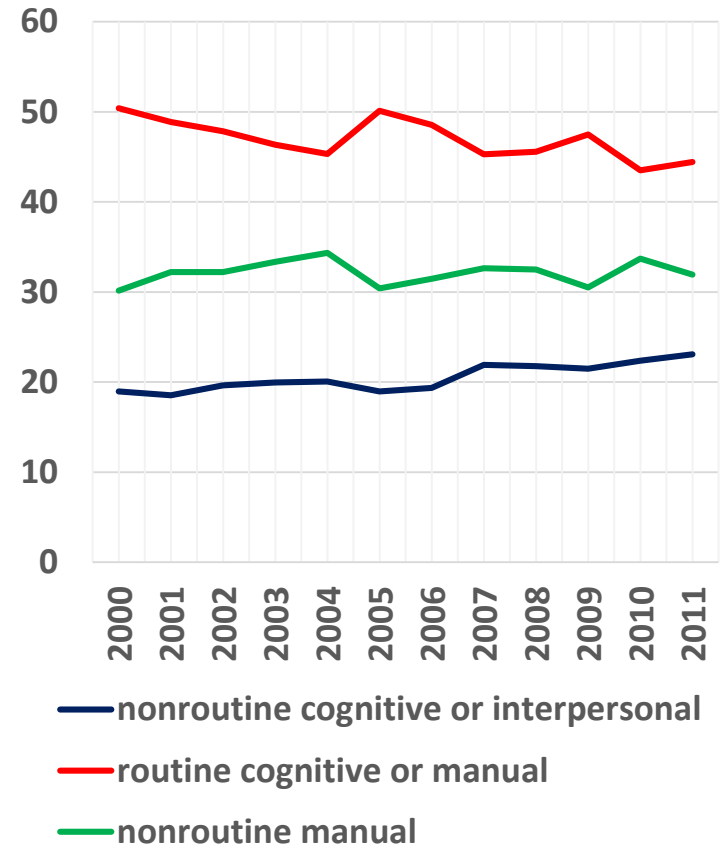
Bloom's taxonomy



High income countries



Low- and middle-income countries



The World Bank, 'World Development Report 2016', 2016, p.124

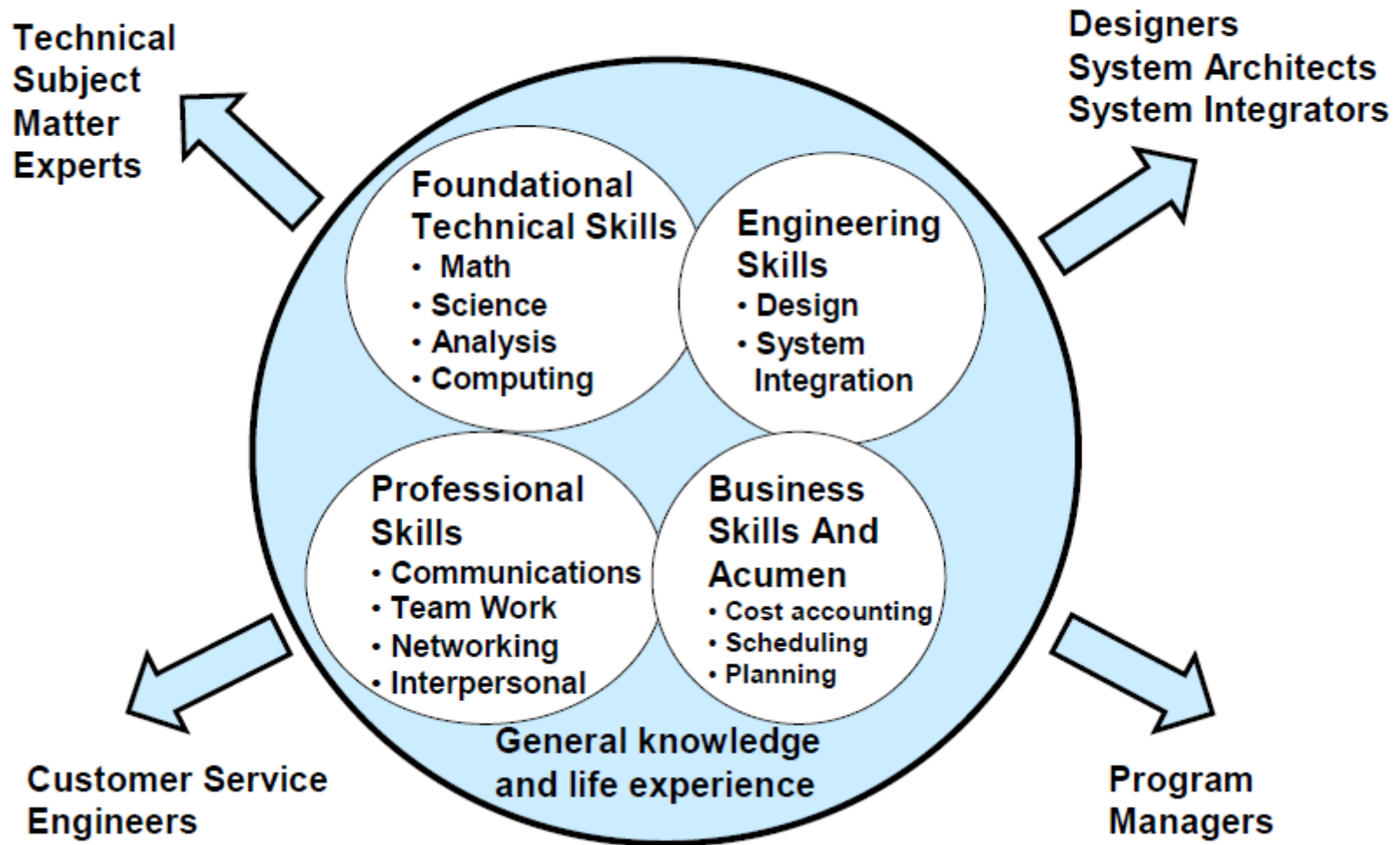
<https://thedocs.worldbank.org/en/doc/240701452003552602-0050022016/render/WDR2016Fig217.pdf>

nonroutine cognitive skills: **abstraction, system thinking, collaboration, and ability to experiment**; see e.g. Robert Reich, 'The Work of Nations', 1992; Kroenk, Boyle, 'Using MIS', 9th ed., 2017, p.43

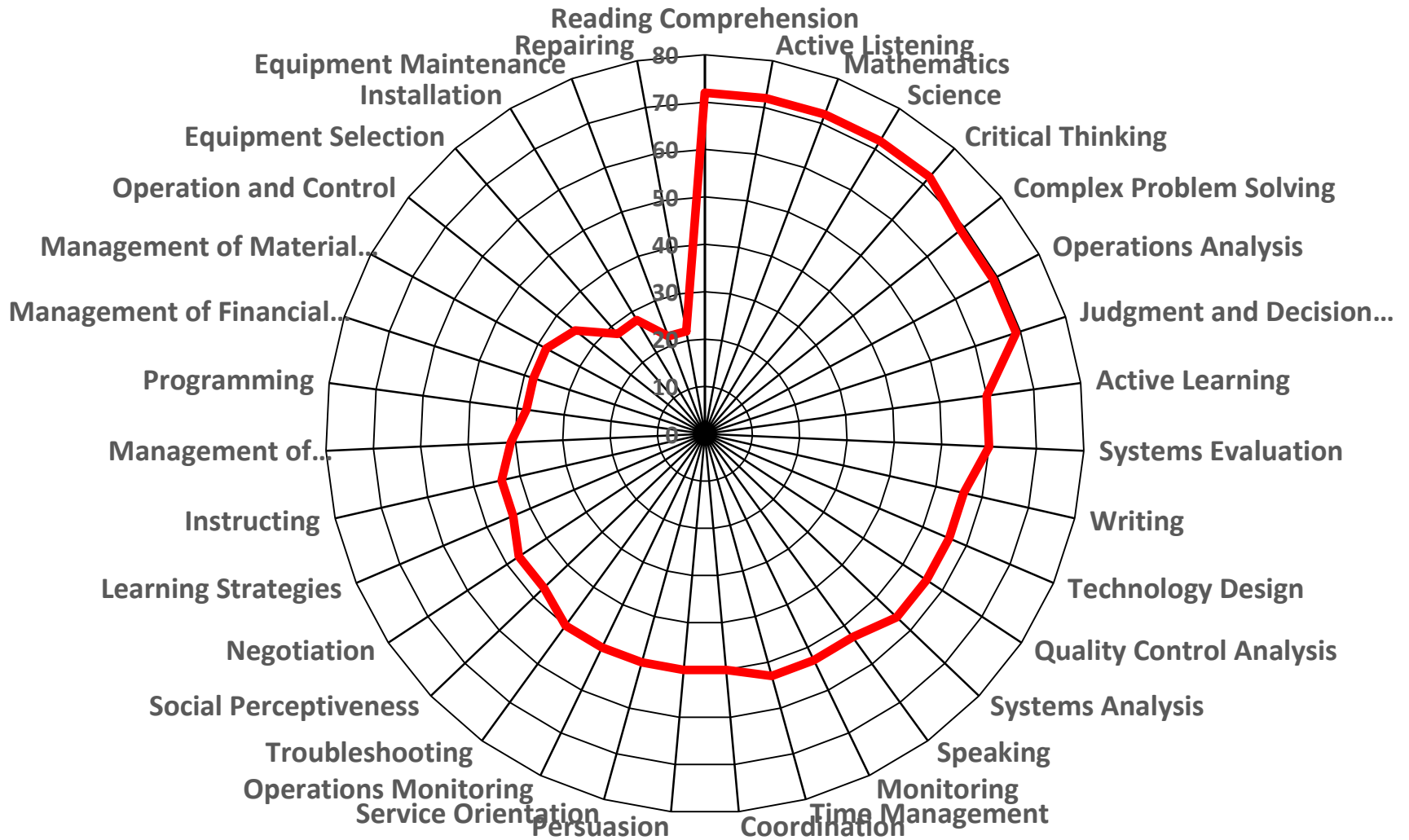
Boeing List of “Desired Attributes of an Engineer”

- **A good understanding of engineering science fundamentals**
 - Mathematics (including statistics)
 - Physical and life sciences
 - Information technology (far more than “computer literacy”)
 - **A good understanding of design and manufacturing processes** (i.e. understands engineering)
 - **A multi-disciplinary, systems perspective**
 - **A basic understanding of the context** in which engineering is practiced
 - Economics (including business practice)
 - History
 - The environment
 - Customer and societal needs
 - **Good communication skills**
 - Written
 - Oral
 - Graphic
 - Listening
 - **High ethical standards**
 - **An ability to think both critically and creatively - independently and cooperatively**
 - **Flexibility. The ability and self-confidence to adapt to rapid or major change**
 - **Curiosity and a desire to learn for life**
 - **A profound understanding of the importance of teamwork.**
- Diversity – wanted and needed !**

Knowledge of Many Skills with Career Choices Based on Talent and Ability



Mech. Eng.s.; skills



Mech. Eng.s.; work activities



The Occupational Information Network (O*NET) is developed under the sponsorship of the **U.S. Department of Labor/Employment and Training Administration** (USDOL/ETA) through a grant to the North Carolina Department of Commerce.

Outline

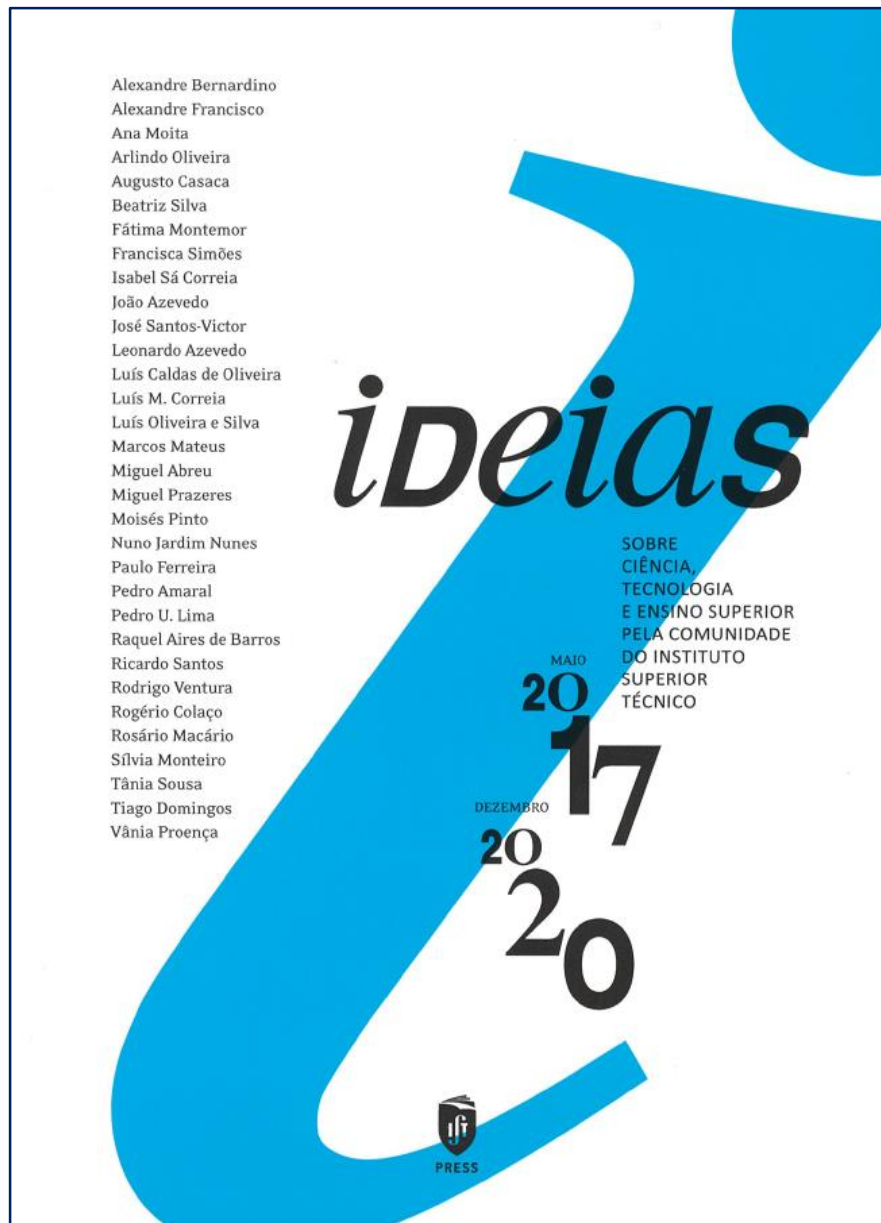
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Seven common characteristics in innovative and entrepreneurial people

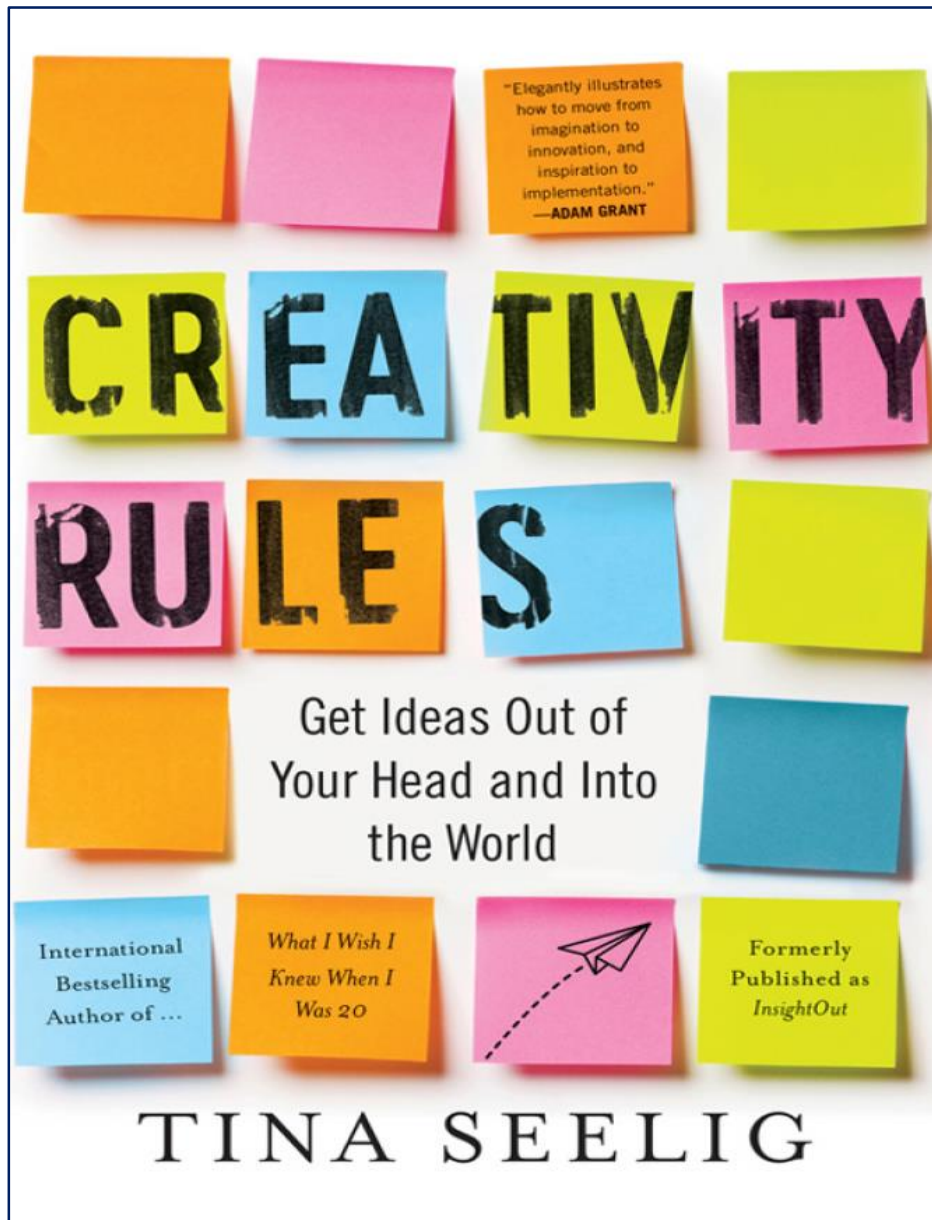
- Confidence in others;
- Acceptance of failure;
- How to interact with people different from us;
- Will to change the world;
- Team work;
- Done is better than perfect;
- How to cope with uncertainty.

Berkeley Innovation Index

<https://innovation-index.anvil.app/>



‘Ideias sobre Ciência, Tecnologia e Ensino Superior pela Comunidade do Instituto Superior Técnico’
Maio de 2017 a Dezembro 2020



The invention cycle:

Imagination is envisioning things that do not exist

Creativity is applying imagination to address a challenge

Innovation is applying creativity to generate unique solutions

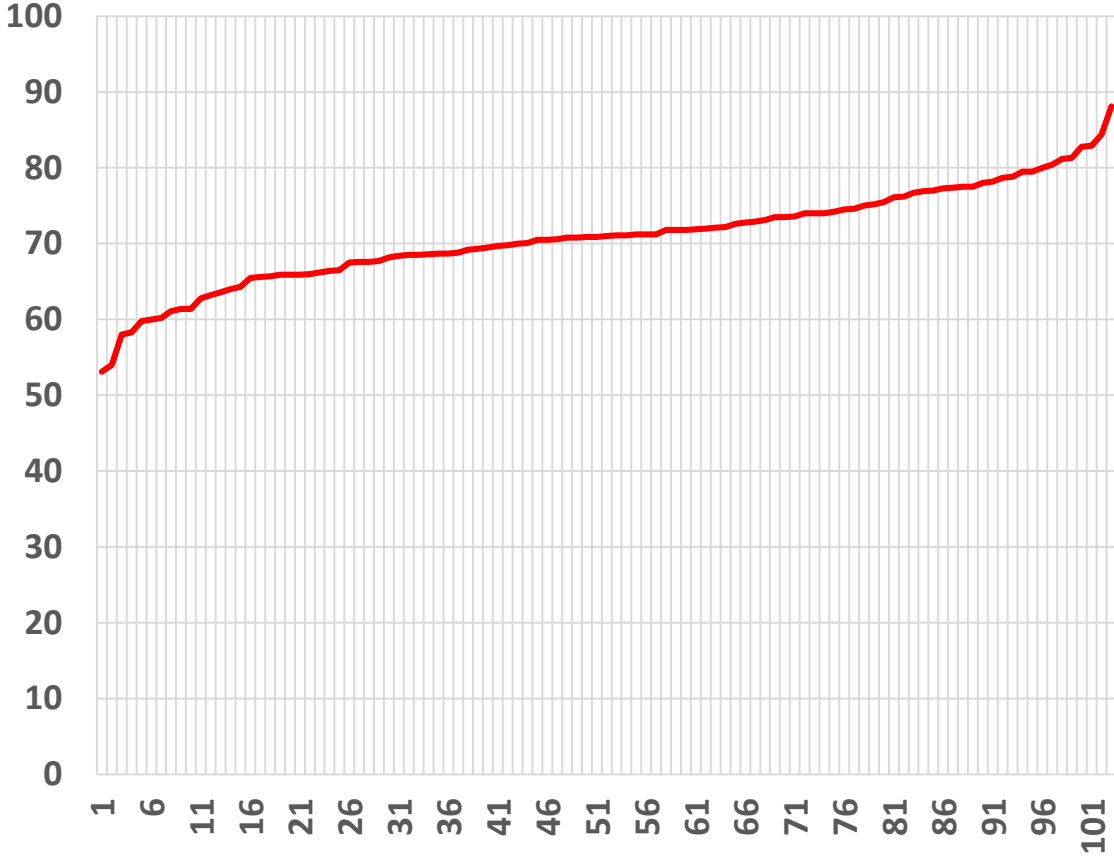
Entrepreneurship is applying innovation, scaling ideas, and thereby inspiring others' imagination

(Luís Caldas de Oliveira, in 'Ideias 2017-2020', IST Press, p.164, p.198, p.312)

SCET Mindset Description and equivalent psychological constructs

Mindset and Description	Psychological Construct	Questionnaire Scale
<p>Friend or Foe If you can't tell: Learn to trust others without expecting anything in return.</p>	Social cohesion, honest behaviour (Fukuyama, 1995)	Trust
<p>Plan to Fail It is necessary to be wrong sometimes. Plan to Experiment. Plan to Fail (Fail Fast). Analyze, Adapt and repeat. The smarter you think you are, the harder this is going to be.</p>	Grit, resilience, entrepreneurial failure (Sarasvathy, 2001)	Resilience
<p>Diversify Diversify your networks. Connect to people you would not normally, then go and listen. Open Up. And connect them to others.</p>	Social capital (Dubini and Aldrich, 1991)	Diversity
<p>Believe Believe that you can change the world.</p>	Self-efficacy (Bandura, 1977)	Belief
<p>Good Enough Perfection is no good but good enough is perfect.</p>	Perfectionism (Kawasaki, 2004)	Perfection
<p>Collaboration Individual vs. team and competitors vs. partners.</p>	Coopetition (Vanaelst & al., 2006)	Collaboration

sample of 1st year FEUP Mech. Eng. students (lic.),
April 2022.
Berkeley Innovation Index





The impact of a lack of mathematical education on brain development and future attainment

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Edited by Tim Shallice, Institute of Cognitive Neuroscience, London, United Kingdom, and accepted by Editorial Board Member Michael S. Gazzaniga November 6, 2020 (received for review June 25, 2020)

Formal education has a long-term impact on an individual's life. However, our knowledge of the effect of a specific lack of education, such as in mathematics, is currently poor but is highly relevant given the extant differences between countries in their educational curricula and the differences in opportunities to access education. Here we examined whether neurotransmitter concentrations in the adolescent brain could classify whether a student is lacking mathematical education. Decreased γ -aminobutyric acid (GABA) concentration within the middle frontal gyrus (MFG) successfully classified whether an adolescent studies math and was negatively associated with frontoparietal connectivity. In a second experiment, we uncovered that our findings were not due to pre-existing differences before a mathematical education ceased. Furthermore, we showed that MFG GABA not only classifies whether an adolescent is studying math or not, but it also predicts the changes in mathematical reasoning \sim 19 mo later. The present results extend previous work in animals that has emphasized the role of GABA neurotransmission in synaptic and network plasticity and highlight the effect of a specific lack of education on MFG GABA concentration and learning-dependent plasticity. Our findings reveal the reciprocal effect between brain development and education and demonstrate the negative consequences of a specific lack of education during adolescence on brain plasticity and cognitive functions.

mathematical education | GABA | plasticity | middle frontal gyrus

Educational decisions have a long-lasting impact on both the individual and wider society (1). Mathematical education and attainment has been associated with several quality-of-life indices, including educational progress, socioeconomic status, employment, mental and physical health, and financial stability (2–5). In several countries, such as the United Kingdom and India, 16-y-old adolescents as part of their advanced (i.e., A-level) subjects can choose to stop studying math. The consequences of not choosing math as an A-level subject can be significant. When controlling for potential confounding factors such as socioeconomic status it emerged that the decision to not study math as an A-level subject can lead to an 11% decrease in financial income compared to those who choose to study math as part of their A-level curriculum. No other A-level subject category is associated with such a wage premium (6). In addition, previous studies highlighted the cognitive, emotional, and social factors that are associated with mathematical education (7, 8).

