

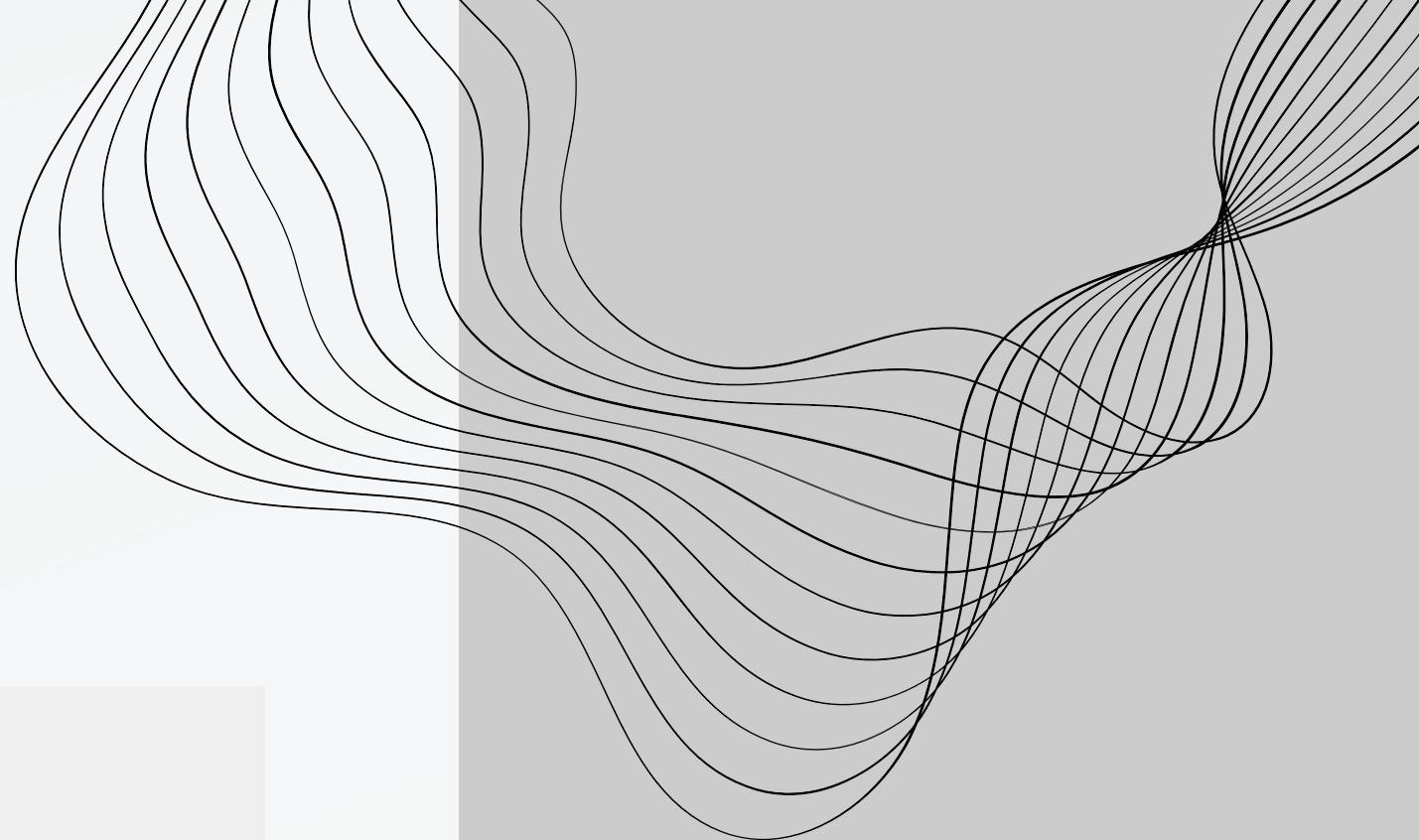
ISRAEL

AN ANALYSIS OF ISRAEL'S GROWTH EXPERIENCE
ACROSS VARIOUS INDICES IN THE 21ST CENTURY



OBJECTIVES:

- Understand the philosophy behind Israel's trajectory of growth and development.
- Quantitative analysis of Israel's growth across various indices in the 21st Century.
- Connect the various trends to its policies and decision making.





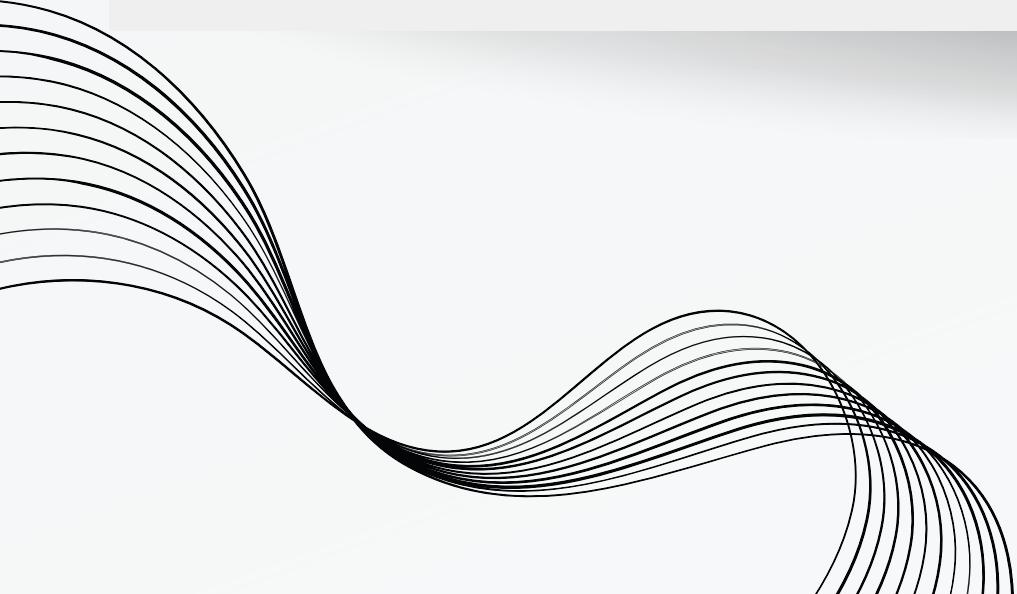
OBJECTIVES:

- Look at Israel's economic growth in terms of various existing growth models.



A BRIEF HISTORY.

- Born out of the Zionist movement and gained status of a Jewish nation in the year 1948.
- A nation surrounded by hostile countries, been through several wars right from its inception, tensions still high.