In recent years, there has been significant interest in the investigation of the neural substrates of mathematical cognition and education, and frontal and parietal regions have been repeatedly highlighted as key regions (9–13). Despite the advancement of our knowledge on the neurobiological underpinnings of math abilities, little is known about whether and how they are involved in a lack of mathematical education. At the neurobiological level, the lack of math education could impact neural changes in regions that are involved in skill acquisition of math, primarily in frontoparietal regions (“plasticity account”). This process can be subserved by neurotransmitter concentrations that preceded anatomic changes

(14). However, such differences may exist before the continuation of math education and represent baseline differences at the time of the educational decision not to study vs. to study further math (“biomarker account”).

Using single H-magnetic resonance spectroscopy (MRS), we scanned two previously defined key regions involved in numeracy: the intraparietal sulcus (IPS) and the middle frontal gyrus (MFG) (Fig. 1). We also examined their functional connectivity using resting-state functional MRI (for reviews see refs. 15–19). Such an approach allowed us to examine the role of γ -aminobutyric acid (GABA) and glutamate, the brain major inhibitory and excitatory neurotransmitters, respectively. Brain inhibition and excitation levels are thought to be critical in triggering the onset and defining the duration of sensitive periods of a given function, during which the neural system is particularly plastic in its response to environmental stimulation (20). It is thought that this is achieved by a shift in the ratio of intrinsic and spontaneous activity and activity in response to the environmental stimulation, whereby the intrinsic and spontaneous activity is reduced and the activity in response to the environmental stimulation is increased (21). Although very early in development, GABA functions as an excitatory neurotransmitter (22), during adolescence GABA and glutamate function as the main inhibitory and excitatory neurotransmitters, respectively, and previous studies have shed some light on the actions of these two neurotransmitters during adolescence. For example, compared to early childhood where there is a peak synaptic density, but the synaptic density is significantly

Significance

Our knowledge of the effect of a specific lack of education on the brain and cognitive development is currently poor but is highly relevant given differences between countries in their educational curricula and the differences in opportunities to access education. We show that within the same society, adolescent students who specifically lack mathematical education exhibited reduced brain inhibition levels in a key brain area involved in reasoning and cognitive learning. Importantly, these brain inhibition levels predicted mathematical attainment \sim 19 mo later, suggesting they play a role in neuroplasticity. Our study provides biological understanding of the impact of the lack of mathematical education on the developing brain and the mutual play between biology and education.

Author contributions: F.S. and R.C.K. designed research; G.Z. and F.S. performed research; G.Z. and R.C.K. analyzed data; and G.Z. and R.C.K. wrote the paper.

The authors declare no competing interest.

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This article contains supporting information online at <https://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2013155118/-DCSupplemental>.

Published June 7, 2021.

PSYCHOLOGICAL AND COGNITIVE SCIENCES
NEUROSCIENCE

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Educational decisions have a long-lasting impact on both the individual and wider society.

Mathematical education and attainment has been associated with several quality-of-life indices, including educational progress, socioeconomic status, employment, mental and physical health, and financial stability.

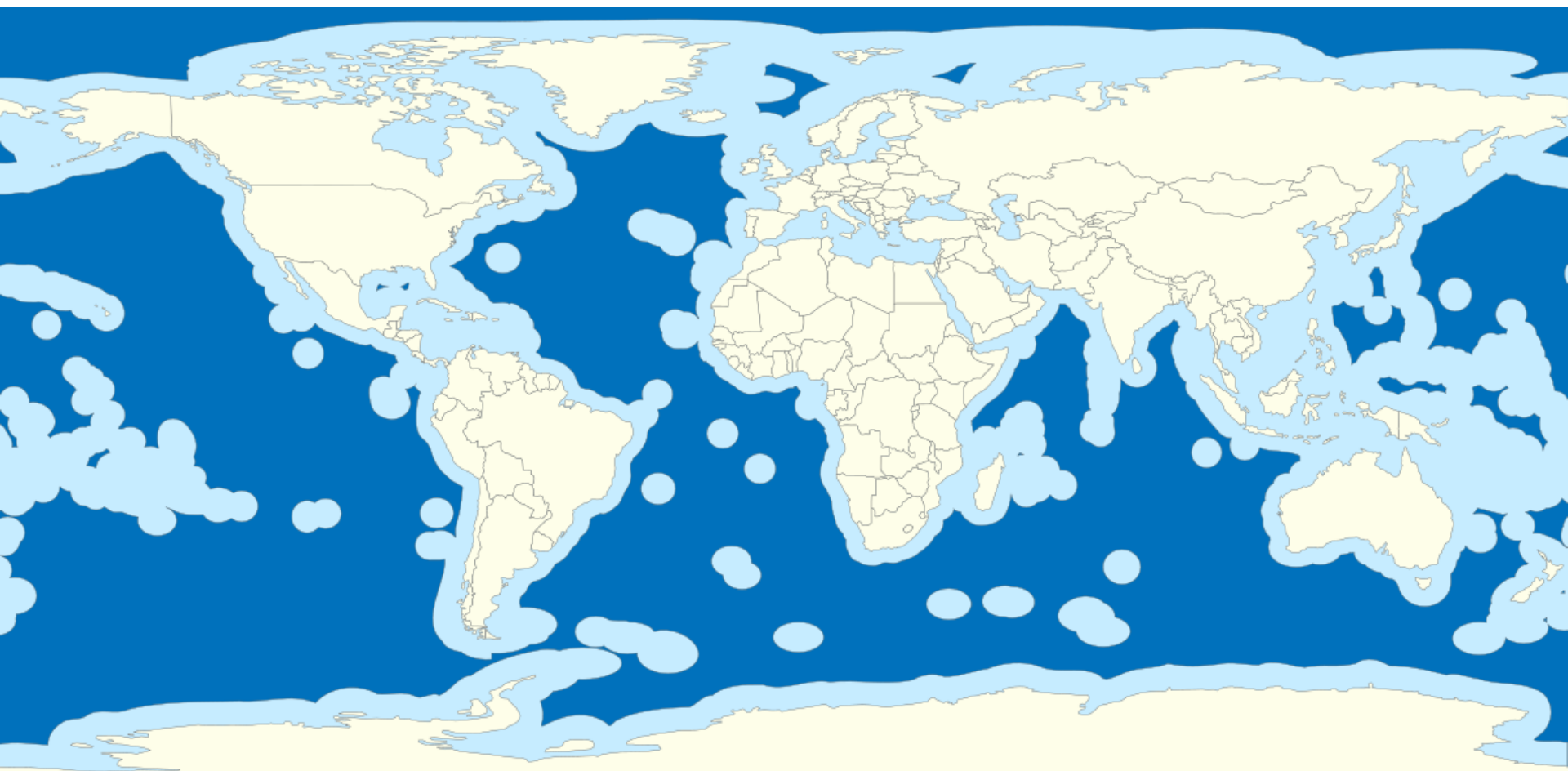
In several countries, such as the UK and India, 16-y-old adolescents as part of their advanced (i.e., A-level) subjects can choose to stop studying math. it emerged that **the decision to not study math** as an A-level subject **can lead to an 11% decrease in financial income** compared to those who choose to study math as part of their A-level curriculum.

No other A-level subject category is associated with such a wage premium.

In addition, previous studies highlighted the cognitive, emotional, and societal factors that are associated with mathematical education.

Outline

- Portugal
- Macroeconomy
- Inequality
- Innovation
- Skills
- Education
- **R&D**
- Sustainability
- Future
- Geopolitics



international waters - dark blue
exclusive economic zones - light blue

Portugal has the 5th largest EEZ within Europe, 3rd largest of the EU and the 20th largest in the world, at $1,7 \times 10^6 \text{ km}^2$

MARITIME ZONES

- Territorial Waters
- Exclusive Economic Zone, EEZ

200 MILES

0 - 3 MILES

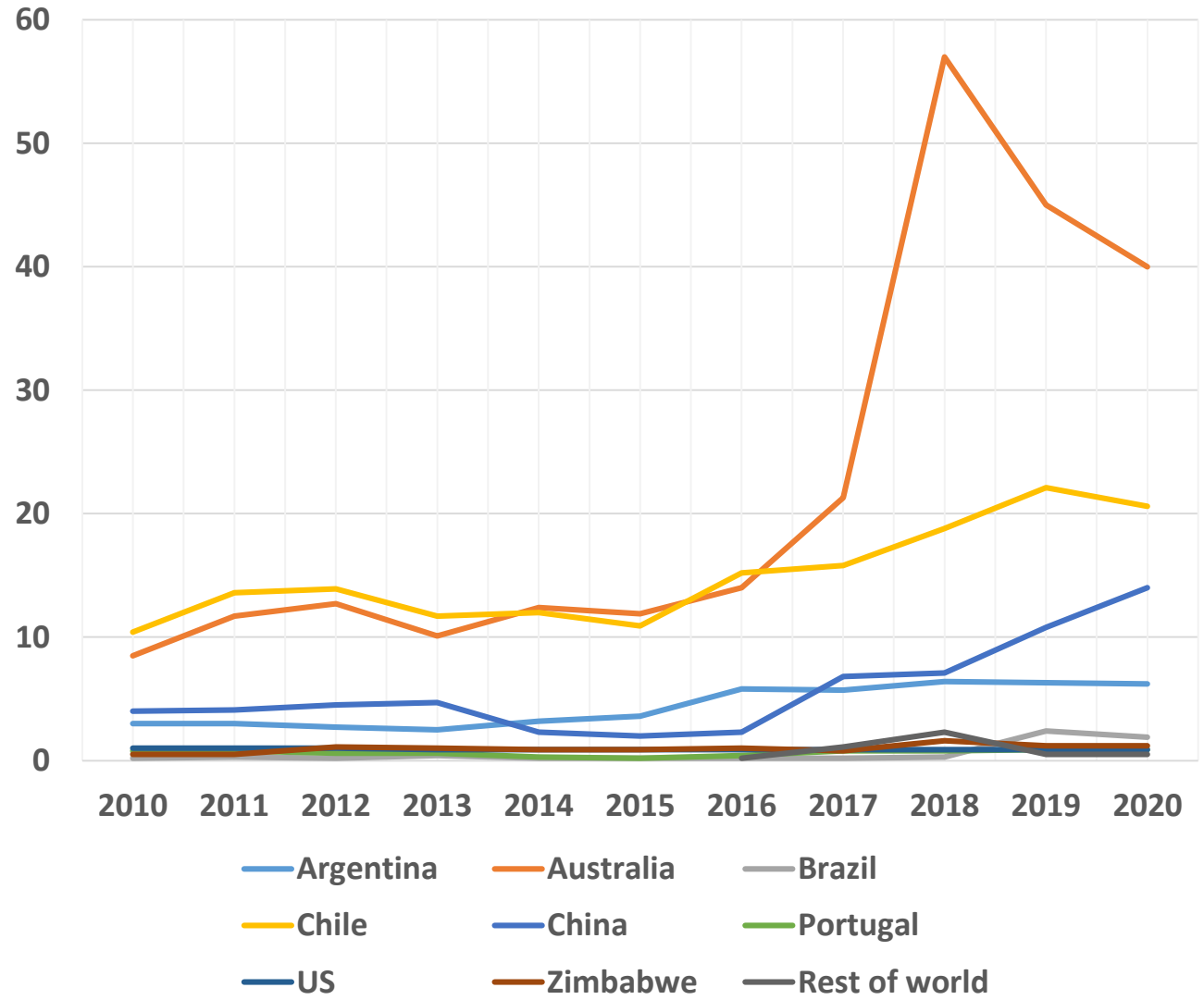


Play (k)



Country	2020 Lithium Production* (tonnes)	% of World Total
Australia	40,000	46.3%
Chile	20,600	23.9%
China	14,000	16.2%
Argentina	6,200	7.2%
Brazil	1,900	2.2%
Zimbabwe	1,200	1.4%
U.S.	900	1.0%
Portugal	900	1.0%
Rest of the World	500	0.6%
Total	86,300	100%

Lithium. Mine production. Thousand tonnes of Lithium content



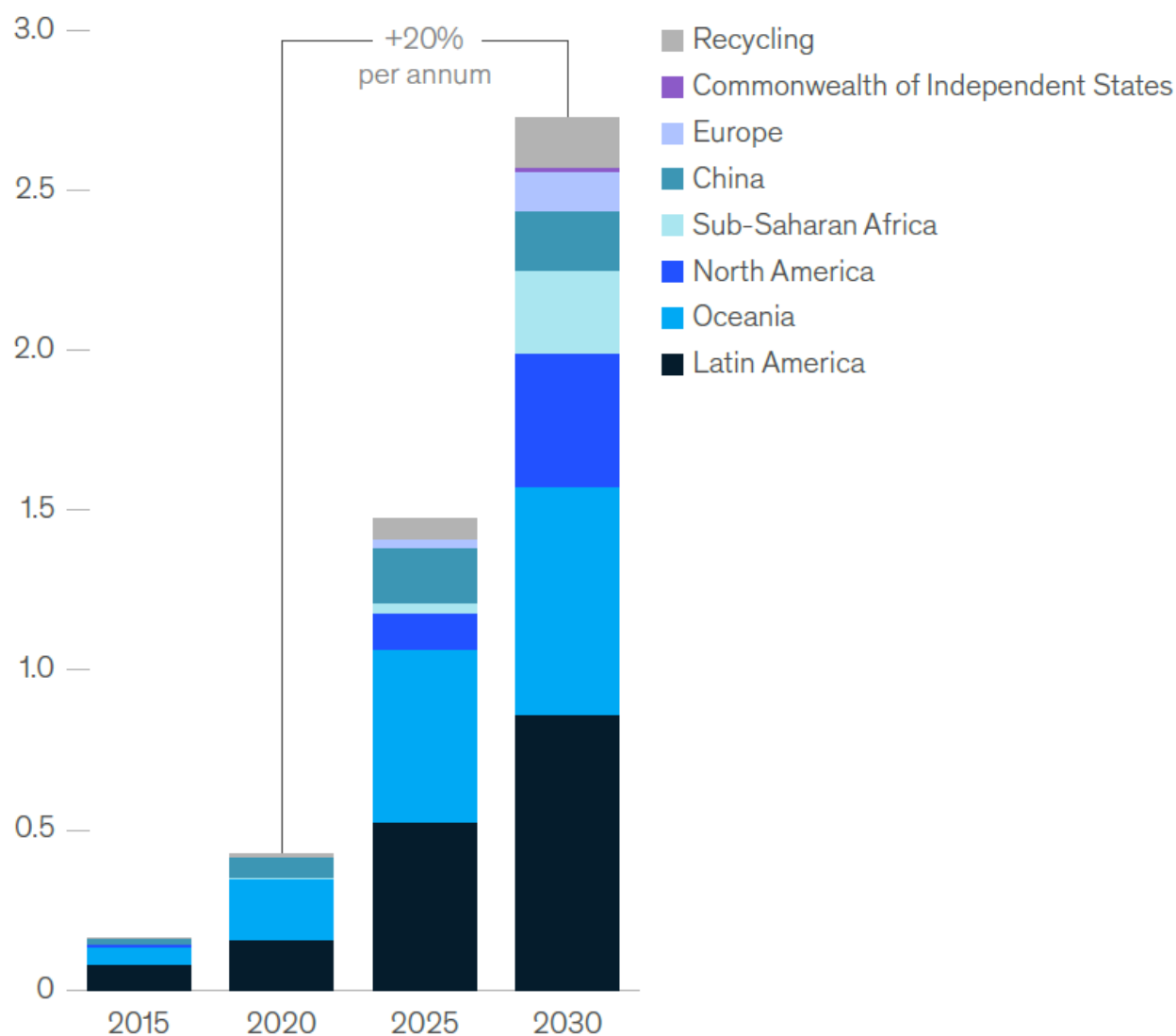
AUSTRALIA AND CHILE IN THE FRONT ROW

Countries with major Lithium production and reserves

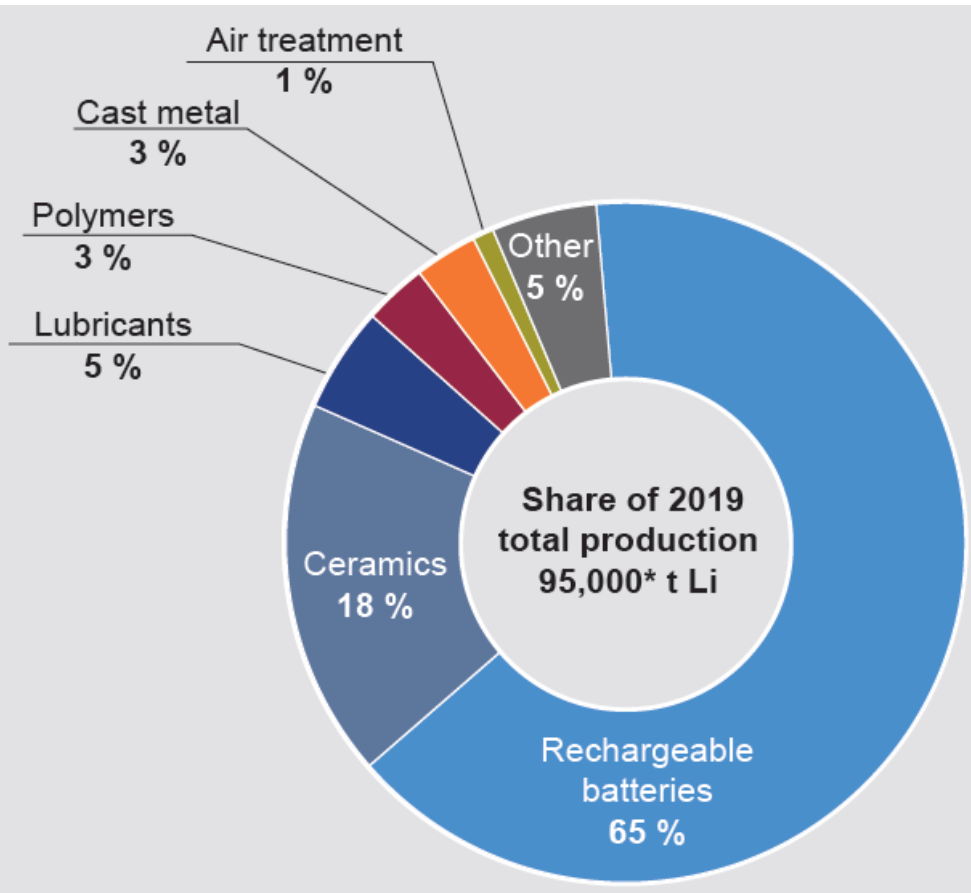
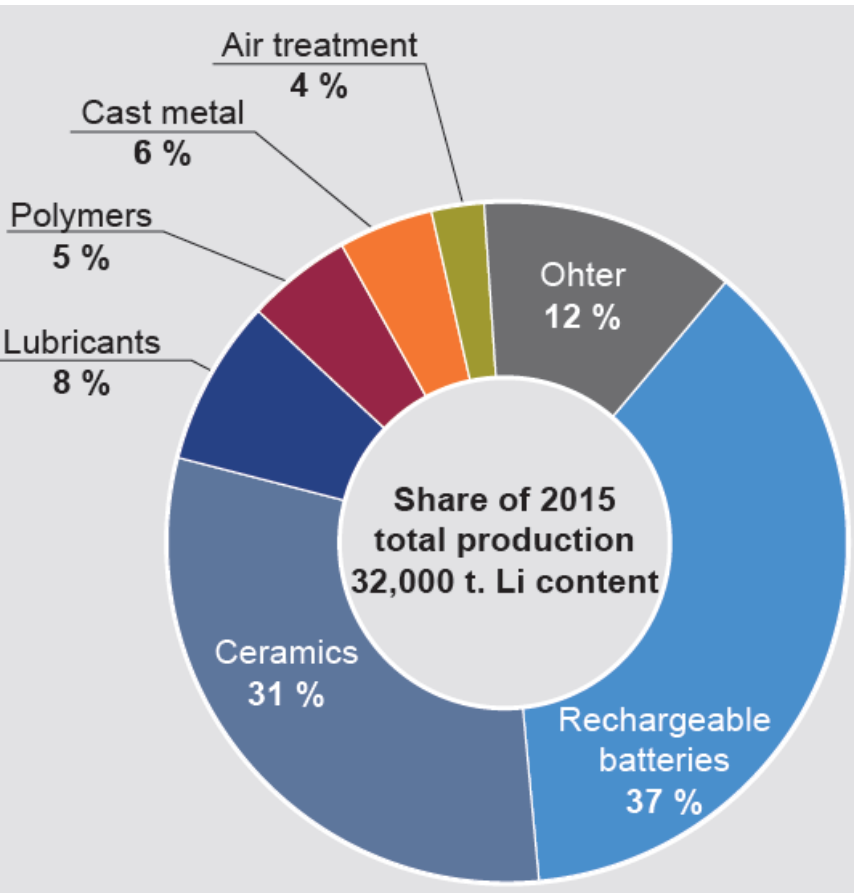


Lithium production is expected to expand by 20 percent a year.