Israel Reference Map

as of 13 Oct 2016

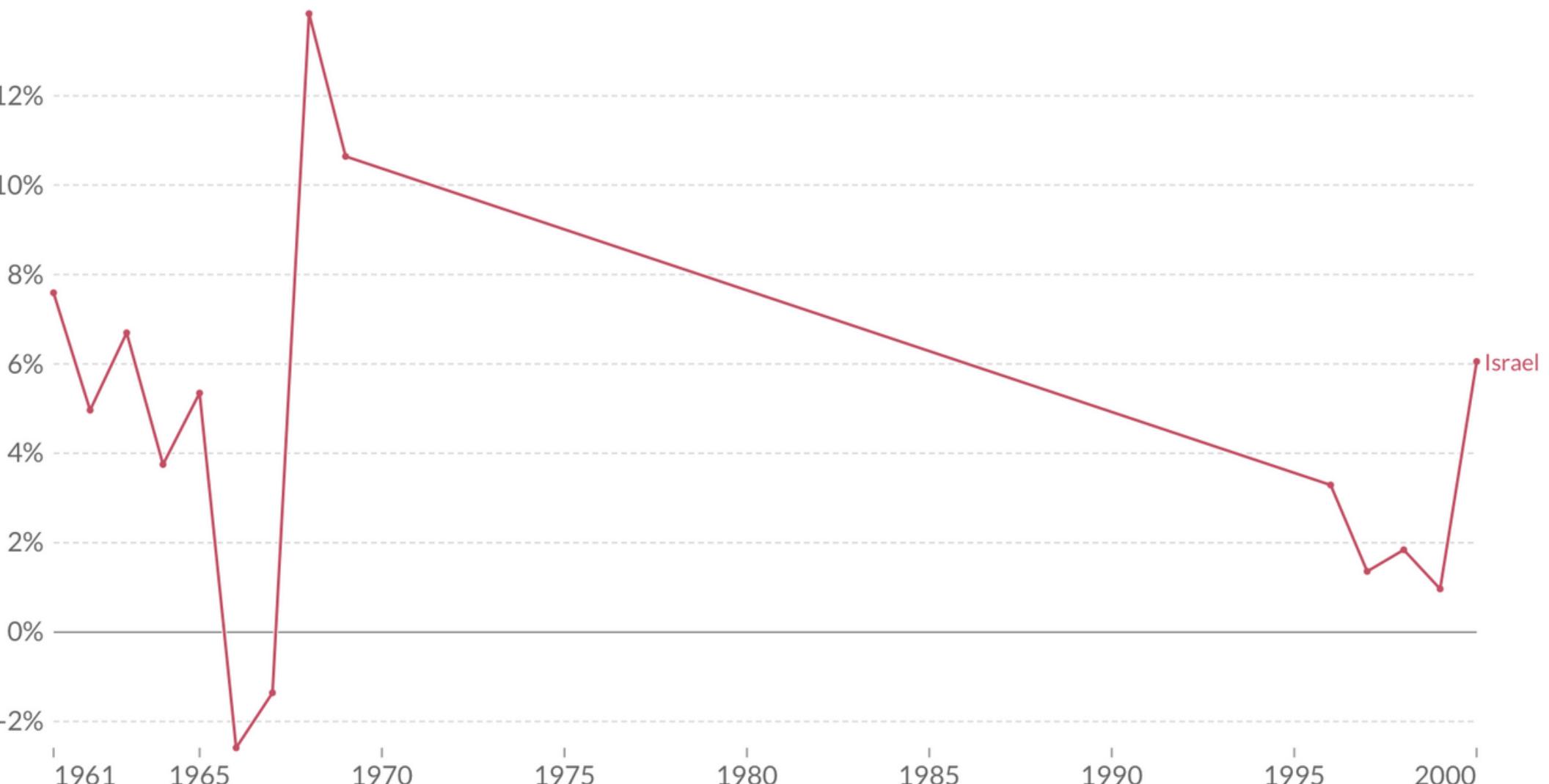


Annual growth of GDP per capita, 1961 to 2000

Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant U.S. dollars.

Our World
in Data

+ Add country



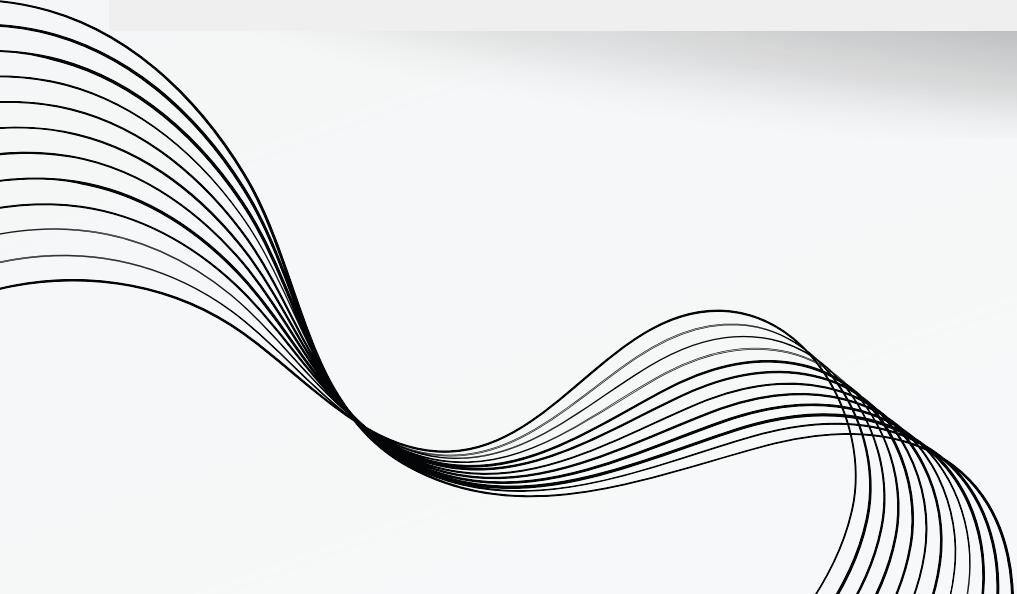
Source: World Bank and OECD

OurWorldInData.org/economic-growth • CC BY



A BRIEF HISTORY.

- Born out of the Zionist movement and gained status of a Jewish nation in the year 1948.
- A nation surrounded by hostile countries, been through several wars right from its inception, tensions still high.
- Growth (on all fronts) is a matter of survival.