Global lithium production by source,¹
million metric tons
lithium carbonate
equivalent



Li carbonate – 19% Li content; Li hydroxide – 29% Li content
(Azevedo, 'Lithium and cobalt: A tale of two commodities', McKinsey, 2018, p.9-10)





Contents lists available at SciVerse ScienceDirect

Theoretical and Applied Fracture Mechanics

journal homepage: www.elsevier.com/locate/tafmec



Friction stir welded joints of Al–Li Alloys for aeronautical applications: butt-joints and tailor welded blanks



S.M.O. Tavares^{a,*}, J.F. dos Santos^b, P.M.S.T. de Castro^a

^a *Department of Mechanical Engineering, Faculty of Engineering of the University of Porto, Portugal*

^b *Helmholtz-Zentrum Geesthacht GmbH, Institute of Materials Research, Materials Mechanics, Solid State Joining Processes (WMP), Geesthacht, Germany*



Contents lists available at SciVerse ScienceDirect

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Friction stir welded joints of Al–Li Alloys for aeronautical applications: butt-joints and tailor welded blanks



S.M.O. T

^a Department
^b Helmholtz-Z

Theoretical and Applied Fracture Mechanics 60 (2012) 1–9



Contents lists available at SciVerse ScienceDirect

Theoretical and Applied Fracture Mechanics

journal homepage: www.elsevier.com/locate/tafmec



Fatigue and fracture behaviour of friction stir welded aluminium–lithium 2195

P.M.G.P. Moreira ^{a,*}, A.M.P. de Jesus ^b, M.A.V. de Figueiredo ^c, M. Windisch ^d, G. Sinnema ^e,
P.M.S.T. de Castro ^c

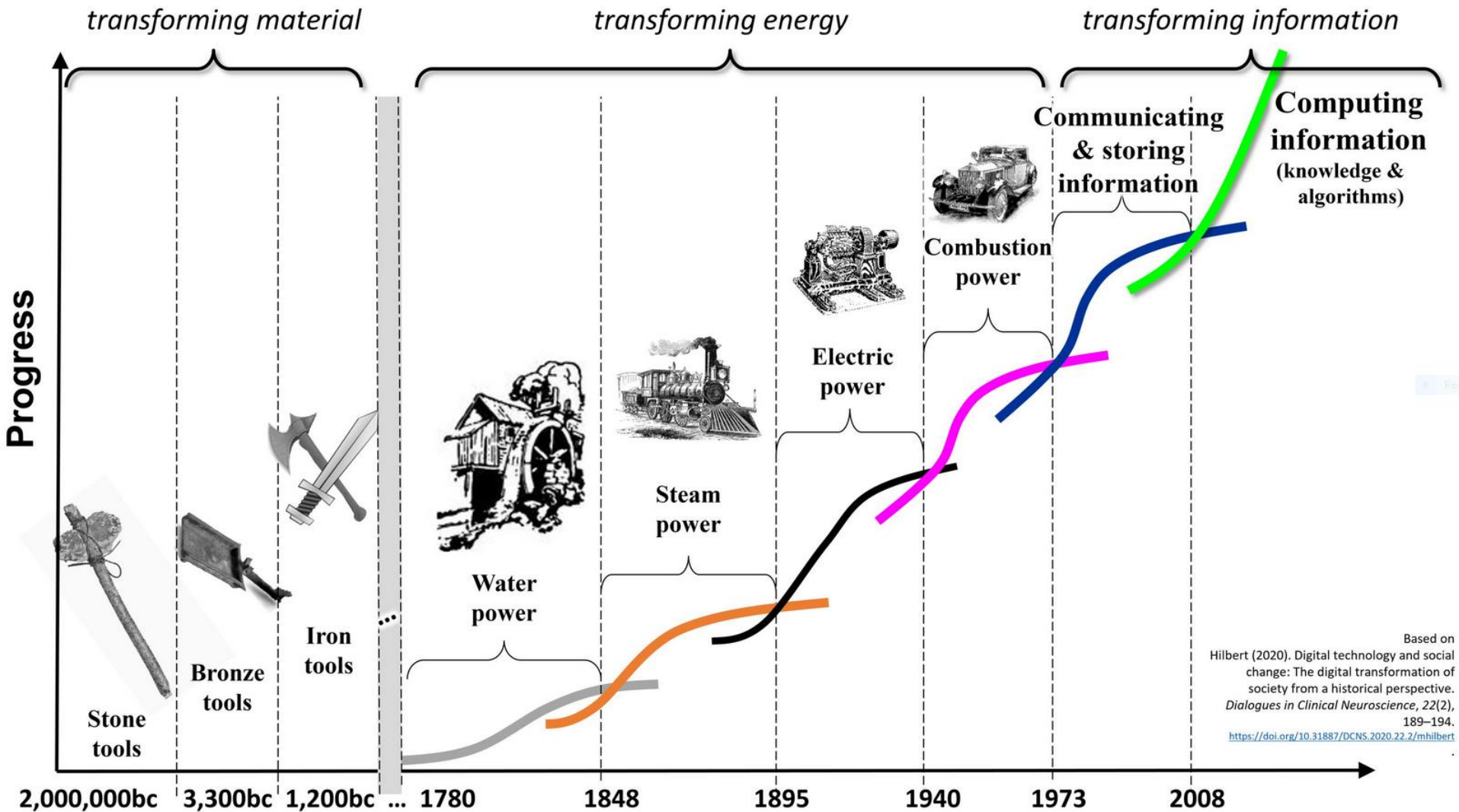
^a INEGI, Laboratório de Óptica e Mecânica Experimental – LOME, Porto, Portugal

^b Universidade de Trás-os-Montes e Alto Douro, Departamento de Eng. Mecânica, Vila Real, Portugal

^c Universidade do Porto, Faculdade de Engenharia, Departamento de Eng. Mecânica, Porto, Portugal

^d MT Aerospace AG, Department TEA, Fracture Mechanics and Damage Tolerance, Augsburg, Germany

^e European Space Agency (ESA), ESTEC, Noordwijk, The Netherlands



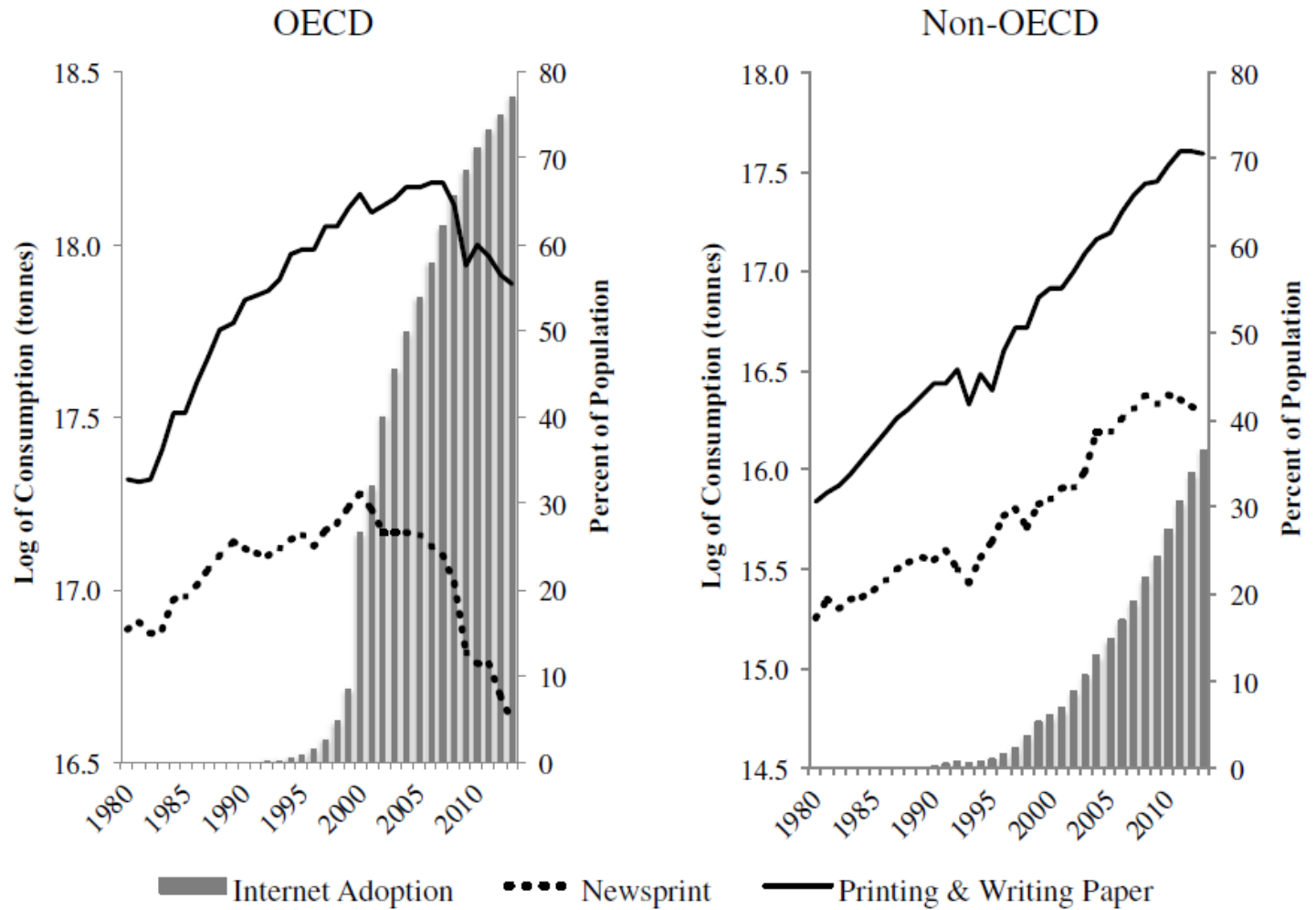
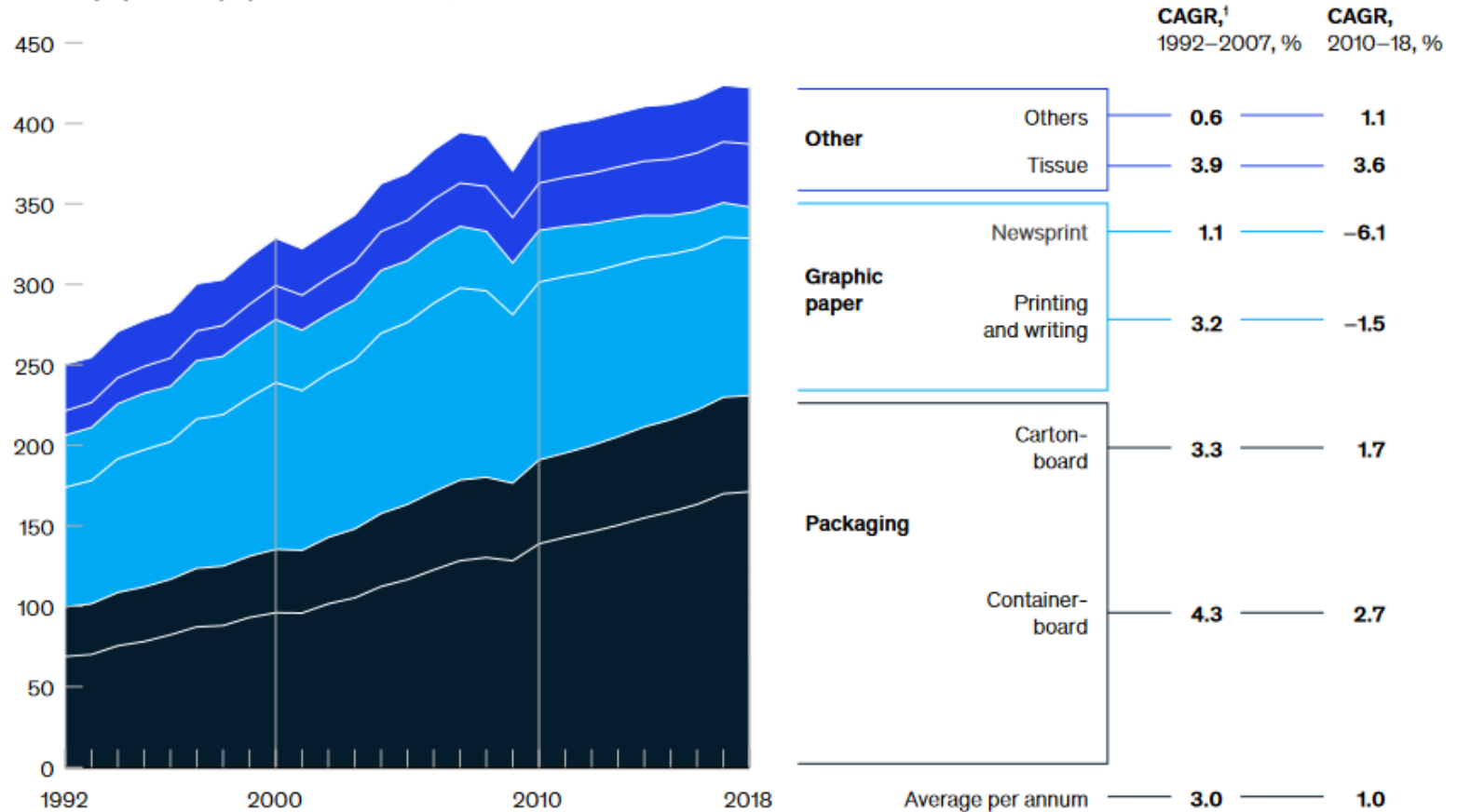


Fig. 1. Observed newspaper consumption, printing and writing paper consumption, and Internet adoption for OECD and non-OECD regions, 1980–2013.

The global paper and paperboard industry continues to grow despite decline in the graphic-paper segment.

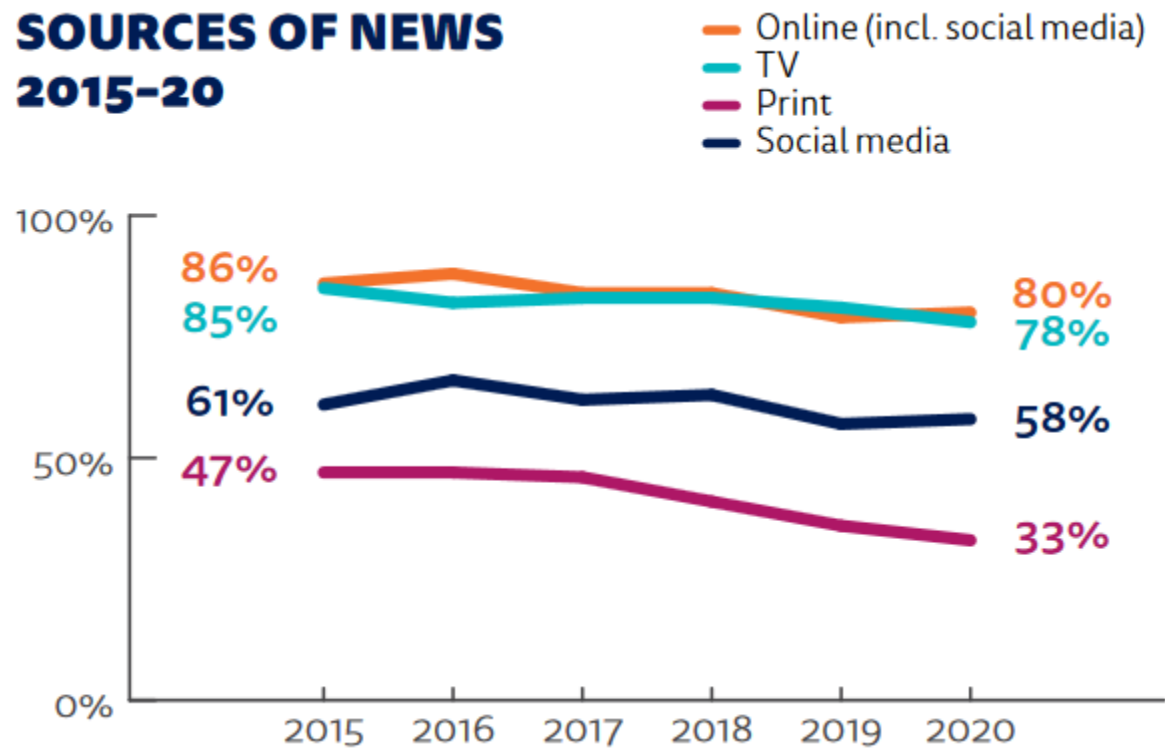
Global paper and paperboard market, million metric tons

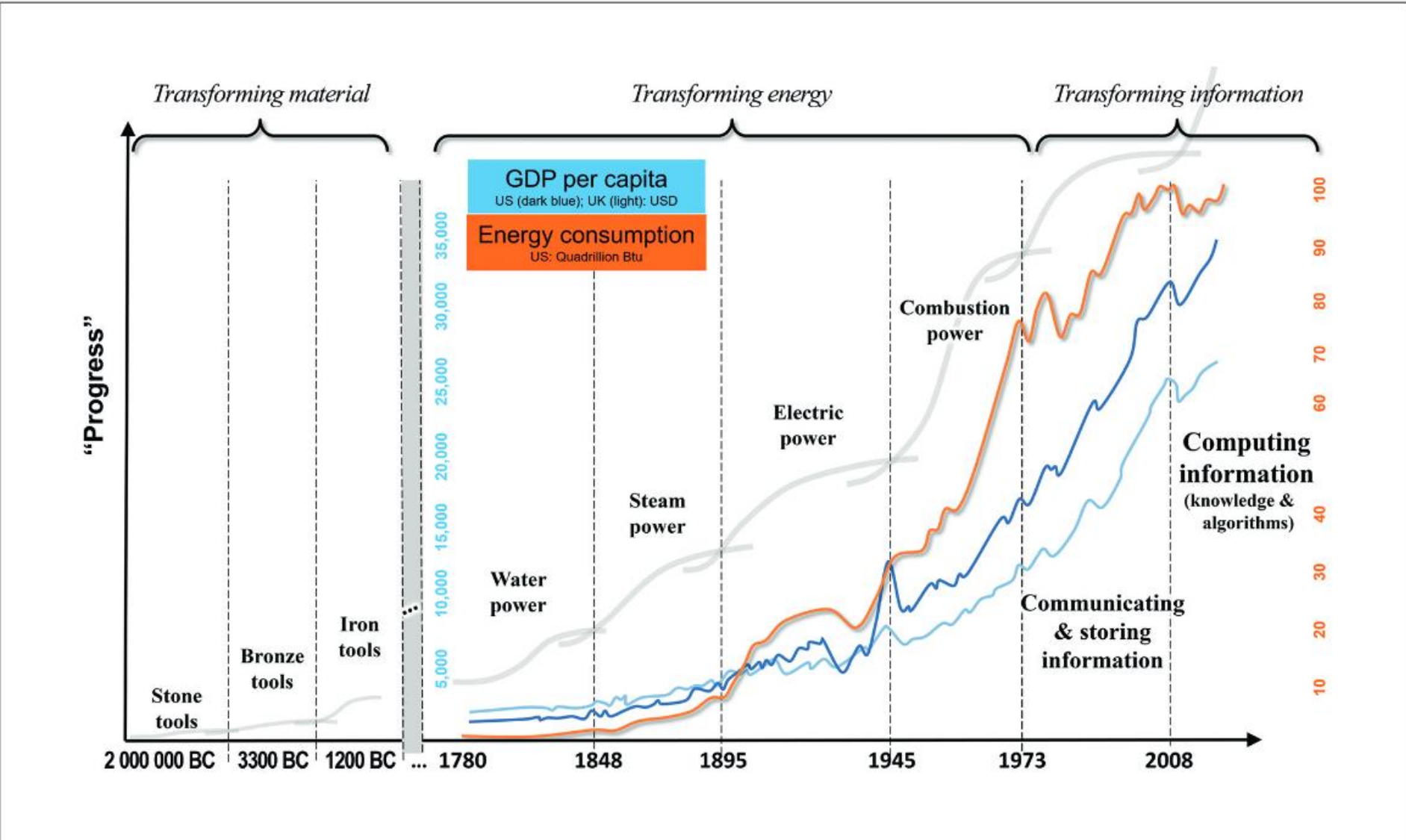


¹Compound annual growth rate.