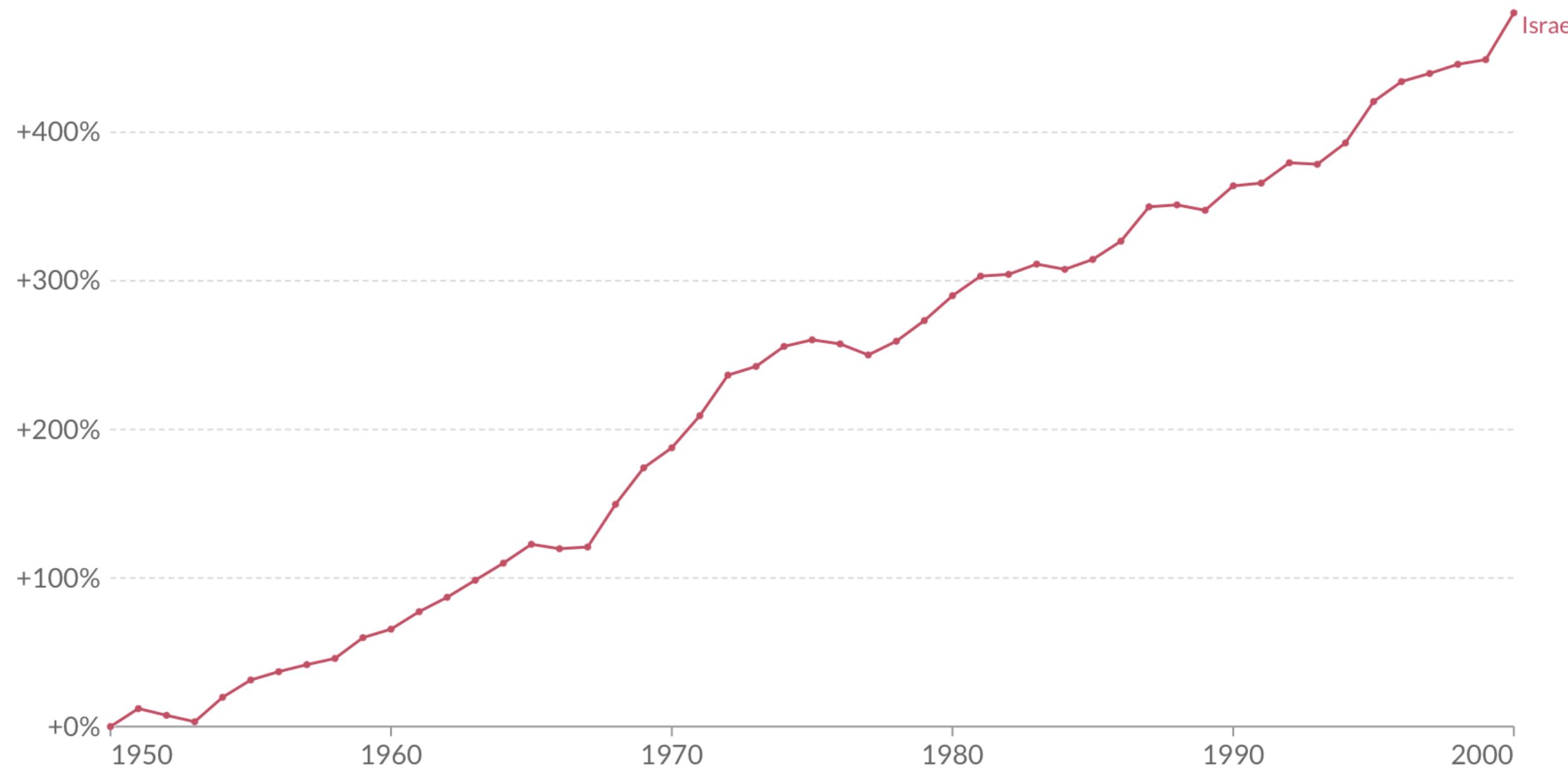


Change in GDP per capita, 1950 to 2000

This data is adjusted for inflation and for differences in the cost of living between countries.