Source: Resource Information Systems Inc (RISI), Feb 2019

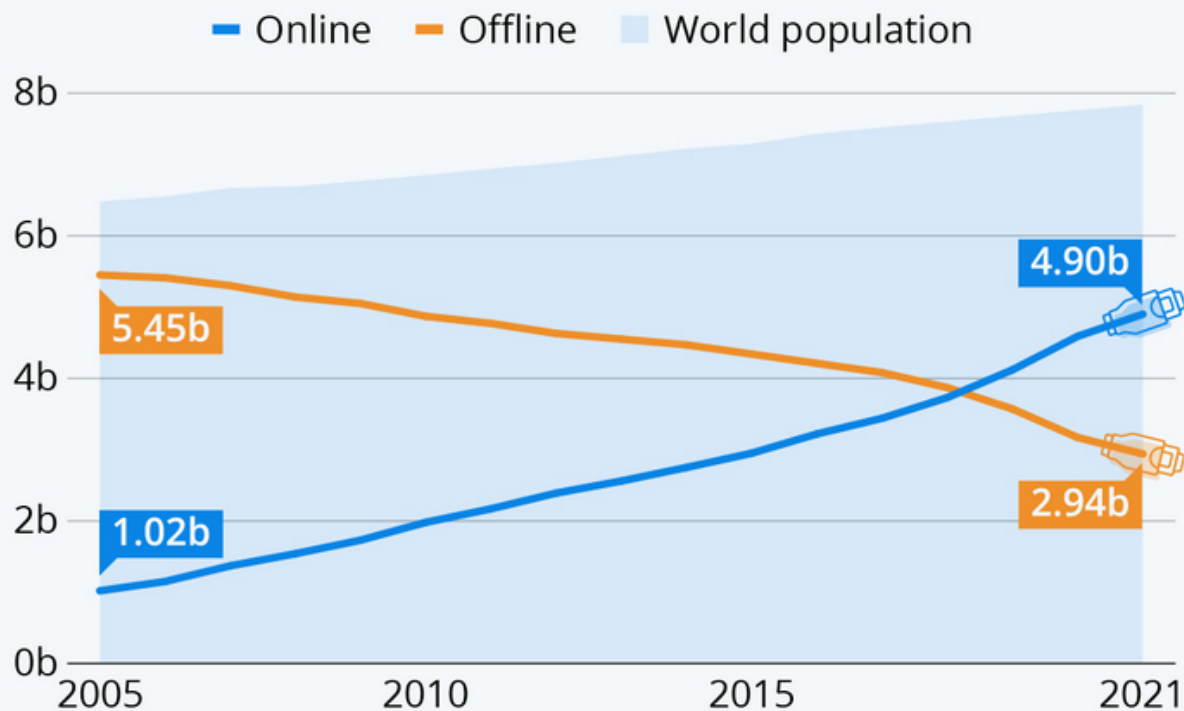
SOURCES OF NEWS 2015-20





Disconnected: 2.9 Billion People Still Offline

Estimated number of individuals worldwide using/not using the internet



Source: ITU



Ensaios Virtuais de Estruturas Aeronáuticas - 11.05.2012

<https://www.youtube.com/user/FEUPtv/>
<https://sites.google.com/site/videosfq/pt/rtp/eng>
<https://www.youtube.com/watch?v=usT7Rdj-Gws>

ENG N° 1

PEDRO PONCES CAMANHO
ESPECIALISTA FEUP/ INEGI
EM ENGENHARIA AERONÁUTICA

Ensaios Virtuais de Estruturas Aeronáuticas - 11.05.2012
1,107 views · May 14, 2012

4 DISLIKE SHARE SAVE ...

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Chucky Wright
4.7M views · 7 months ago
- Why Nobody Wants This Part of Europe

Segurança dos Aviões - 05.10.2012

<https://www.youtube.com/user/FEUPtv/>

<https://sites.google.com/site/videosfq/pt/rtp/eng>

<https://www.youtube.com/watch?v=QT9MTsCtFmw>

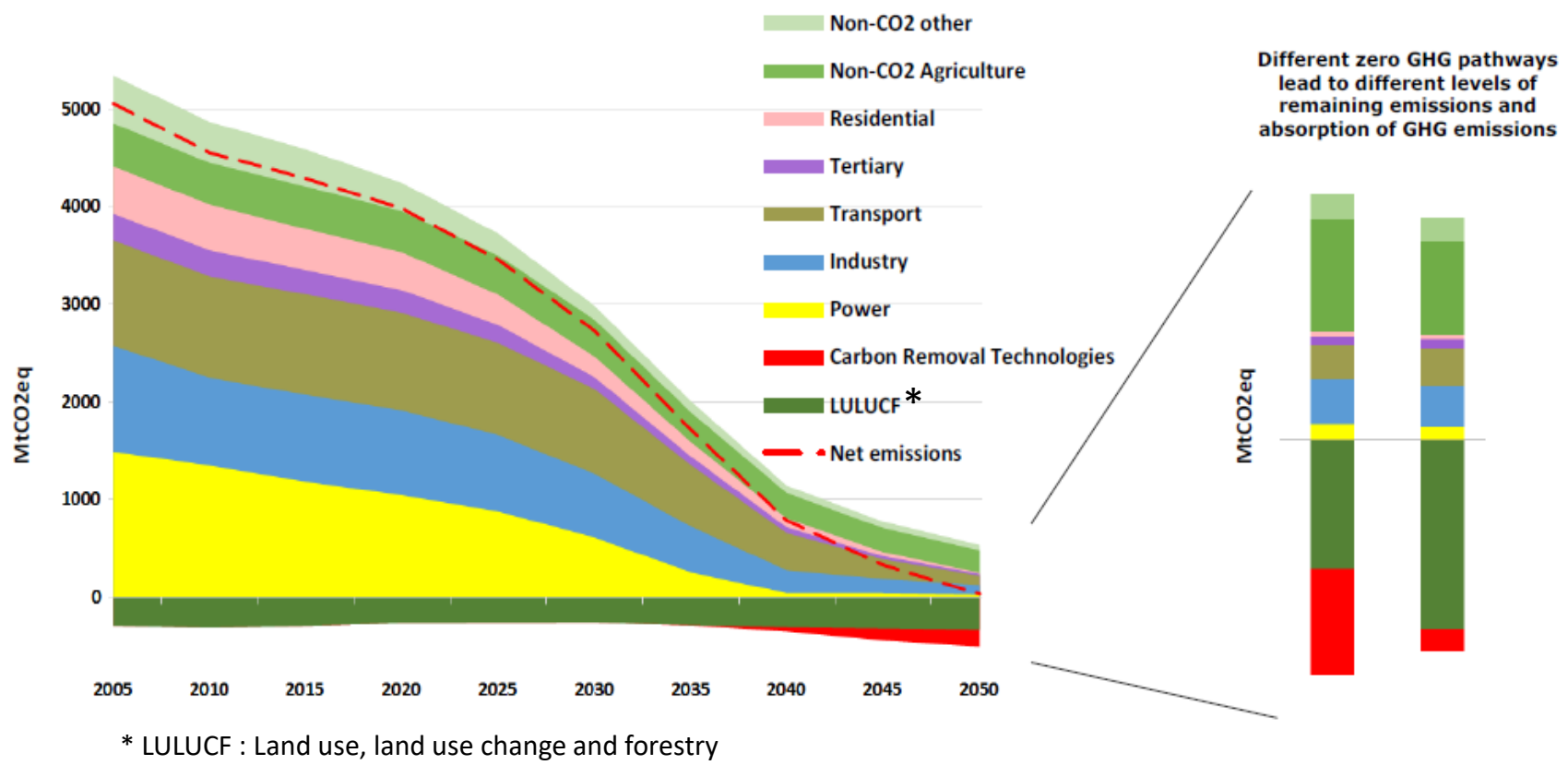
The screenshot displays a YouTube video player with a man in a white shirt speaking. The video title is "Segurança dos Aviões - 05.10.2012" and it has 2,809 views. The browser shows the URL <https://www.youtube.com/watch?v=QT9MTsCtFmw>. The right sidebar features a Monday.com advertisement and a list of recommended videos:

- EARLY MORNING ARRIVALS AND DEPARTURES AT CORK...** by IansAviation, 439 views, 3 days ago.
- Why Turkey is Turning Istanbul Into an Island** by RealLifeLore, 4.3M views, 10 months ago.
- The \$500,000 Maybach 62 Was the Ultimate 2000s Luxury...** by Doug DeMuro, 2.3M views, 1 year ago.
- One Day in the Coldest Village on Earth | Yakutia** by Kiun B, 15M views, 1 month ago.
- Warren Buffett Leaves The Audience SPEECHLESS | One ...** by FREENVESTING, 6.3M views, 4 months ago.
- SPE 2022 :: Promo Video Eng. Minas e Geo-Ambiente** by FEUPtv.

Fuselagem dos aviões - 26.03.2012

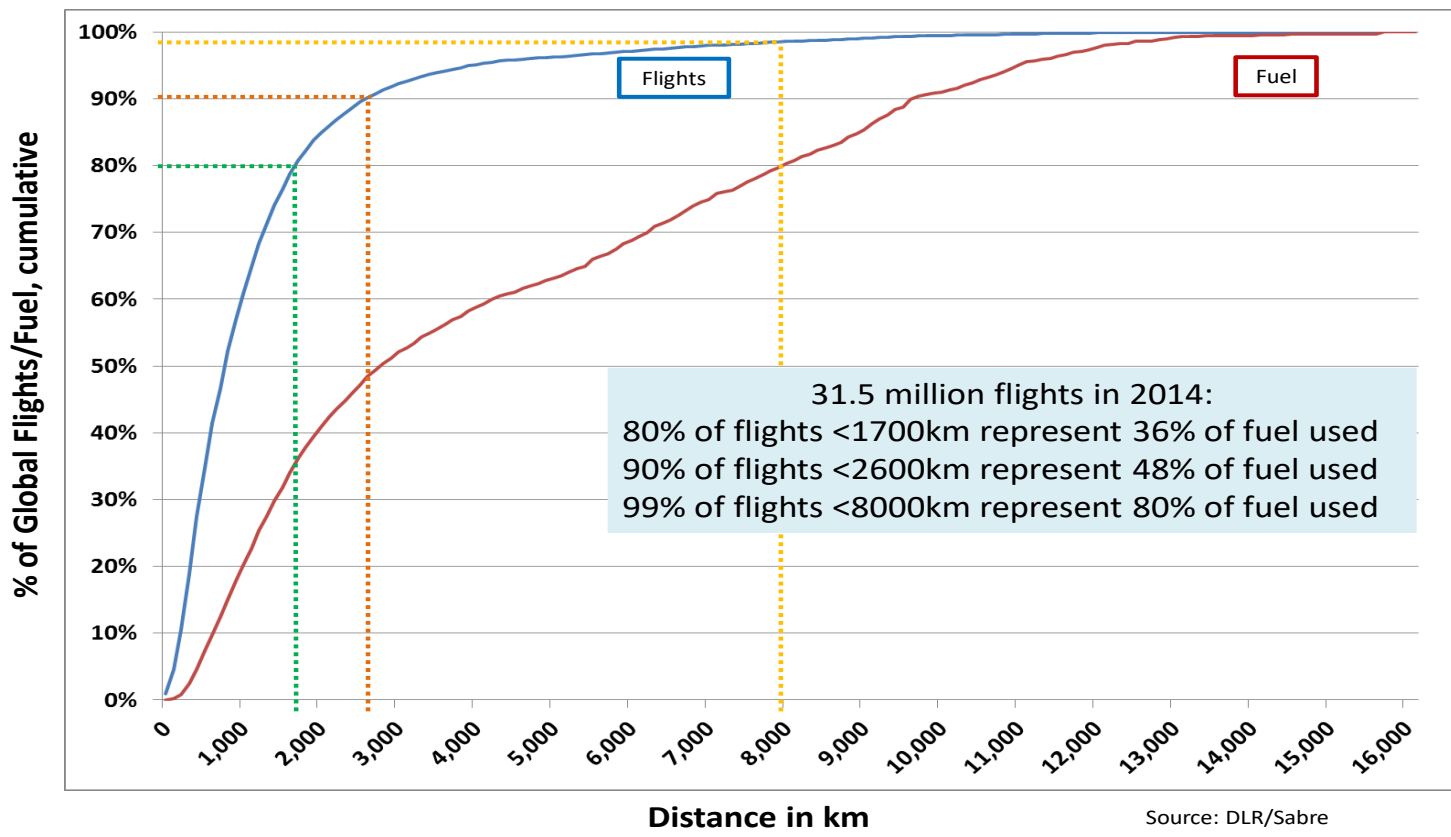
https://www.youtube.com/user/FEUPtv/
https://sites.google.com/site/videosfq/pt/rtp/eng
https://www.youtube.com/watch?v=J_m2C7JvEMU

Europe’s GHG emissions trajectory in a 1.5° scenario

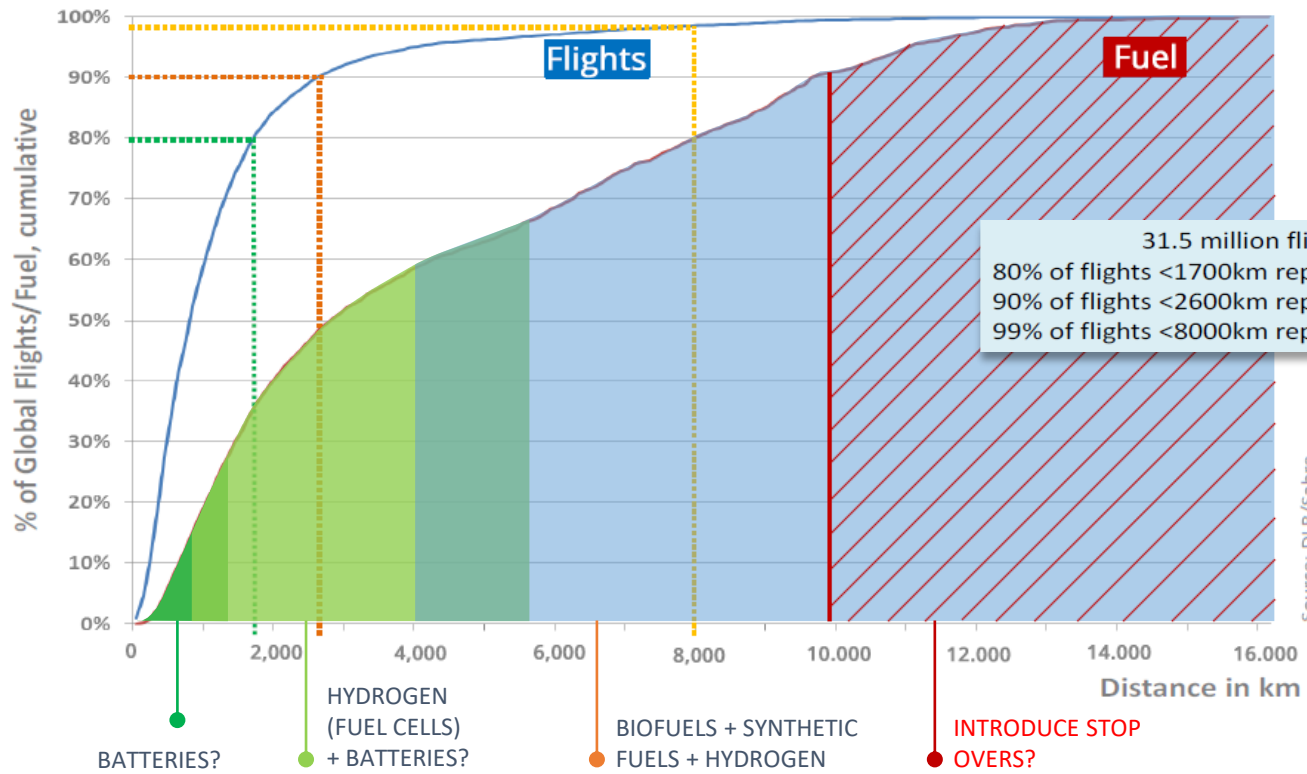


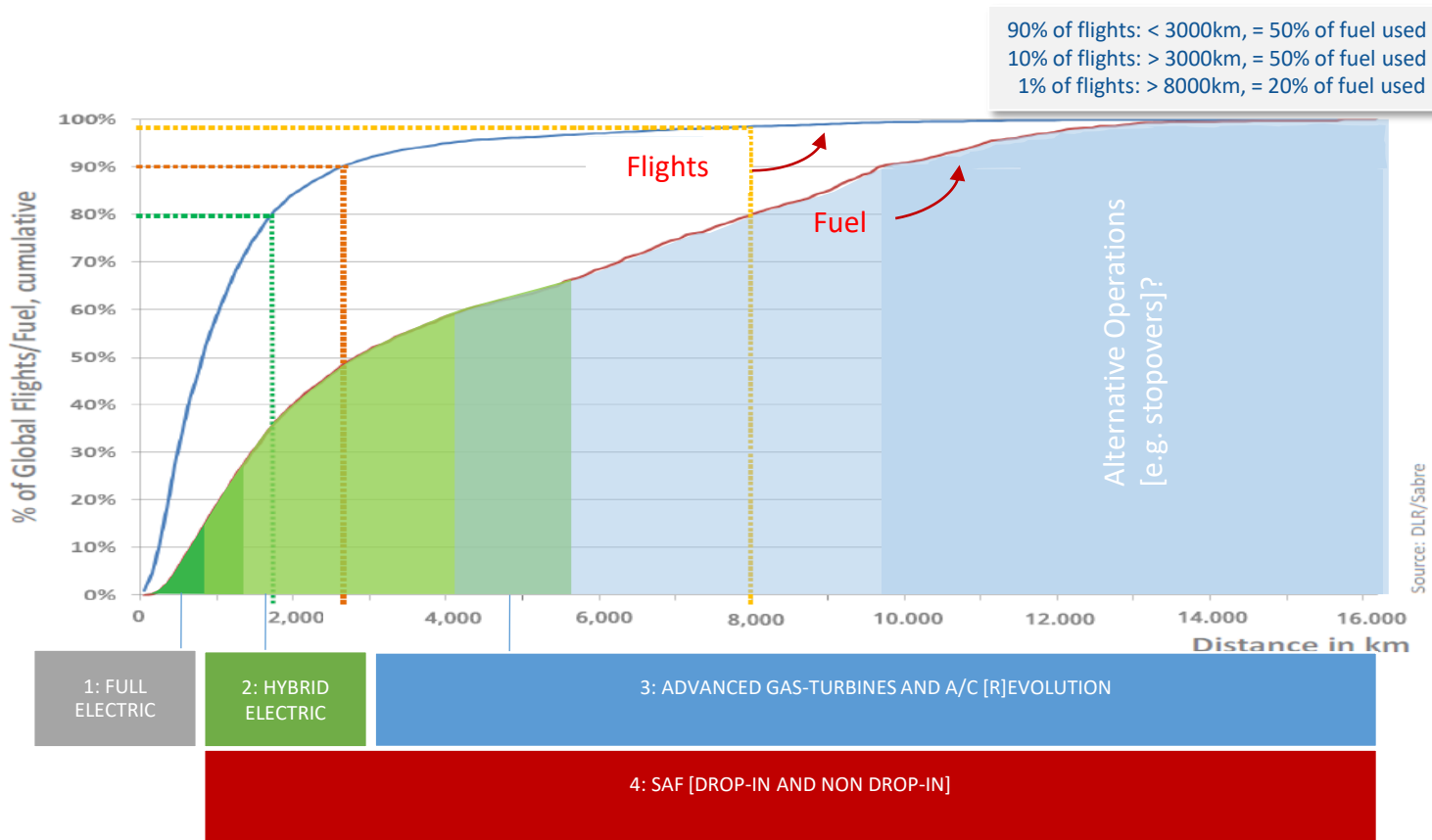
EU CO₂ reduction target of -80% in 2050 vs. 1990

(Working Document: Setting the scene for an Aviation Partnership in Horizon Europe - Input for Clean Sky 3 discussions - Clean Sky Joint Undertaking – April 4, 2019
Cumulative distribution of global flights in 2014 and fuel burn)



The vast majority of flights are short-haul although 50% of fuel is burned by flights above 3000km





Cindy Steinmetz, Clean Sky

see also, e.g., <https://www.youtube.com/watch?v=cRexb0ftrYw>

Next Decade European Aeronautics Research Programme (2020-2030)

A paper prepared by the Clean Sky Scientific Committee (SciCom) for
submission to the Clean Sky Joint Undertaking (CSJU)

26 May 2019

Authors

Peter HECKER (SciCom Chairperson)

Trevor YOUNG (SciCom Vice-Chairperson)

Paulo Tavares DE CASTRO

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Patrik FERNBERG

Christian MARI

Maria Angeles MARTIN PRATS

Janusz NARKIEWICZ

Wim PASTEUNING

Francesca SANNA-RANDACCIO

Dieter SCHMITT

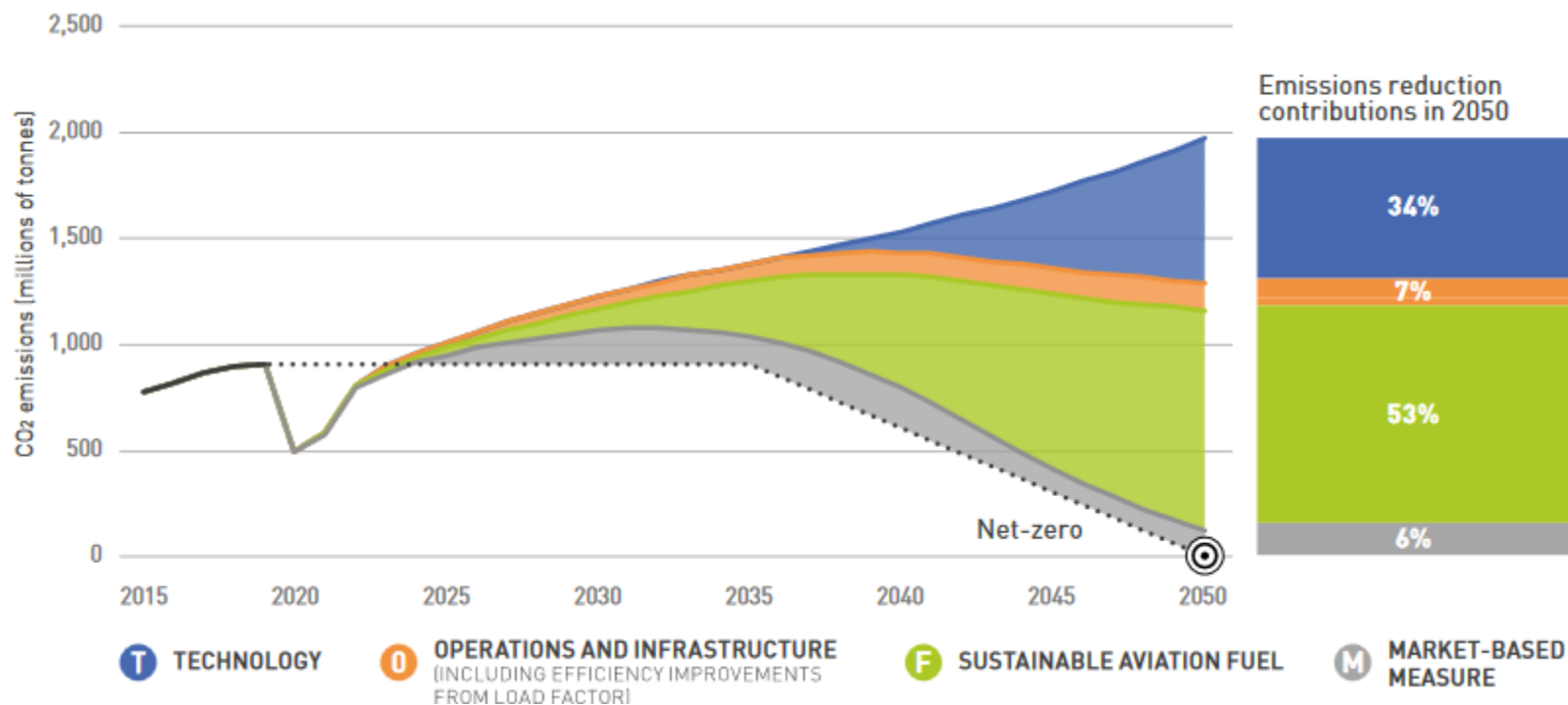
Régine SUTRA ORUS

..... decarbonizing aviation is more challenging than for other industries. The sector is characterized by long innovation cycles, complex system integration, high energy density storage requirements (which hampers electrification) and higher safety standards than many other sectors.