Our World
in Data

+ Add country or region ✓ Relative change

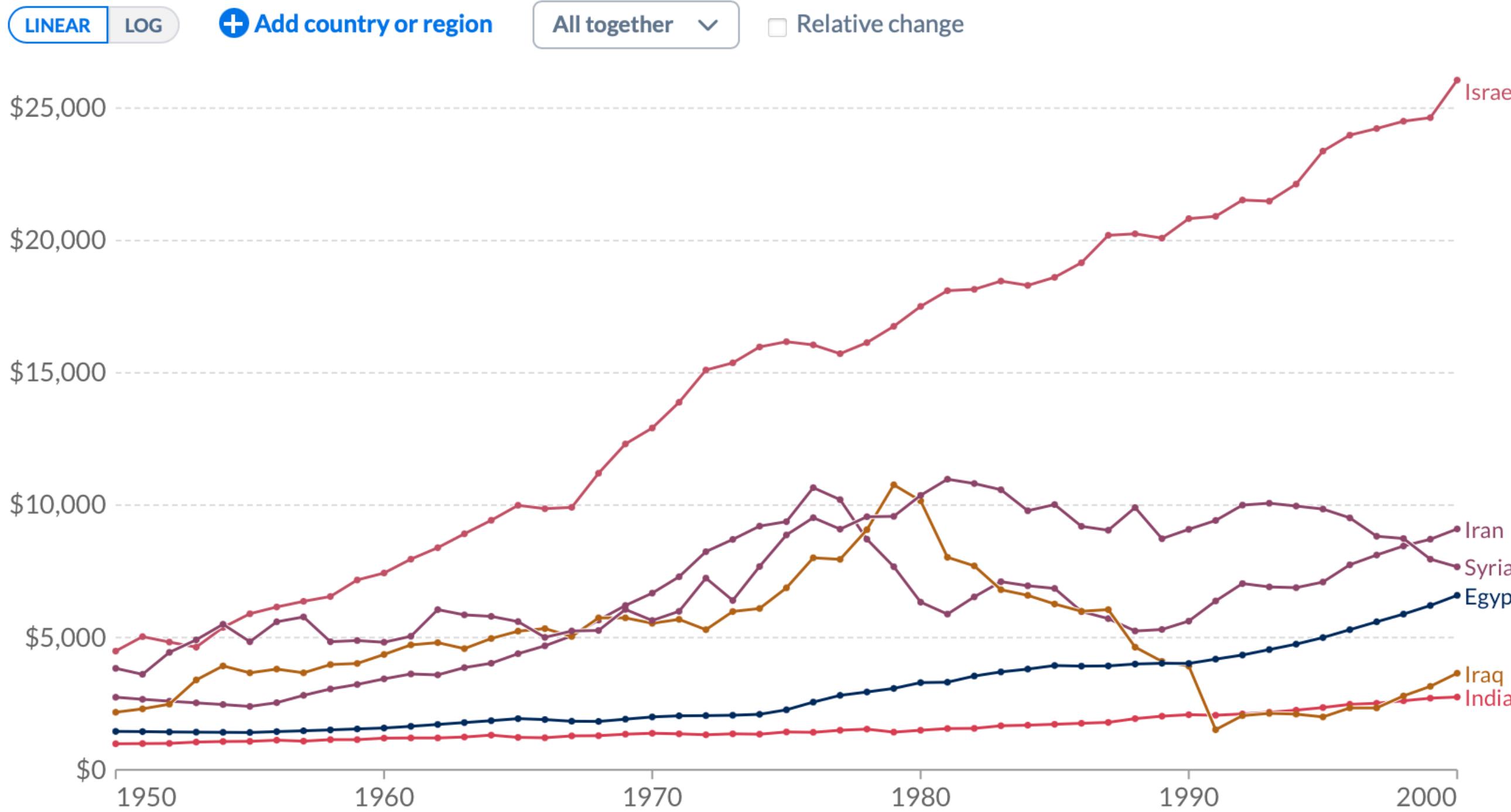


Source: Maddison Project Database 2020 (Bolt and van Zanden, 2020)
Note: This data is expressed in international-\$ at 2011 prices.

OurWorldInData.org/economic-growth • CC BY

GDP per capita, 1950 to 2000

This data is adjusted for inflation and for differences in the cost of living between countries.



Source: Maddison Project Database 2020 (Bolt and van Zanden, 2020)

Note: This data is expressed in international-\$ at 2011 prices.

OurWorldInData.org/economic-growth • CC BY

Israel Rankings : 2000

Index	Rank
GDP Per Capita	26
HDI	23
Military	-
Child Mortality Rate	< 20
Literacy Rate	-



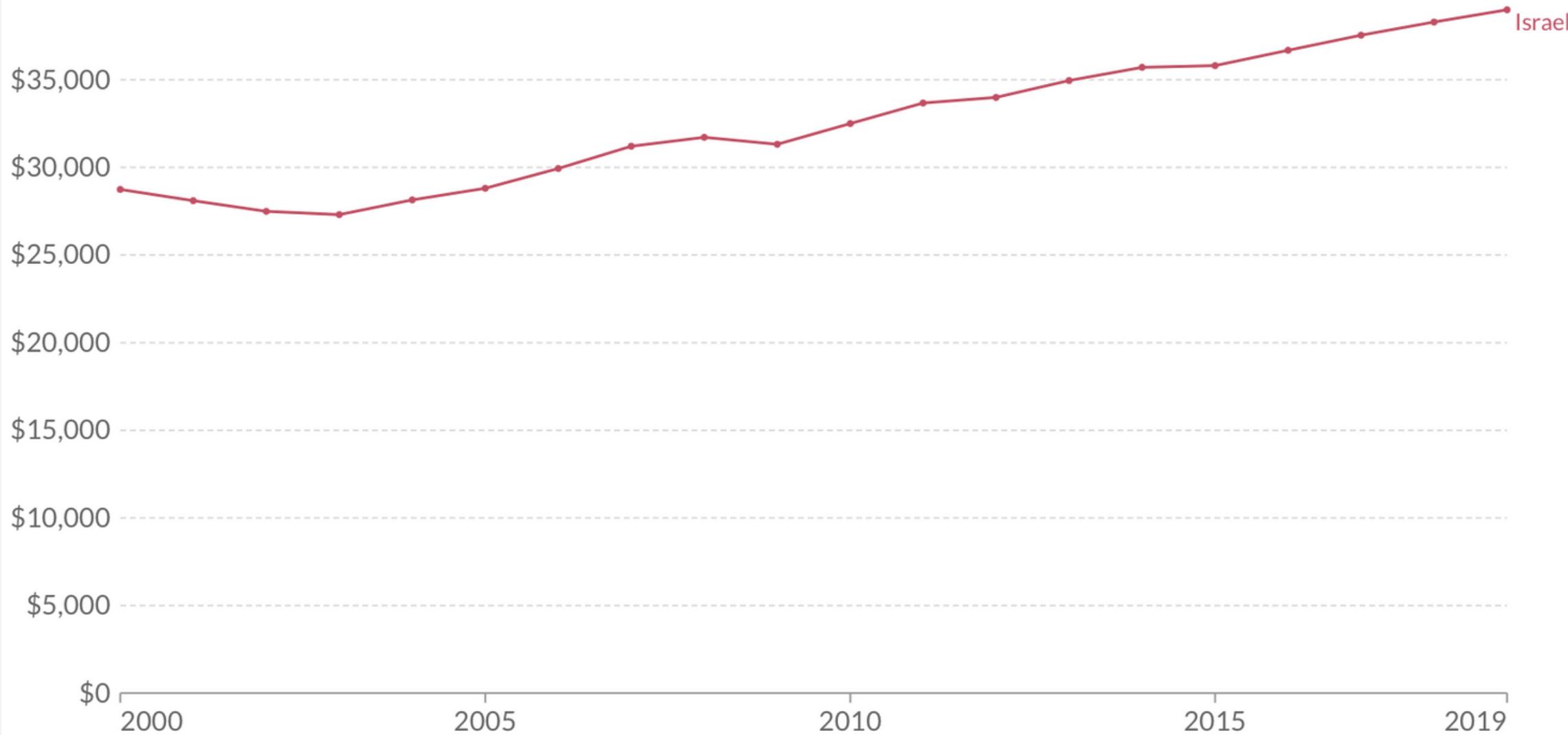
ISRAEL'S GROWTH IN THE 21ST CENTURY

GDP per capita

This data is expressed in US dollars. It is adjusted for inflation but does not account for differences in the cost of living between countries.

Our World
in Data

+ Add country

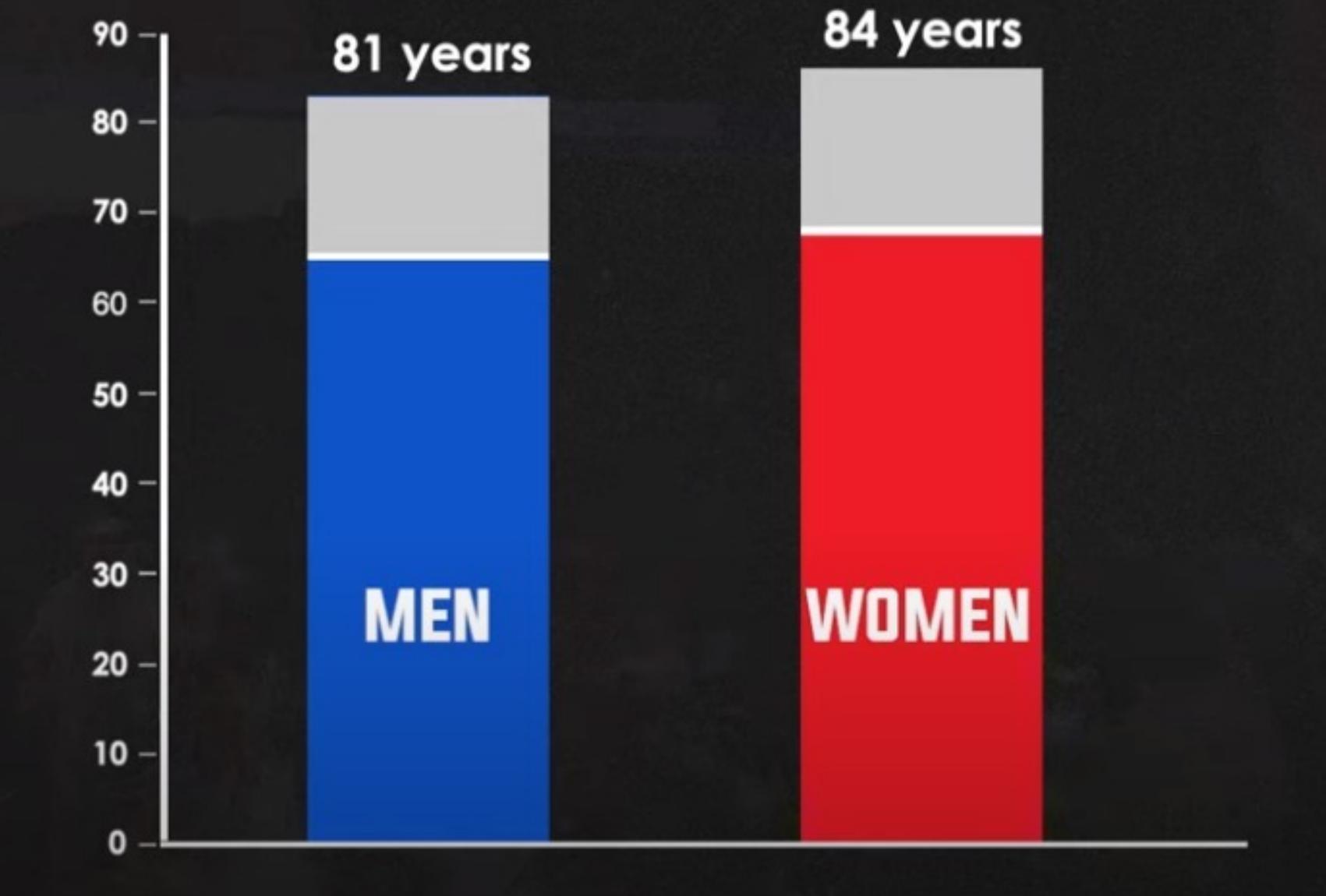


Source: World Bank and OECD
Note: Data is expressed in constant 2010 US\$.