Research activities spanning TRL 1–6 should be integrated into a single programme, with the management responsibility falling under a single organisation, to maximise the potential benefit of the work.

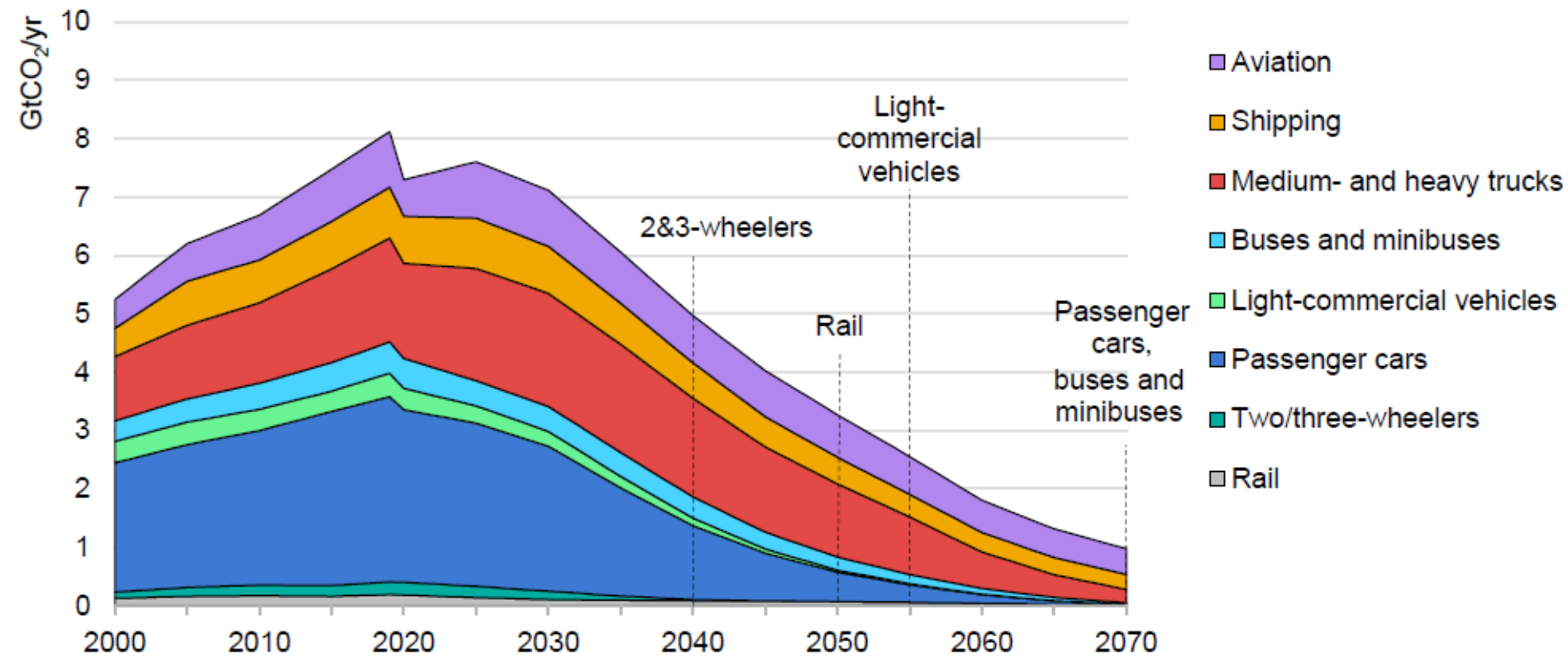
.....

ATAG, Waypoint 2050, 2nd ed, 2021 (executive summary p.7)



see also, e.g., <https://www.youtube.com/watch?v=cRexb0ftrYw>







Figure 3.16 Global CO₂ emissions in transport by mode in the Sustainable Development Scenario, 2000-70



IEA 2020.



Map 4.1 Speed of rail connections between major urban centres in the EU, 2019

- km/h
-  < 60
 -  60 – 90
 -  90 – 120
 -  120 – 150
 -  > 150
 -  no connection within 10 hours

Speeds are based on optimal travel time on a weekday relative to the straight-line distance. Only urban centres located within 500 km from each other were considered.

In addition, each pair of urban centres must contain an urban centre that has more than 500 000 inhabitants (or represents the national capital) and the other urban centre has to have at least 200 000 inhabitants.

*Overseas: links between city pairs involving a sea crossing where neither a fixed railway link or a train ferry is available.

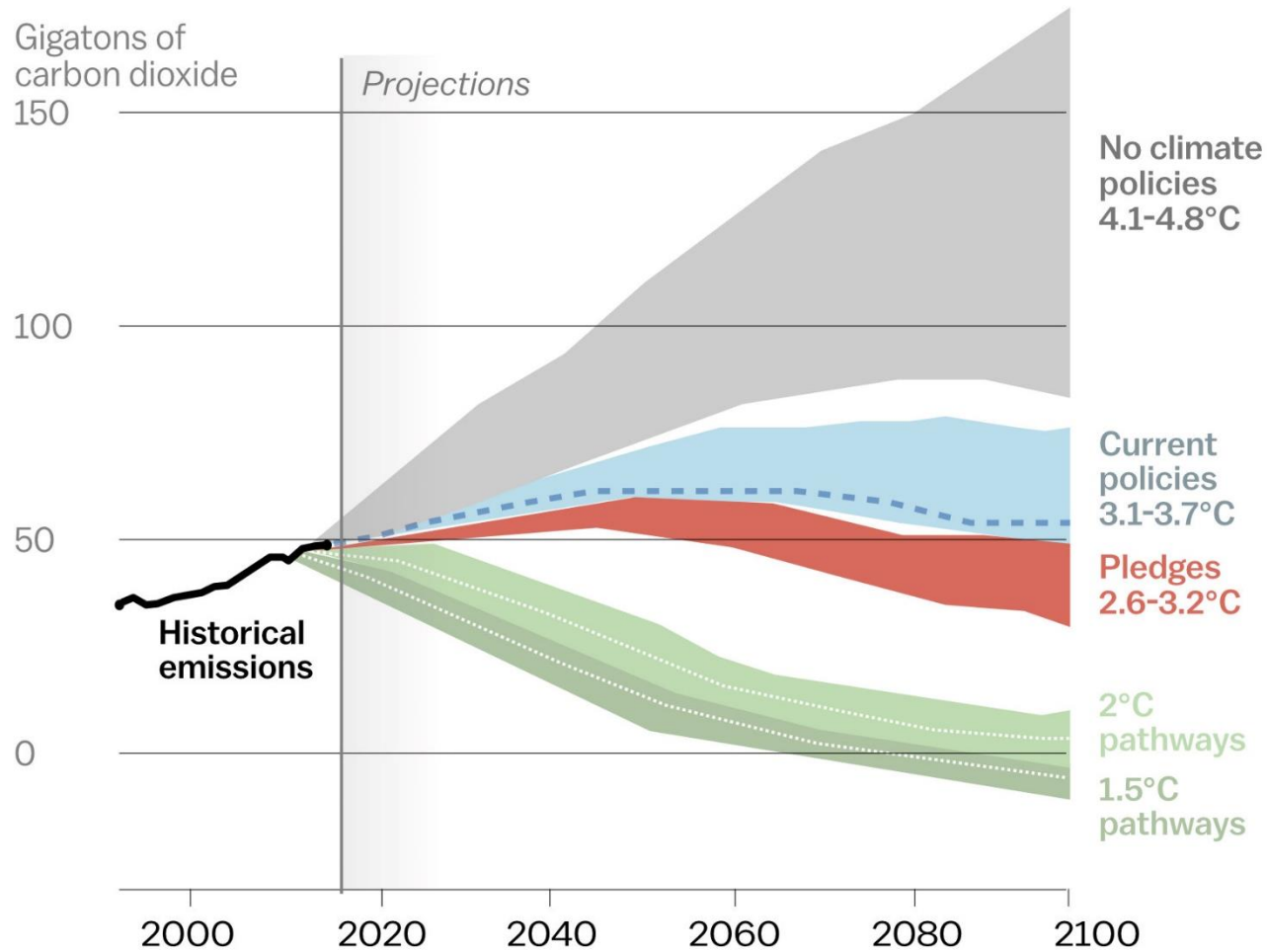
Source: DG REGIO based on data from UIC, national and regional rail operators, JRC.

Outline

- Portugal
- Macroeconomy
- Inequality
- Innovation
- Skills
- Education
- R&D
- **Sustainability**
- Future
- Geopolitics

Effect of current pledges and policies

Global greenhouse gas emissions

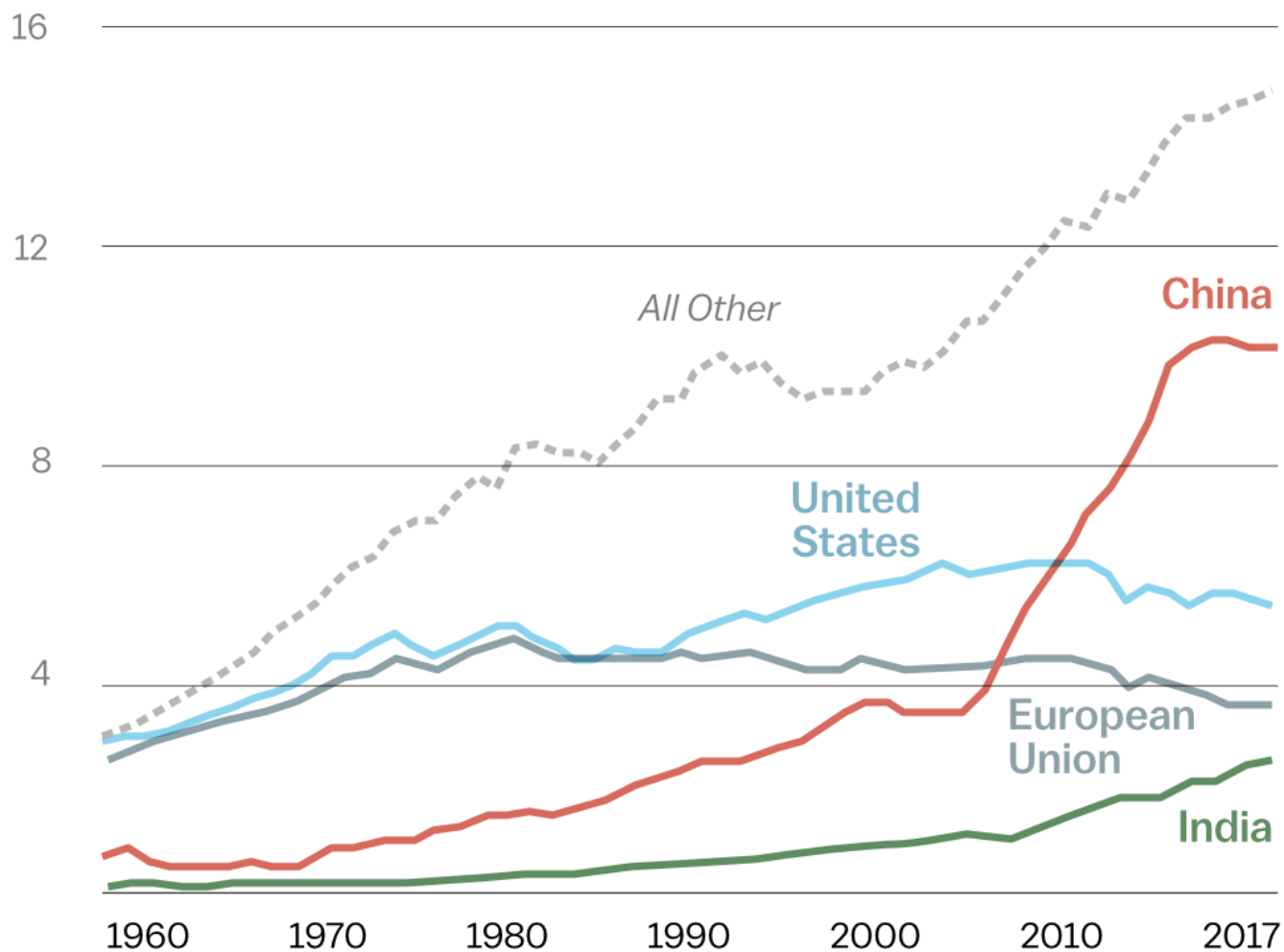


Source: Climate Action Tracker

Vox

Global CO2 emissions

Gigatonnes of carbon dioxide



Source: Carbon Dioxide Information Analysis Center/Global Carbon Project

Vox

<https://thewalrus.ca/extraction/>

Edward Burtynsky **Extraction**

The Walrus Environment / July/August 2007

Updated Jul. 17, 2019

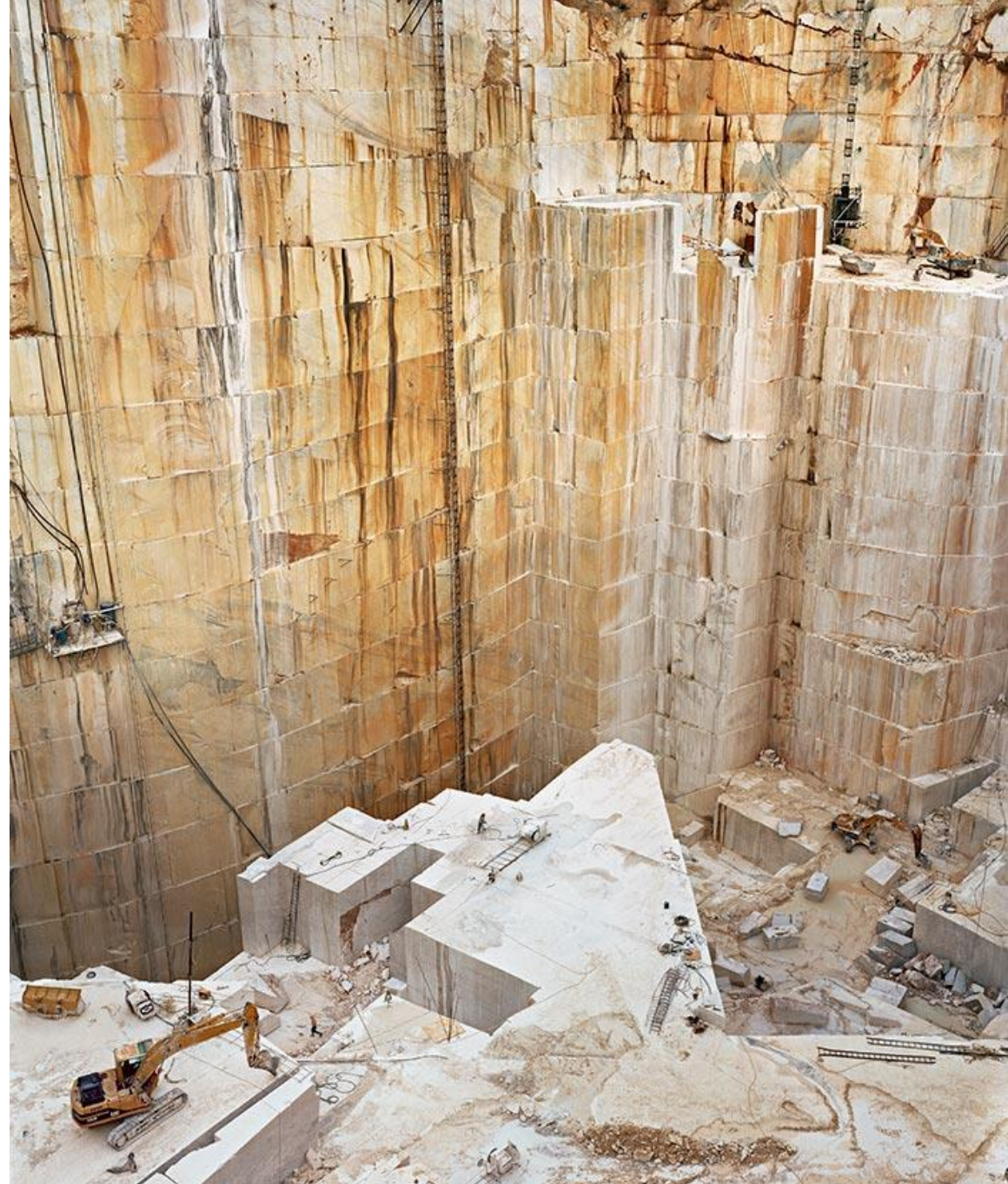
Published Jul. 12, 2007

Iberia Quarries #9, Cochicho Co., Pardais,
Portugal, 2006.