OurWorldInData.org/economic-growth • CC BY

Life Expectancy

Data Source: World Bank

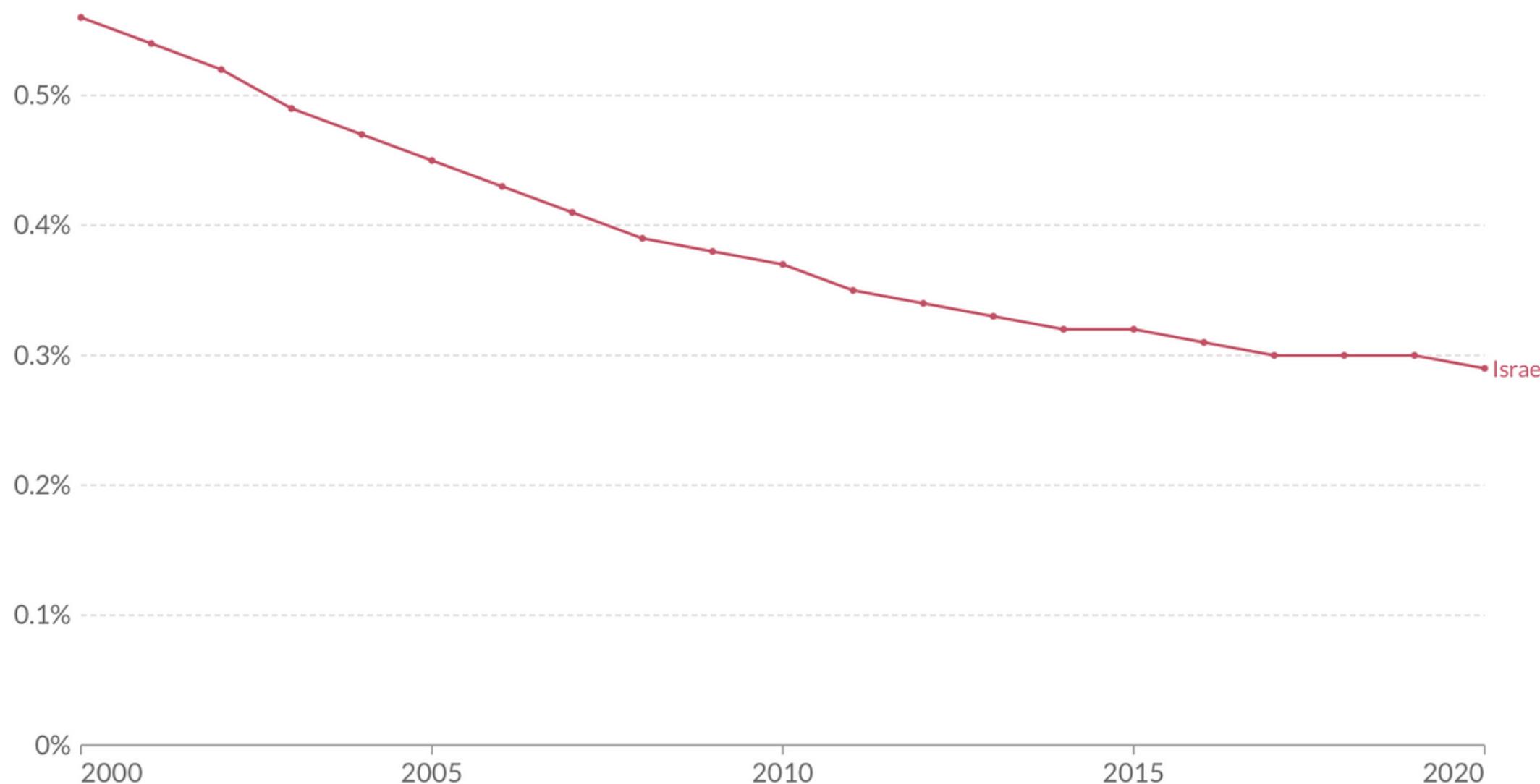


Infant mortality rate

The share of newborns who die before reaching one year of age.

Our World
in Data

+ Add country



Source: UN Inter-agency Group for Child Mortality Estimation (via World Bank)

OurWorldInData.org/child-mortality/ • CC BY

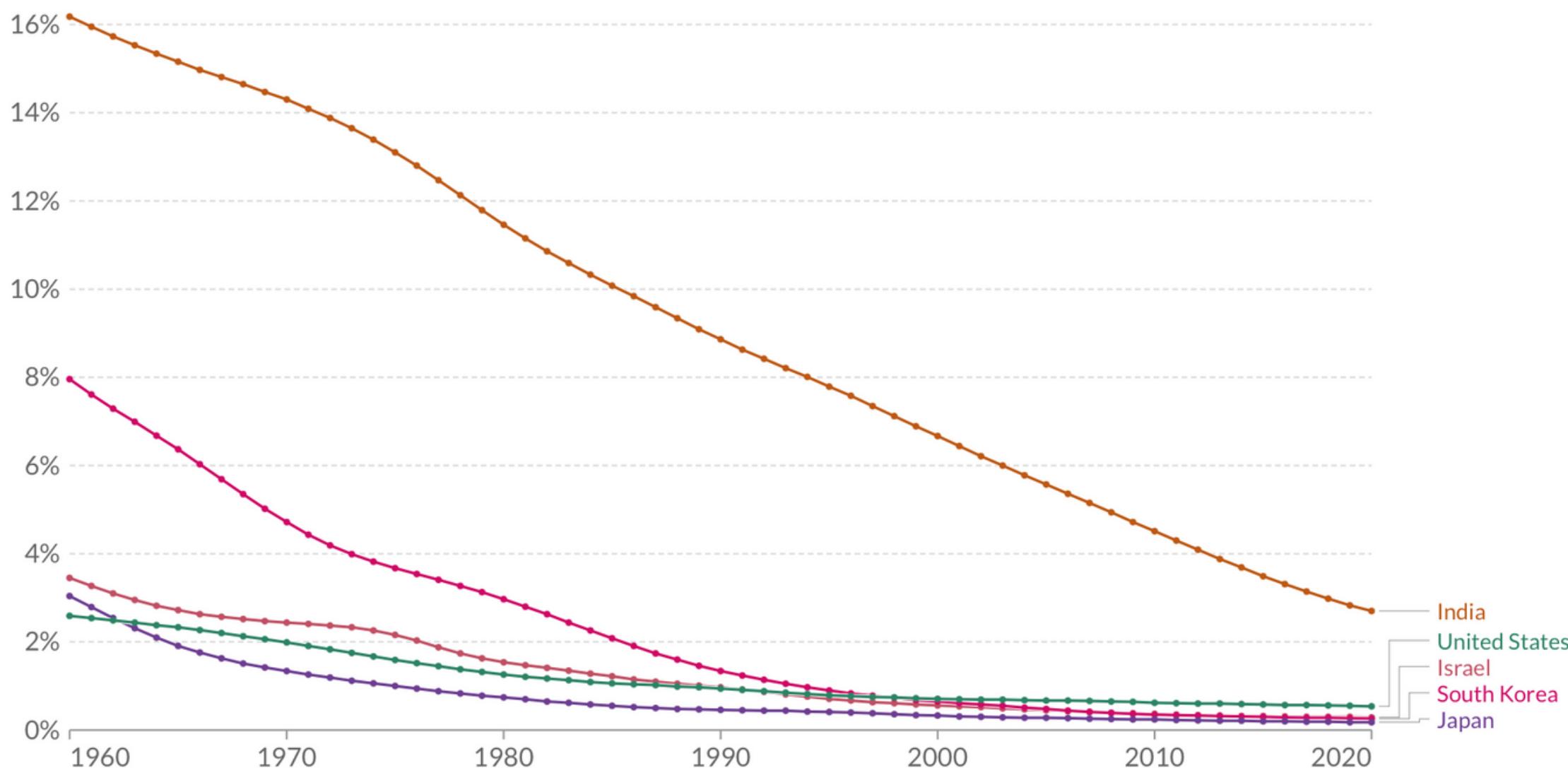
Infant mortality rate

The share of newborns who die before reaching one year of age.

Our World
in Data

+ Add country

All together ▾



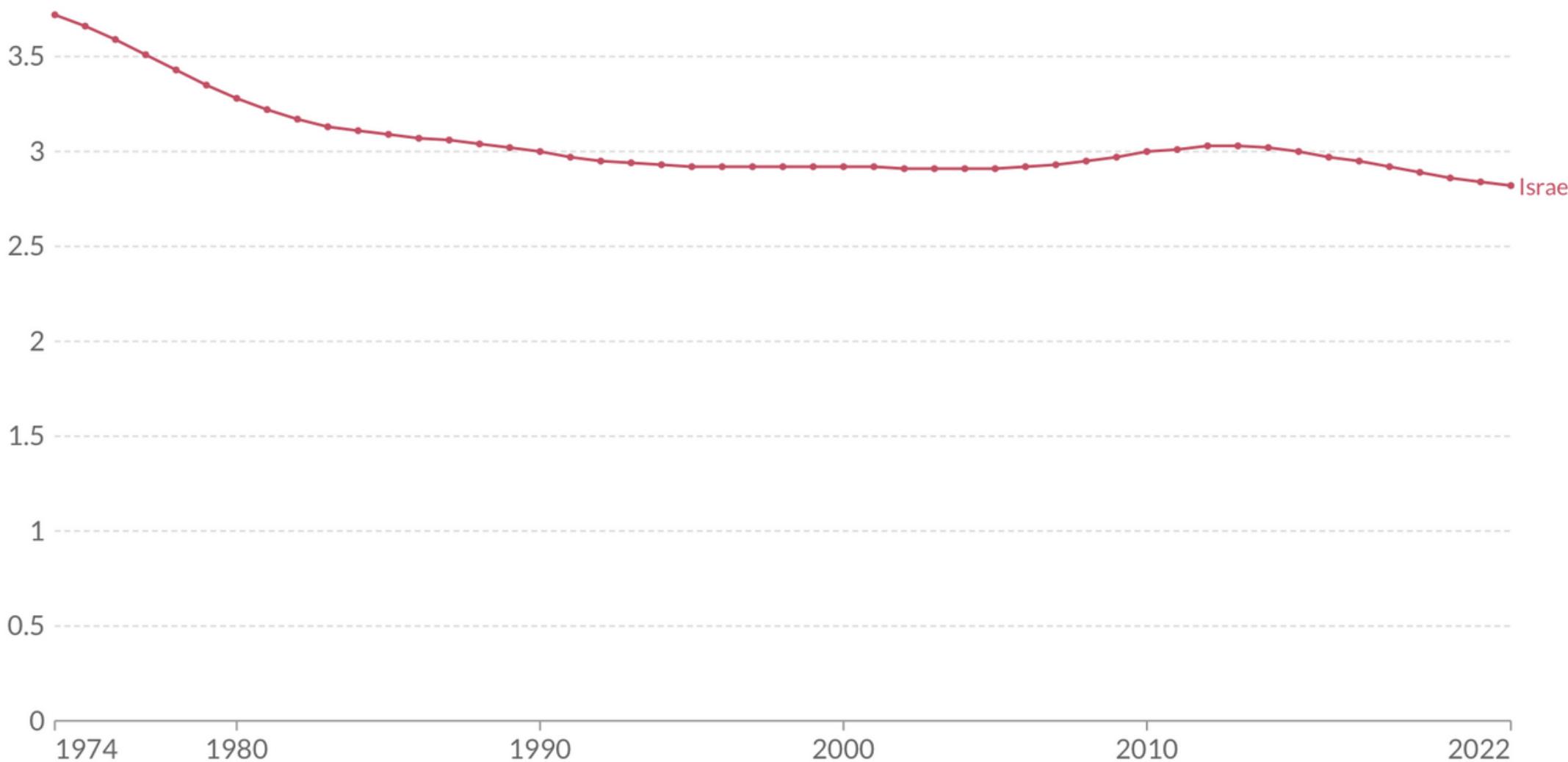
Source: UN Inter-agency Group for Child Mortality Estimation (via World Bank)

OurWorldInData.org/child-mortality/ • CC BY

Fertility rate: children per woman, 1974 to 2022

Our World
in Data

+ Add country



Source: Gapminder (2017)

Note: The total fertility rate is the number of children that would be born to a woman if she were to live to the end of her child-bearing years and give birth to children at the current age-specific fertility rates.

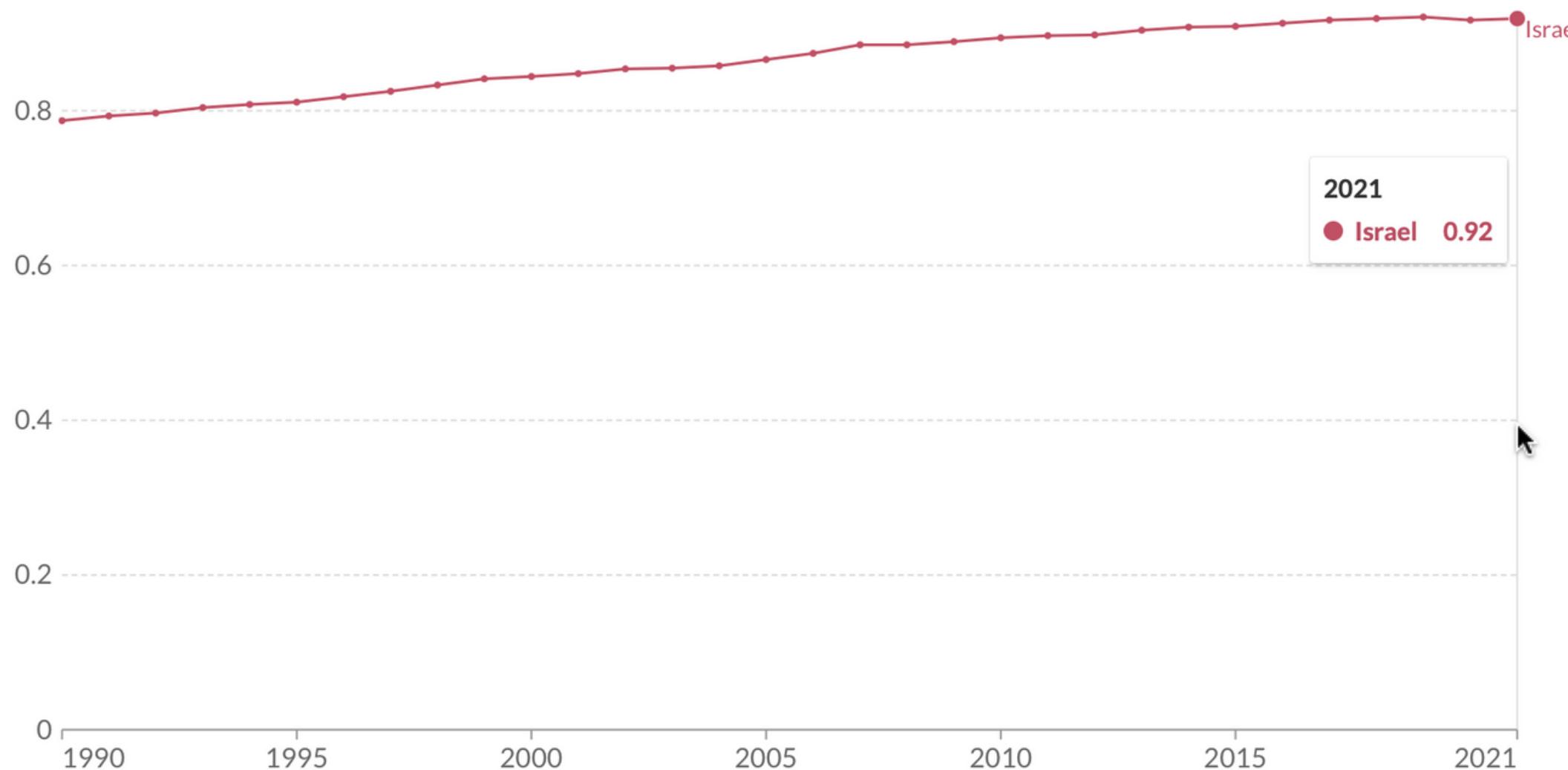
OurWorldInData.org/fertility-rate • CC BY