Edward Burtynsky

The Guardian Weekly, 22 April 2022,

pp.54-56







<https://www.pinterest.pt/pin/333266441145354789/>

Edward Burtynsky, Nickel Tailings #34

No, it's not lava. This photograph was taken in Sudbury, Ontario in Canada. This phenomenon is the result of excess iron seeps into the water and produces the deep red color






DOI: 10.1111/geb.12676

RESEARCH PAPER

WILEY Global Ecology
and Biogeography

A Journal of
Macroecology

Inhibitory effects of *Eucalyptus globulus* on understorey plant growth and species richness are greater in non-native regions

Pablo I. Becerra¹  | Jane A. Catford^{2,3,4} | Inderjit⁵ | Morgan Luce McLeod⁶ |
Krikor Andonian⁷ | Erik T. Aschehoug⁸ | Daniel Montesinos⁹ | Ragan M. Callaway¹⁰

James *et al.*, 'Urban Sustainability in Theory and Practice: Circles of Sustainability', Routledge, 2015

Circles of Sustainability is a method for understanding and assessing [sustainability](#), and for managing projects directed towards socially sustainable outcomes. simple view of the sustainability of a particular city, urban settlement, or region. The circular figure is divided into four domains: ecology, economics, politics and culture. Each of these domains is divided in to seven subdomains, with the names of each of these subdomains read from top to bottom in the lists under each domain name. (see book appendix pp.58-62

SAO PAULO

2012

ECONOMICS

Production & Resourcing
Exchange & Transfer
Accounting & Regulation
Consumption & Use
Labour & Welfare
Technology & Infrastructure
Wealth & Distribution

ECOLOGY

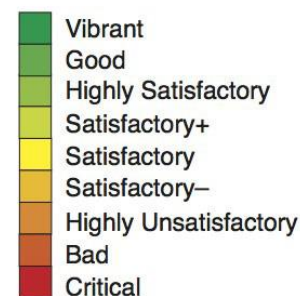
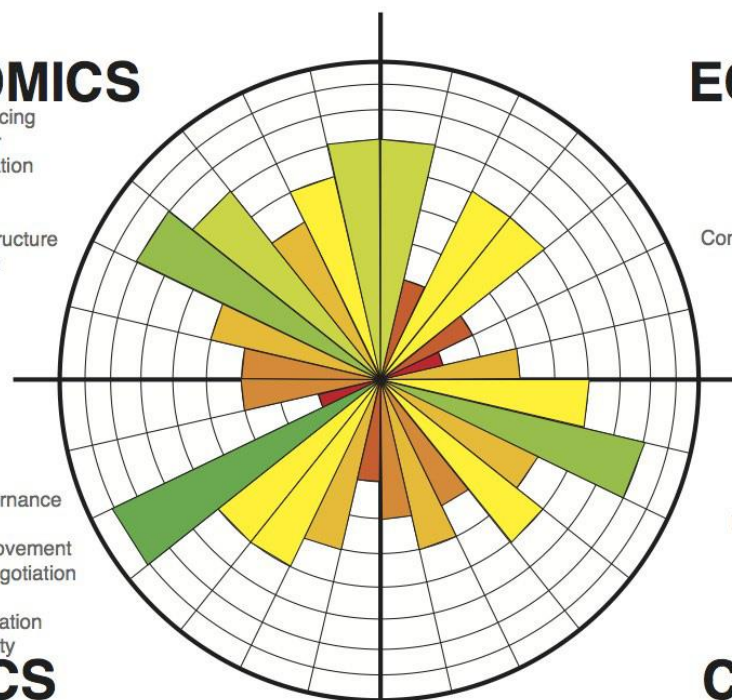
Materials & Energy
Water & Air
Flora & Fauna
Habitat & Land
Place & Space
Constructions & Settlements
Emission & Waste

Organization & Governance
Law & Justice
Communication & Movement
Representation & Negotiation
Security & Accord
Dialogue & Reconciliation
Ethics & Accountability

POLITICS

Engagement & Identity
Performance & Creativity
Memory & Projection
Belief & Meaning
Gender & Generations
Enquiry & Learning
Health & Wellbeing

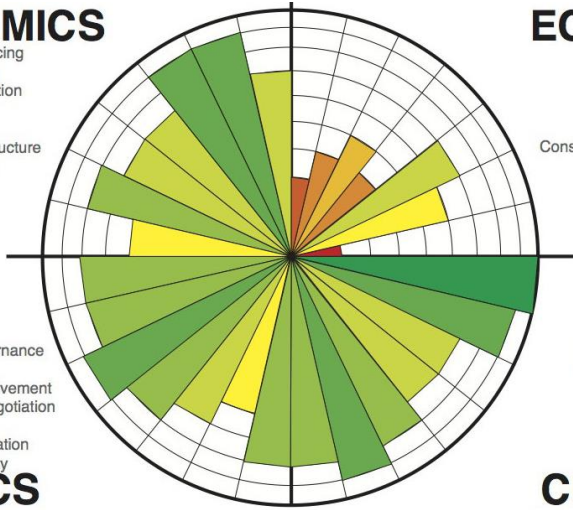
CULTURE



*Sao Paulo Macro Metropolitan Region, 2012

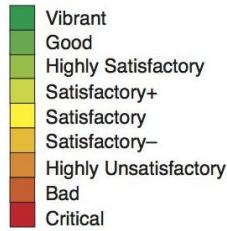
ECONOMICS

Production & Resourcing
Exchange & Transfer
Accounting & Regulation
Consumption & Use
Labour & Welfare
Technology & Infrastructure
Wealth & Distribution



Organization & Governance
Law & Justice
Communication & Movement
Representation & Negotiation
Security & Accord
Dialogue & Reconciliation
Ethics & Accountability

POLITICS



ECOLOGY

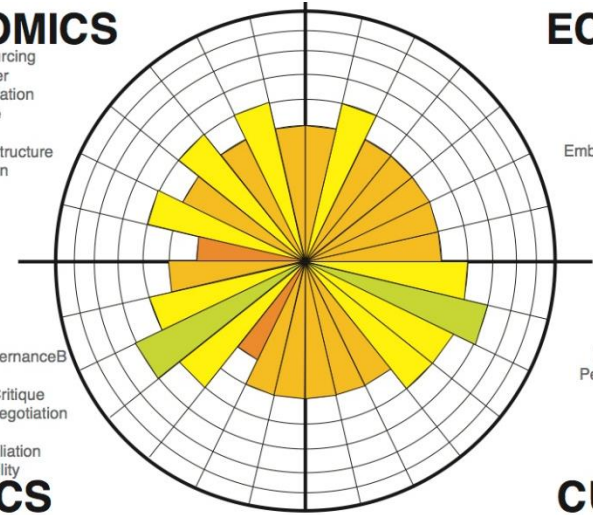
Materials & Energy
Water & Air
Flora & Fauna
Habitat & Food
Place & Space
Constructions & Settlements
Emission & Waste

Engagement & Identity
Recreation & Creativity
Memory & Projection
Belief & Meaning
Gender & Generations
Enquiry & Learning
Health & Wellbeing

CULTURE

ECONOMICS

Production & Resourcing
Exchange & Transfer
Accounting & Regulation
Consumption & Use
Labour & Welfare
Technology & Infrastructure
Wealth & Distribution



Organization & Governance
Law & Justice
Communication & Critique
Representation & Negotiation
Security & Accord
Dialogue & Reconciliation
Ethics & Accountability

POLITICS



ECOLOGY

Materials & Energy
Water & Air
Flora & Fauna
Habitat & Settlements
Built-Form & Transport
Embodiment & Sustenance
Emission & Waste

Engagement & Identity
Performance & Creativity
Memory & Projection
Belief & Meaning
Gender & Generations
Enquiry & Learning
Wellbeing & Health

CULTURE

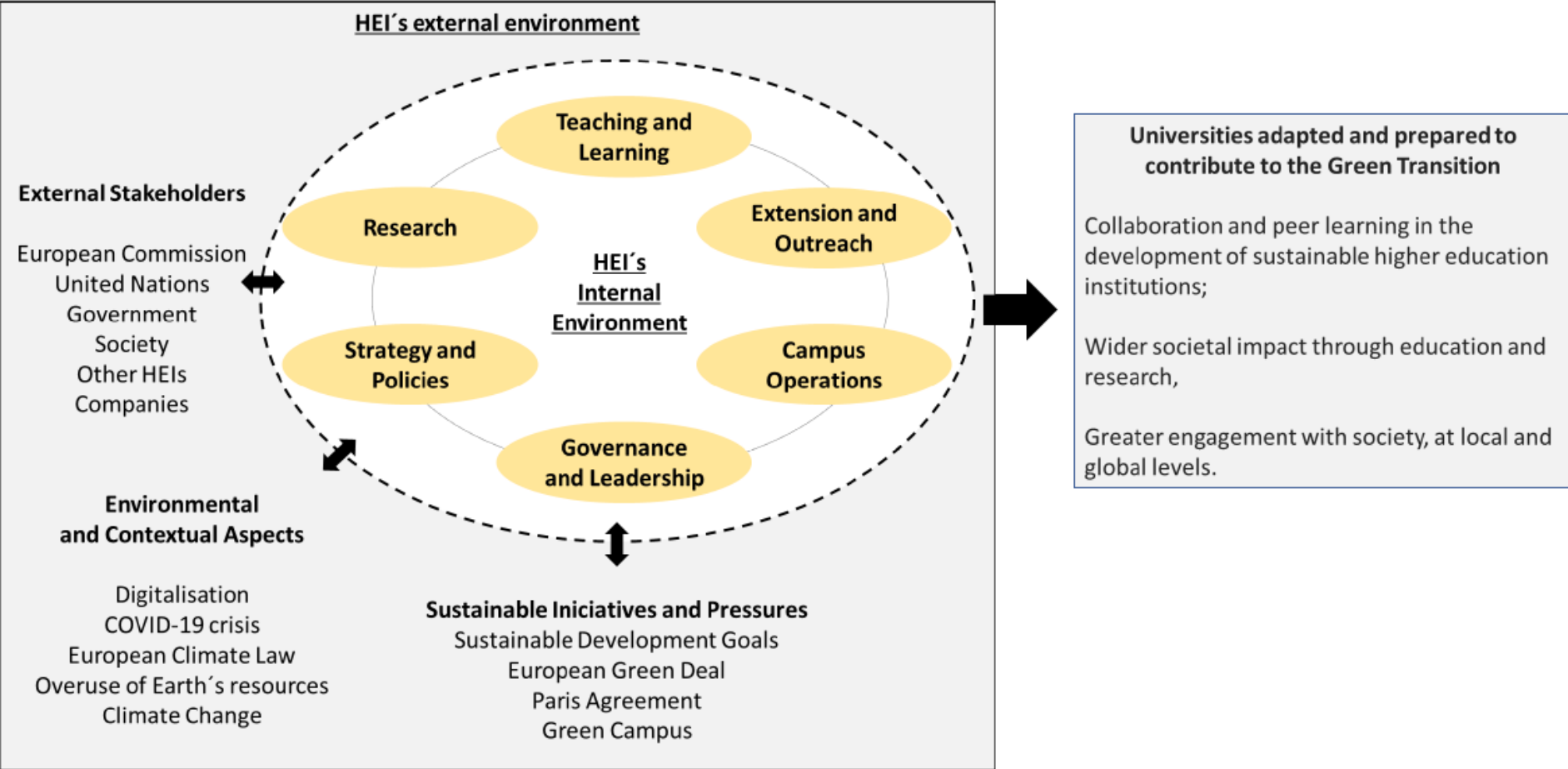
Melbourne

2011

Delhi

2012

Figure 7.1. The role of HEIs in contributing to the green transition



Outline

- Portugal
- Macroeconomy
- Inequality
- Innovation
- Skills
- Education
- R&D
- Sustainability
- **Future**
- Geopolitics

FORESIGHT PORTUGAL 2030

Cenários de evolução
para Portugal

volume 01



FUNDAÇÃO
CALOUSTE GULBENKIAN





Outline

- Portugal
- Macroeconomy
- Inequality
- Innovation
- Skills
- Education
- R&D
- Sustainability
- Future
- **Geopolitics**

Source: 'Roma. Dal solco di Romolo all'impero fascista. Atlantino storico', pubblicato a cura della Federazione italiana nazionale fascista per la lotta contro la tubercolosi, Bergamo, 1940, Istituto Italiano d'Arti Grafiche.





.... RAND Corporation

Global Power Index (GPI) includes measures of the military, economic, technological, political, and demographic capacity of nations.

GPI includes

nuclear weapons as a factor in the military capacity of a state,

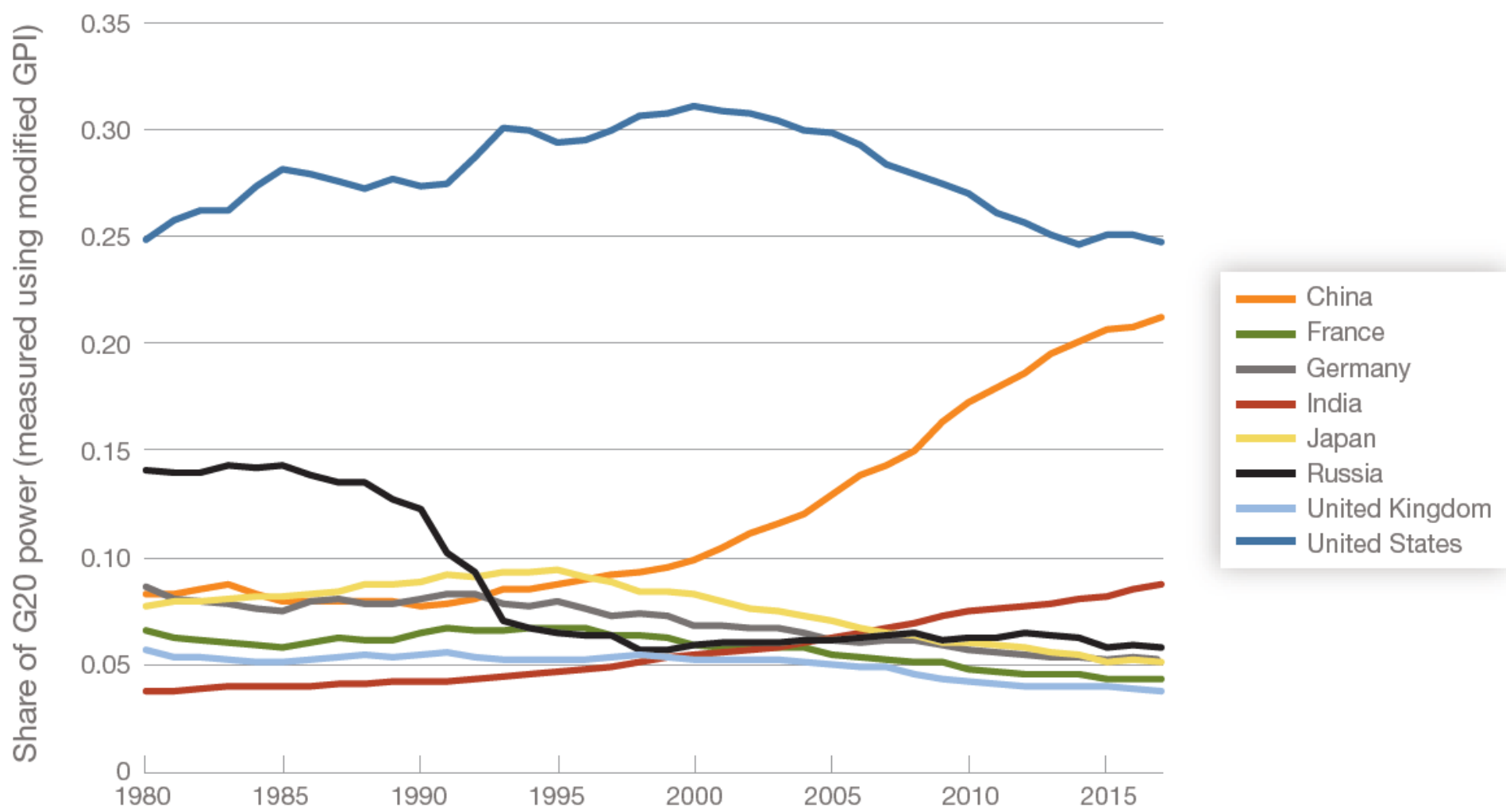
trade as a factor in the economic capacity of a state,

R&D expenditures as a measure of technological capacity,

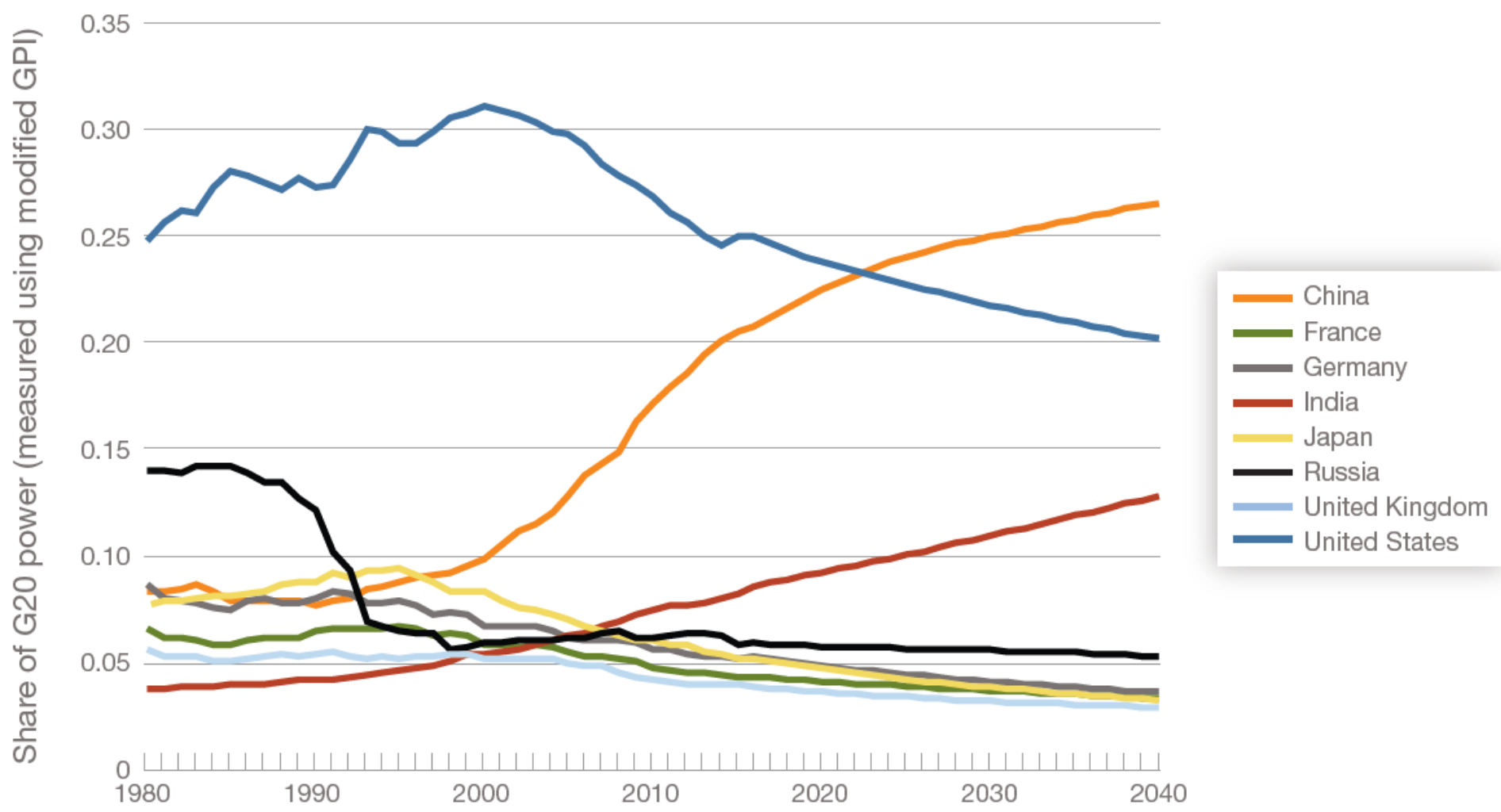
government revenues as a measure of political capacity, and

working-age population (rather than total population) as a measure of labor capacity.

Share of G20's Modified GPI of the United States, China, India, Russia, Germany, Japan, France, and United Kingdom (1980–2017)



Balance of Power (Measured Using Modified GPI) in Baseline Scenario (1980–2040)



The Geographical Journal.

No. 4.

APRIL, 1904.

VOL. XXIII.

THE GEOGRAPHICAL PIVOT OF HISTORY.*

By H. J. MACKINDER, M.A., Reader in Geography in the University of Oxford; Director of the London School of Economics and Political Science.

WHEN historians in the remote future come to look back on the group of centuries through which we are now passing, and see them foreshortened, as we to-day see the Egyptian dynasties, it may well be that they will describe the last 400 years as the Columbian epoch, and will say that it ended soon after the year 1900. Of late it has been a commonplace to speak of geographical exploration as nearly over, and it is recognized that geography must be diverted to the purpose of intensive survey and philosophic synthesis. In 400 years the outline of the map of the world has been completed with approximate accuracy, and even in the polar regions the voyages of Nansen and Scott have very narrowly reduced the last possibility of dramatic discoveries. But the opening of the twentieth century is appropriate as the end of a great historic epoch, not merely on account of this achievement, great though it be. The missionary, the conqueror, the farmer, the miner, and, of late, the engineer, have followed so closely in the traveller's footsteps that the world, in its remoter borders, has hardly been revealed before we must chronicle its virtually complete political appropriation. In Europe, North America, South America, Africa, and Australasia there is scarcely a region left for the pegging out of a claim of ownership, unless as the result of a war between civilized or half-civilized powers. Even in Asia we are probably witnessing the last moves of the game first played by the horsemen of Yermak the Cossack and the shipmen of Vasco da Gama. Broadly speaking, we may contrast the Columbian epoch with the age which preceded it, by describing its essential

* Read at the Royal Geographical Society, January 25, 1904.

in "The Geographical Pivot of History" presented at the Royal Geographical Society, Mackinder formulated the Heartland Theory. This is often considered as a, if not the, **founding moment of geopolitics** as a field of study....

https://en.wikipedia.org/wiki/Halford_Mackinder

Geopolitics: study of the effects of Earth's geography (human and physical) on politics and international relations.

Geostrategy: type of foreign policy mainly guided by geographical factors as they inform, constrain, or affect political and military planning.

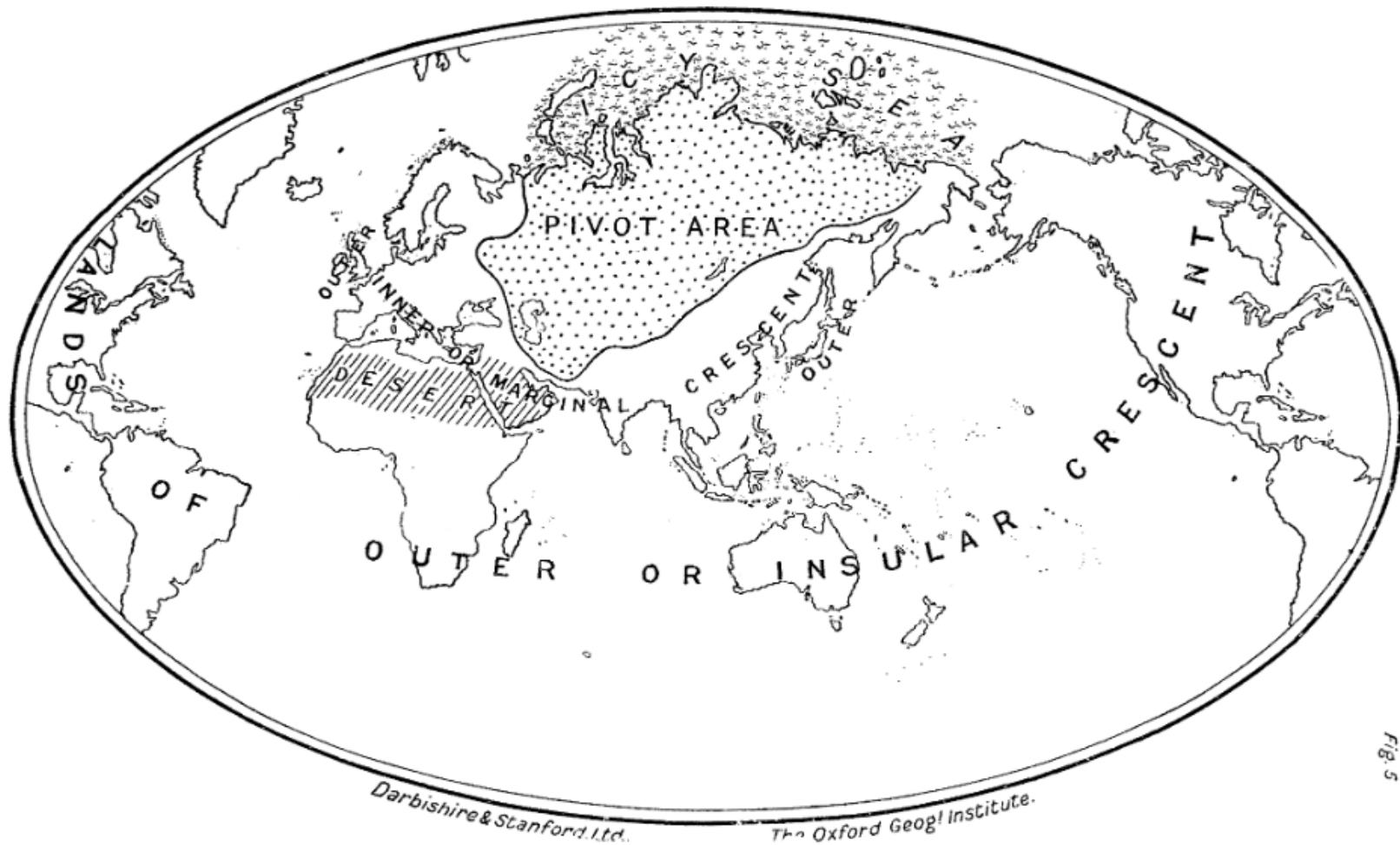


Fig. 5

THE NATURAL SEATS OF POWER.

Pivot area—wholly continental. Outer crescent—wholly oceanic. Inner crescent—partly continental, partly oceanic.

Lambert, 'Seapower states', Yale Univ. Press, 2018

... seapower vs. continental empire Commonwealth' sustained by mutual interest based on economic ties and sea control, vs a 'Roman' contiguous terrestrial empire of land and people

Blouet, 'Global geostrategy', F. Cass, 2005

history as a struggle between land power and sea power.

discussion of Mackinder's paper by Amery (p.441):

both the sea and the railway are going in the future ... to be supplemented by the air as a means of locomotion, and when we come to that ... a great deal of this geographical distribution will lose its importance, and the successful powers will be those who have the greatest industrial base. It will not matter whether they are in the centre of a continent or on an island; those people who have the industrial power and the power of invention and of science will be able to defeat all others

Nevertheless, Russian interest on **warm water** seaports

1905 Port Arthur (now Lüshun / Dalian, in China) - defeat of Russia in Russia Japan war ...

1945 exclave of Kaliningrad ...

1971 Tartus, Lakatia (Siria): civil war 2015-6 ...

2014 annexation of Crimea (since Prince Potemkin Russian fleet is based in Sevastopol) ...

2022 aggression of Ukraine with main focus in the Azov and Black seas.

War - source of questions of a moral nature.

Can war under any circumstances be justified? or is it always incorrect?

There are three main theories that try to answer these questions: realism, pacifism and the theory of just war.

Realism: morals are not called here international political scene: an anarchic arena, with no other rules except those that states can impose, and in which the dominant issues are related to power, security and national interest. In relations between states, the only rule that counts is the “right of the strongest to liberty”. The only correct policy in international relations is “realpolitik”.

- Thucydides ***the strong do what they can and the weak suffer what they must.***
- Clausewitz *war is just the continuation of politics by other means*
- Machiavelli, Thomas Hobbes Henry Kissinger John Mearsheimer

Pacifism: All wars are immoral

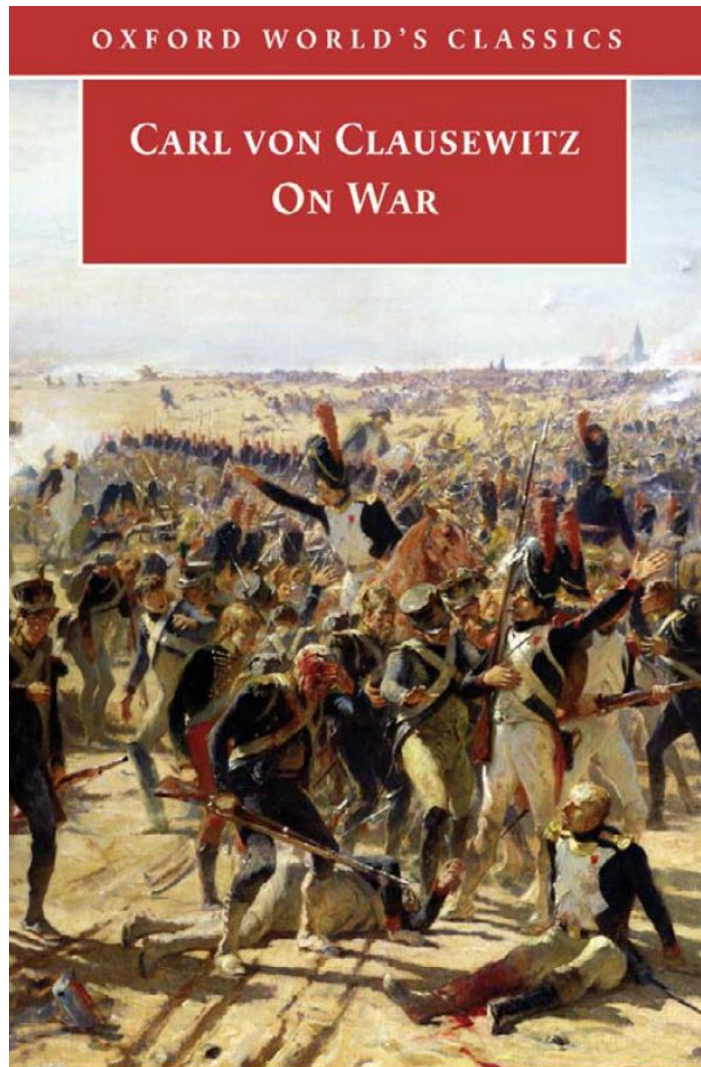
War belongs to the sphere of moral - no war is morally justified. war is always wrong.

bellum justum: answer to the moral problem of war: not all wars are immoral. Contrary to what realists think, war is covered by moral and, contrary to what pacifists think, is sometimes justified. This theory is thus opposed to both realism and pacifism; it forms the basis of the 1949 Geneva Conventions

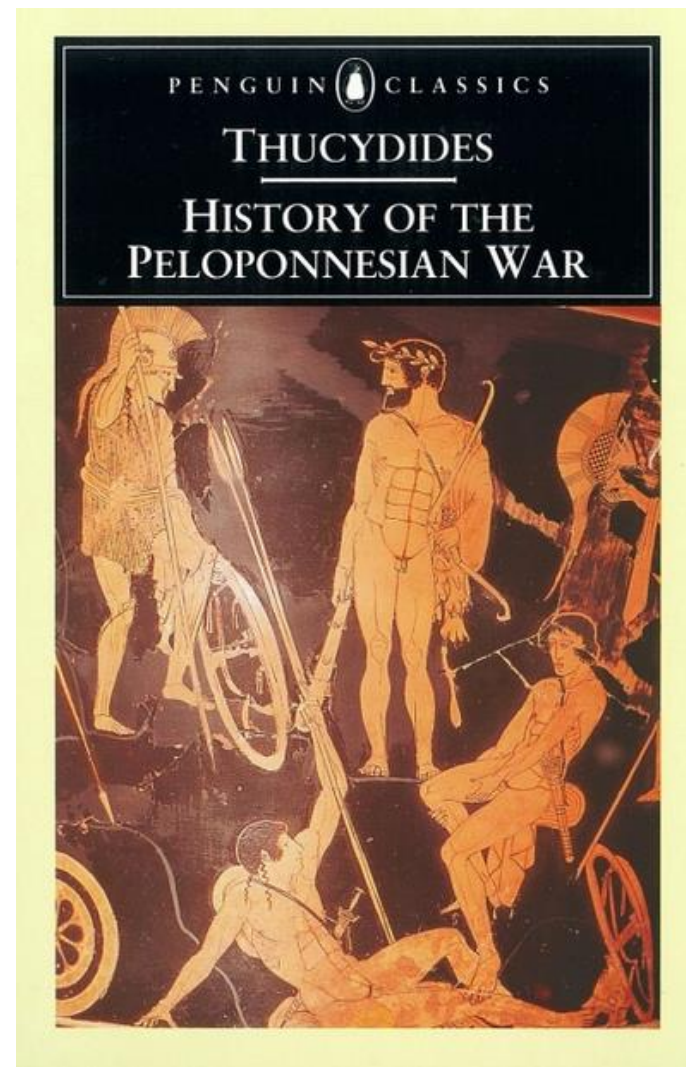
when it is legitimate to resort to war (***jus ad bellum***)

how to conduct war (***jus in bello***)

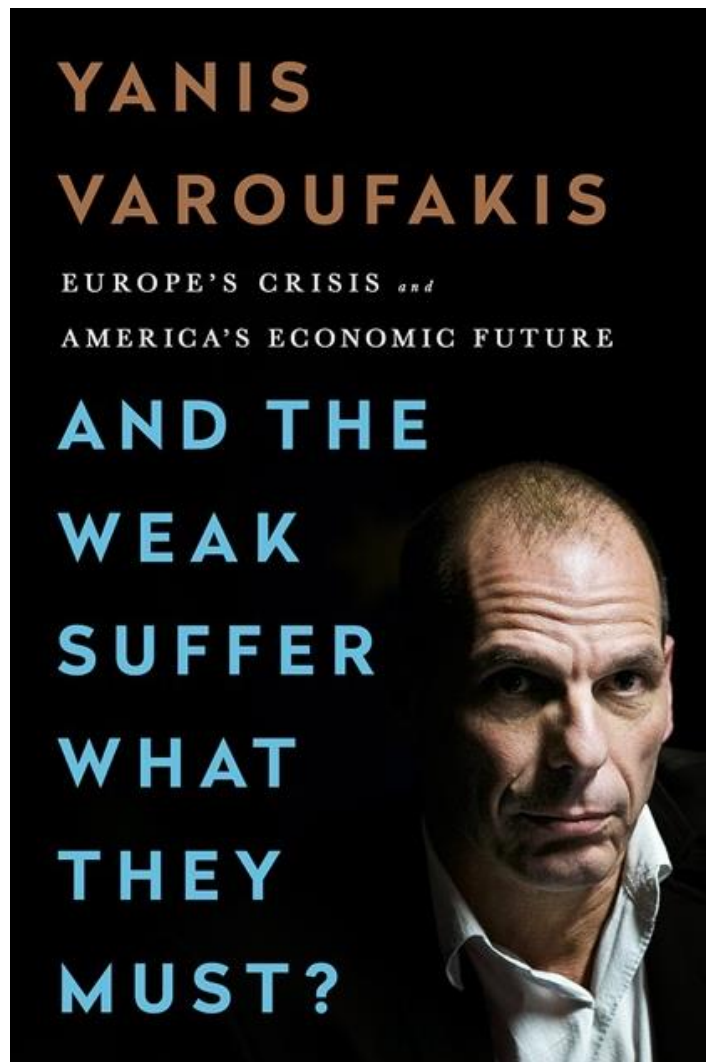
what must be done once the war is over (***jus post bellum***).

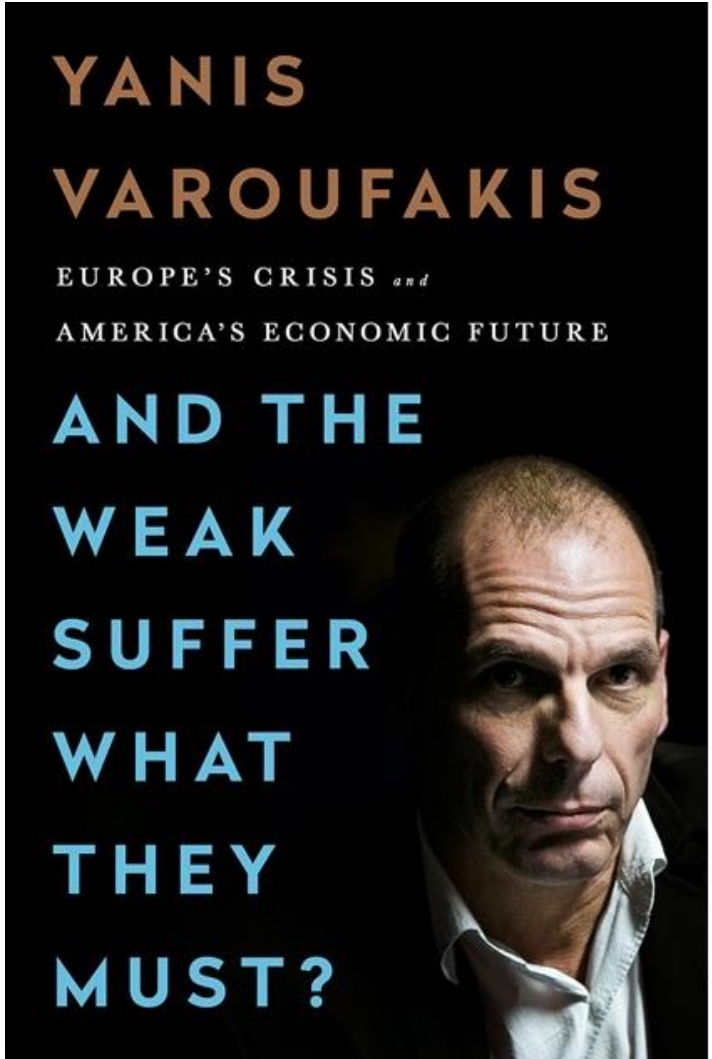


1832

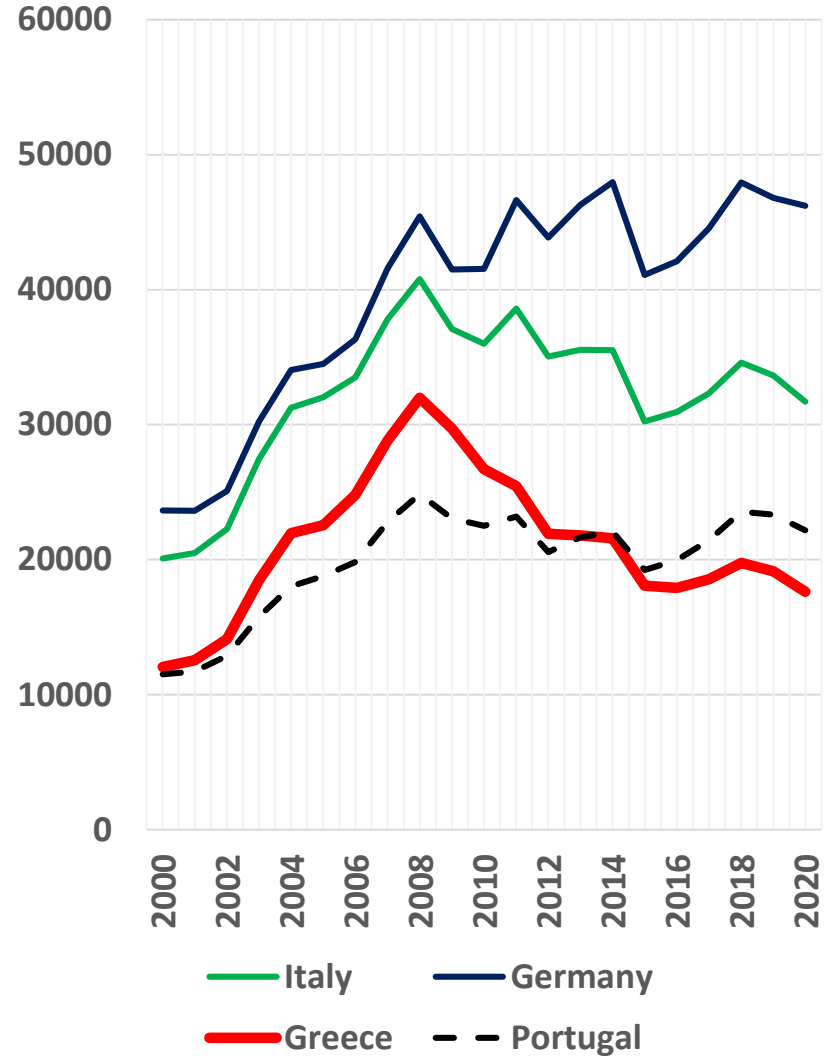


fifth century BC

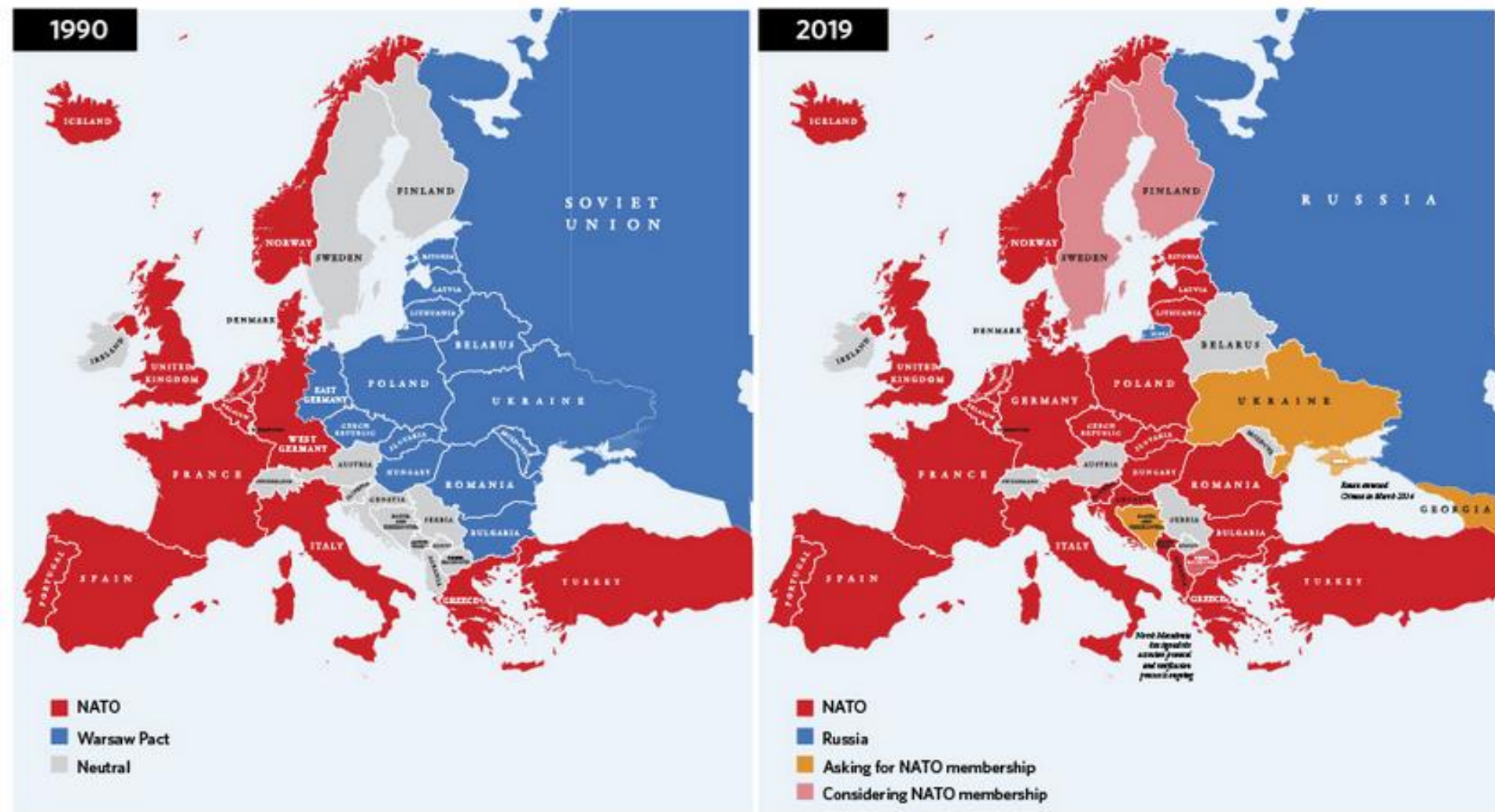




GDP per capita, current US\$,
The World Bank



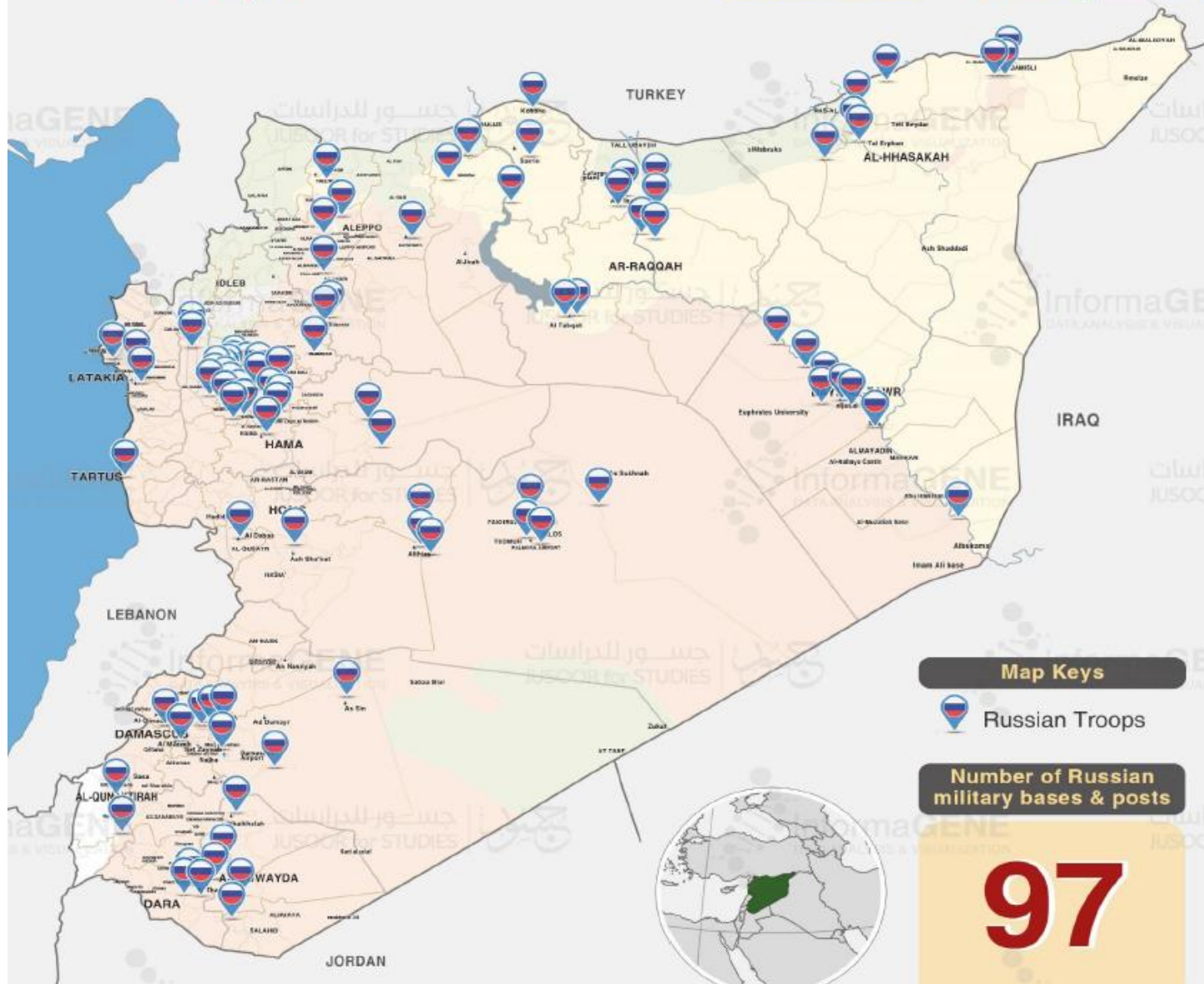
Rumer, Sokolsky, 'Thirty Years of U.S. Policy Toward Russia: Can the Vicious Circle Be Broken?', Carnegie Endowment for International Peace, 2019



source of figure: Russian Institute for Strategic Studies <https://en.riss.ru/>

Mapping Russian Military Bases and Points in Syria

September, 2021



Map Keys

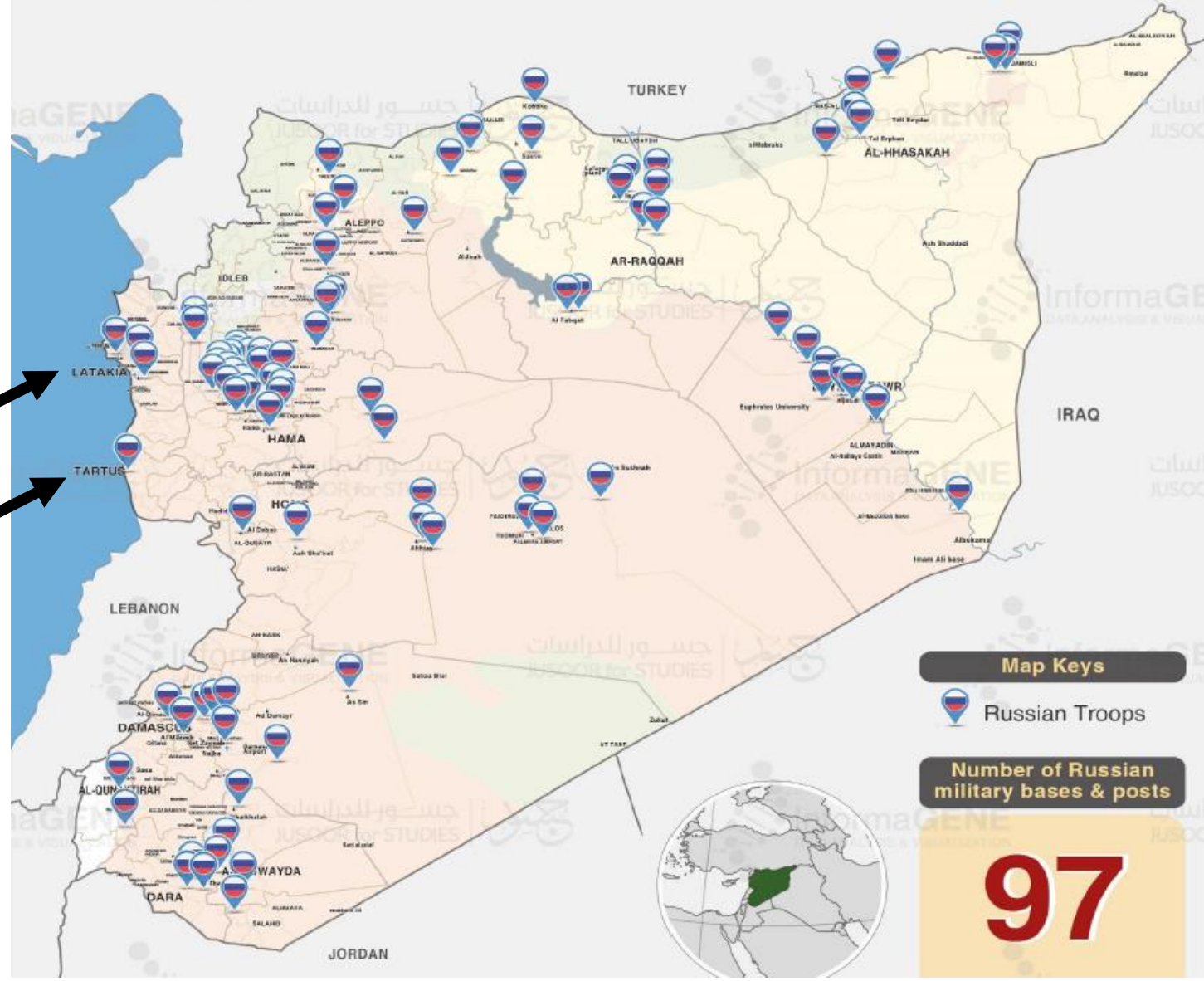
Russian Troops

Number of Russian military bases & posts

97

Mapping Russian Military Bases and Points in Syria

September, 2021



Latakia

Tartus

Map Keys

Russian Troops

Number of Russian military bases & posts

97



Pergamon

Political Geography 20 (2001) 1029–1051

Political
Geography

www.politicalgeography.com

Discussion

Alexander Dugin: geopolitics and neo-fascism in post-Soviet Russia

Alan Ingram *

Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, UK

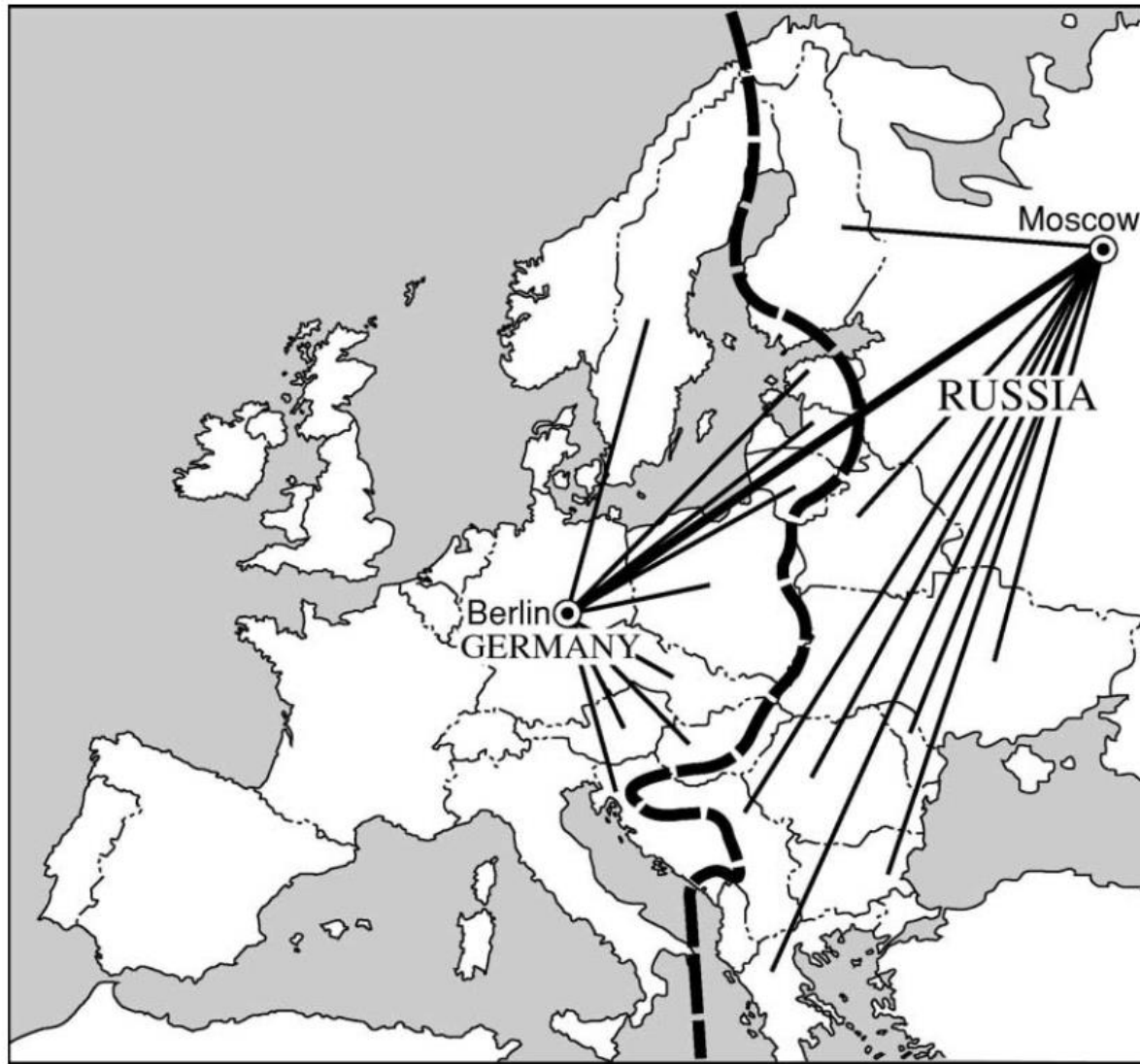


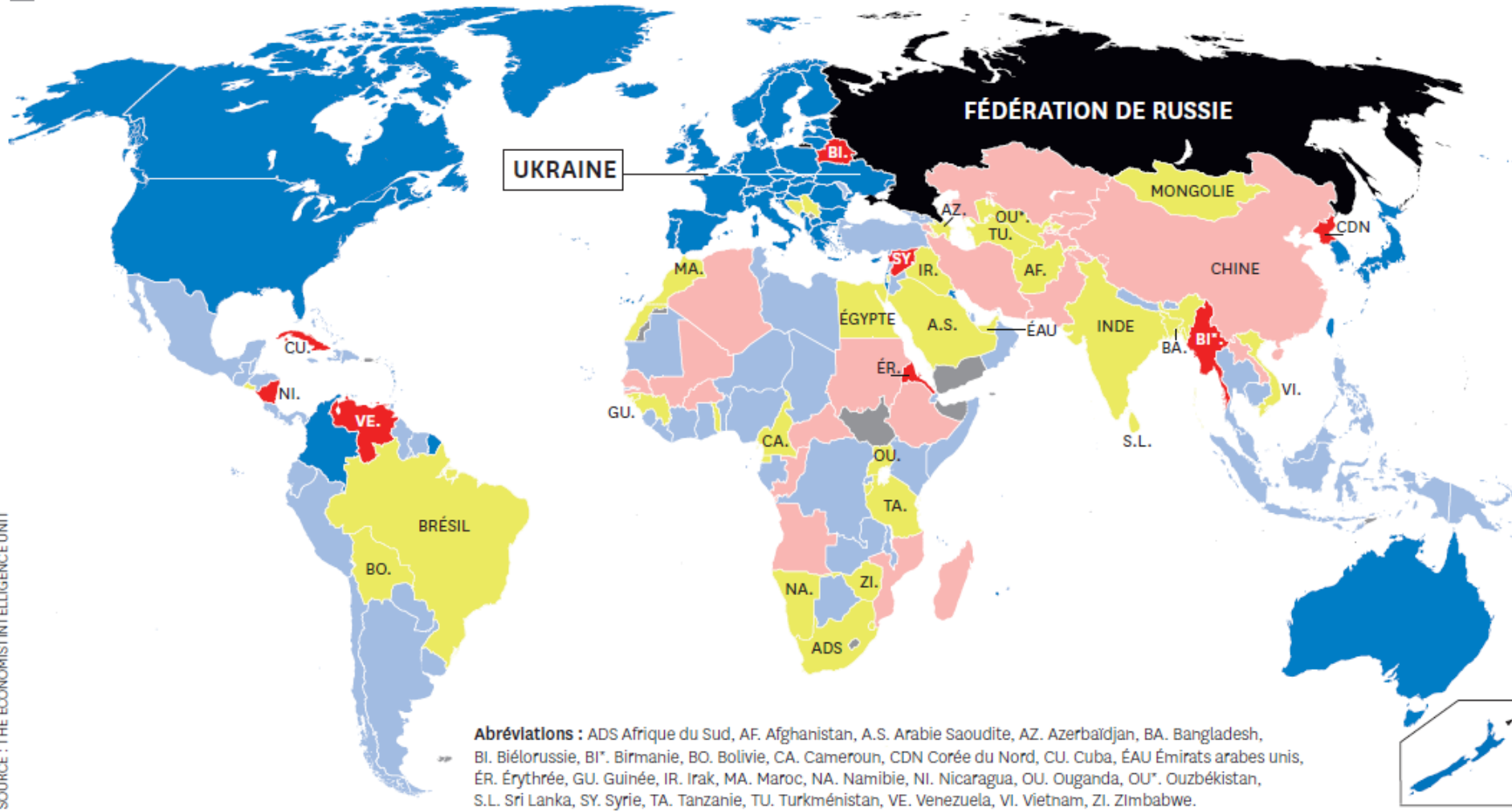
Fig. 3. The geopolitical redivision of Eastern Europe.



Fig. 6. Russia as Eurasian Empire.

POSITIONNEMENT DES GOUVERNEMENTS FACE À LA GUERRE EN UKRAINE, MARS 2022

- Condamnent la Russie
- Proches de l'Occident
- Neutres ou non alignés
- Proches de la Russie
- Soutiennent la Russie
- Aucune donnée

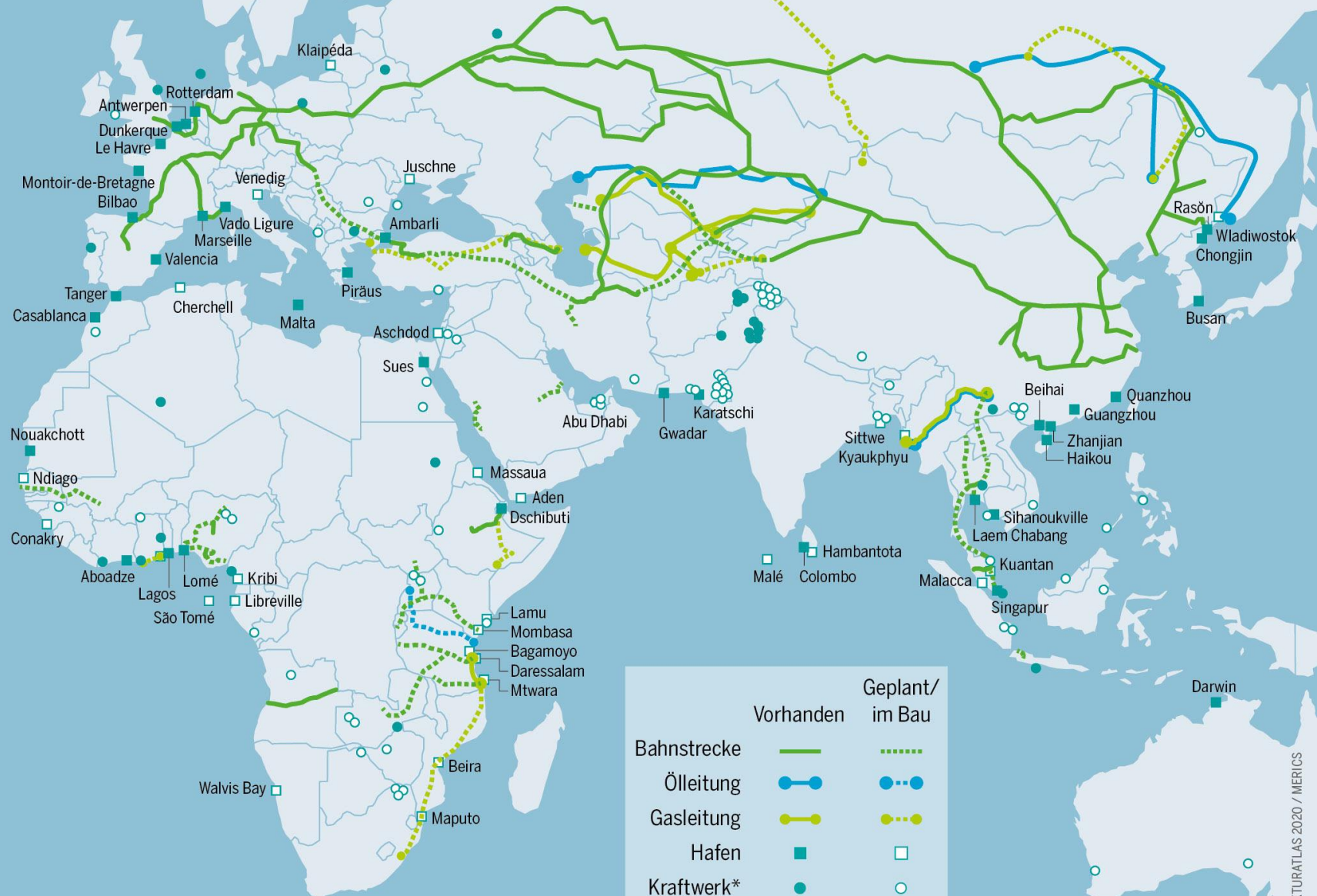


Selon cette carte réalisée par **The Economist Intelligence Unit (EIU)** fin mars, aux données forcément fluctuantes, 131 pays sont hostiles à la guerre menée par Moscou en Ukraine. Si "le camp de l'Ouest" représente plus de 70 % du PIB mondial, il ne pèse en revanche qu'à hauteur de 36 % de la population mondiale, souligne l'EIU. Par ailleurs, 32 pays sont considérés comme neutres,

SOURCE : THE ECONOMIST INTELLIGENCE UNIT

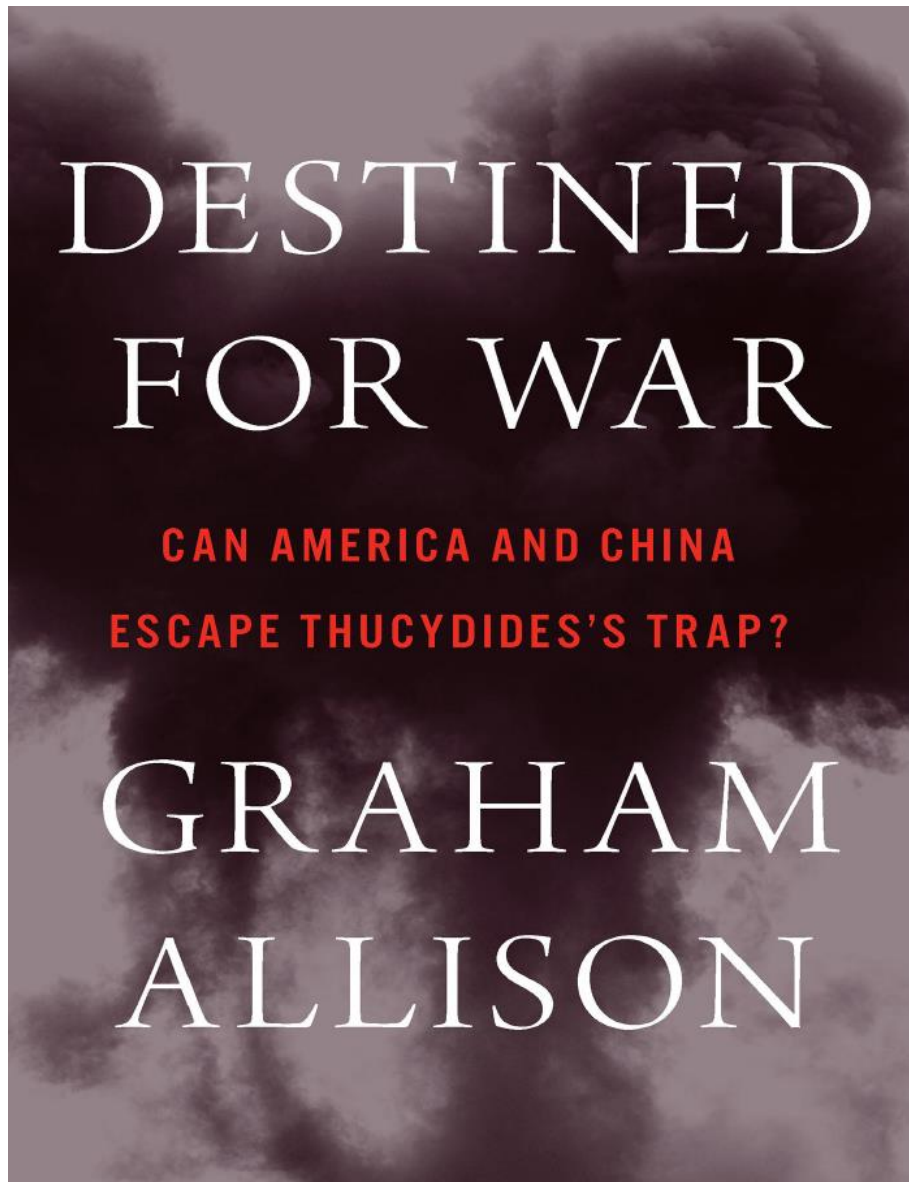
INFRASTRUKTUREN FÜR DREI KONTINENTE

Chinas Belt and Road Initiative umfasst mehr als 2.000 Vorhaben: Lückenschlüsse oder Verbesserungen bestehender Infrastrukturen ebenso wie Neubauprojekte oder den Kauf und Ausbau von Häfen. Die Karte zeigt viele der wichtigsten Projekte (Stand 2018).



STRUKTURATLAS 2020 / MERICS

https://en.wikipedia.org/wiki/Belt_and_Road_Initiative#/media/File:China_Belt_Road_Initiative_Landkarte_Projekte_2018.jpg



Thucydides:

'What made the war inevitable was the growth of Athenian power and the fear which this caused in Sparta'

(G. Allison is the Douglas Dillon Professor of Government at the John F. Kennedy School of Government at Harvard University)