Human Development Index, 1990 to 2021

The Human Development Index (HDI) is a summary measure of key dimensions of human development: a long and healthy life, a good education, and having a decent standard of living.

Our World
in Data

+ Add country



Source: UNDP, Human Development Report (2021-22)

OurWorldInData.org/human-development-index/ • CC BY

Self-reported life satisfaction, 2003 to 2021

Our World
in Data

"Please imagine a ladder, with steps numbered from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?"

+ Add country

All together ▾

10

8

6

4

2

0

2003

2006

2008

2010

2012

2014

2016

2018

2021

Israel

Switzerland

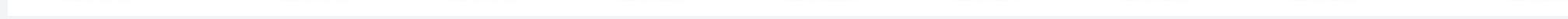
United States

Iraq

Iran

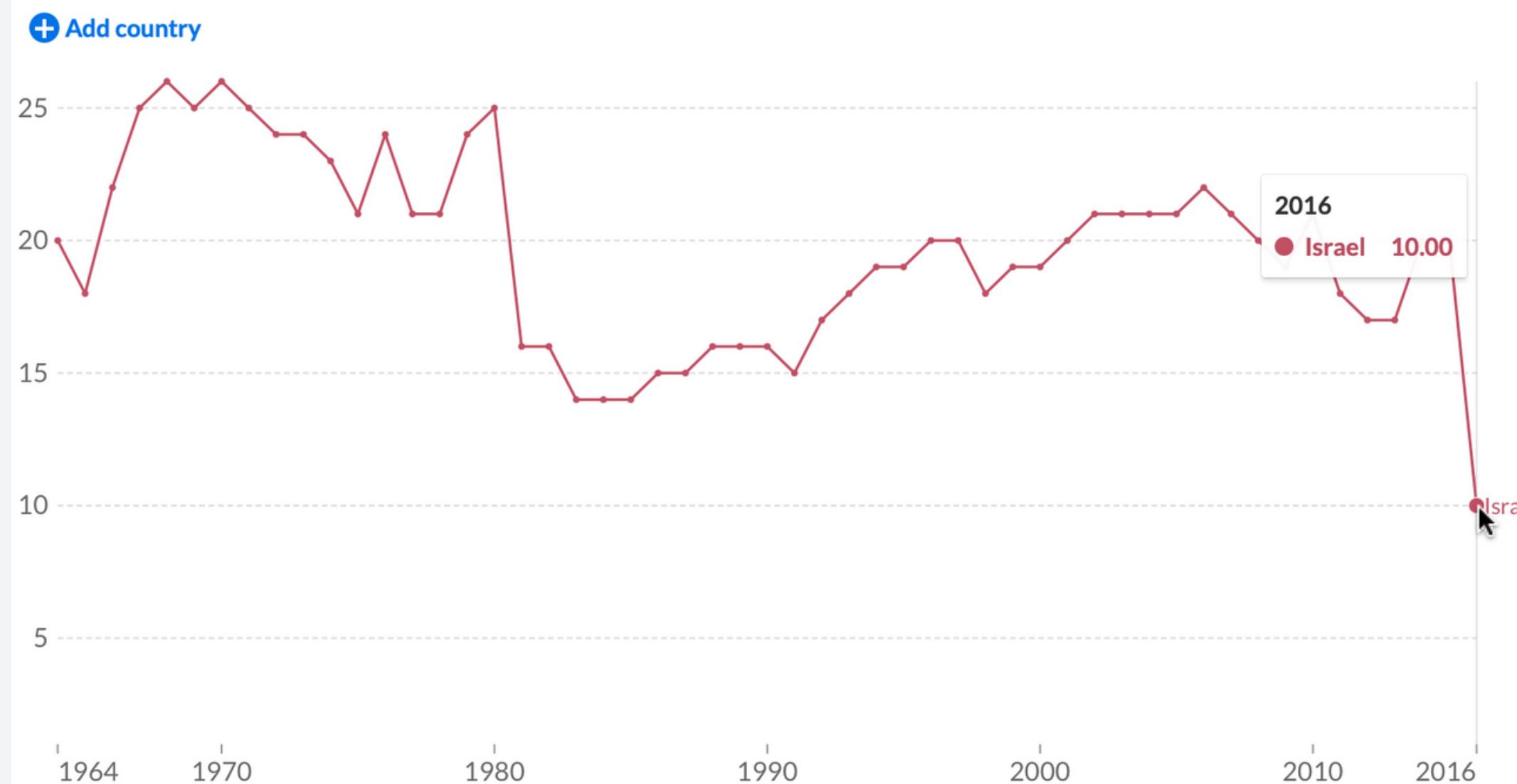
Bangladesh

India



Rank in the Economic Complexity Index, 1964 to 2016

The Economic Complexity Index takes data on exports, and reduces a country's economic system into two dimensions: (i) The number or 'diversification' of products in the export basket, and (ii) the quality, or 'ubiquity' of products in the export basket. This map ranks countries by ECI scores. The highest rank is 1 and corresponds to the country with the most complex economy in that year.



Source: ECI - Observatory of Economic Complexity (2016)

OurWorldInData.org/how-and-why-econ-complexity • CC BY

Israel Rankings : 2023

Index	Rank
GDP Per Capita	21
HDI	22
Military	17
Child Mortality Rate	< 20
Literacy Rate	22



POLICIES ADOPTED

- A country which has very little natural resources or fossil fuels.



FOCUS ON HUMAN CAPITAL

- A country which has very little natural resources or fossil fuels.
- Global leader in several fields including Biotechnology, cybersecurity, and artificial intelligence.
- Human capital and technological expertise is the key contributing factor.



FOCUS ON HUMAN CAPITAL

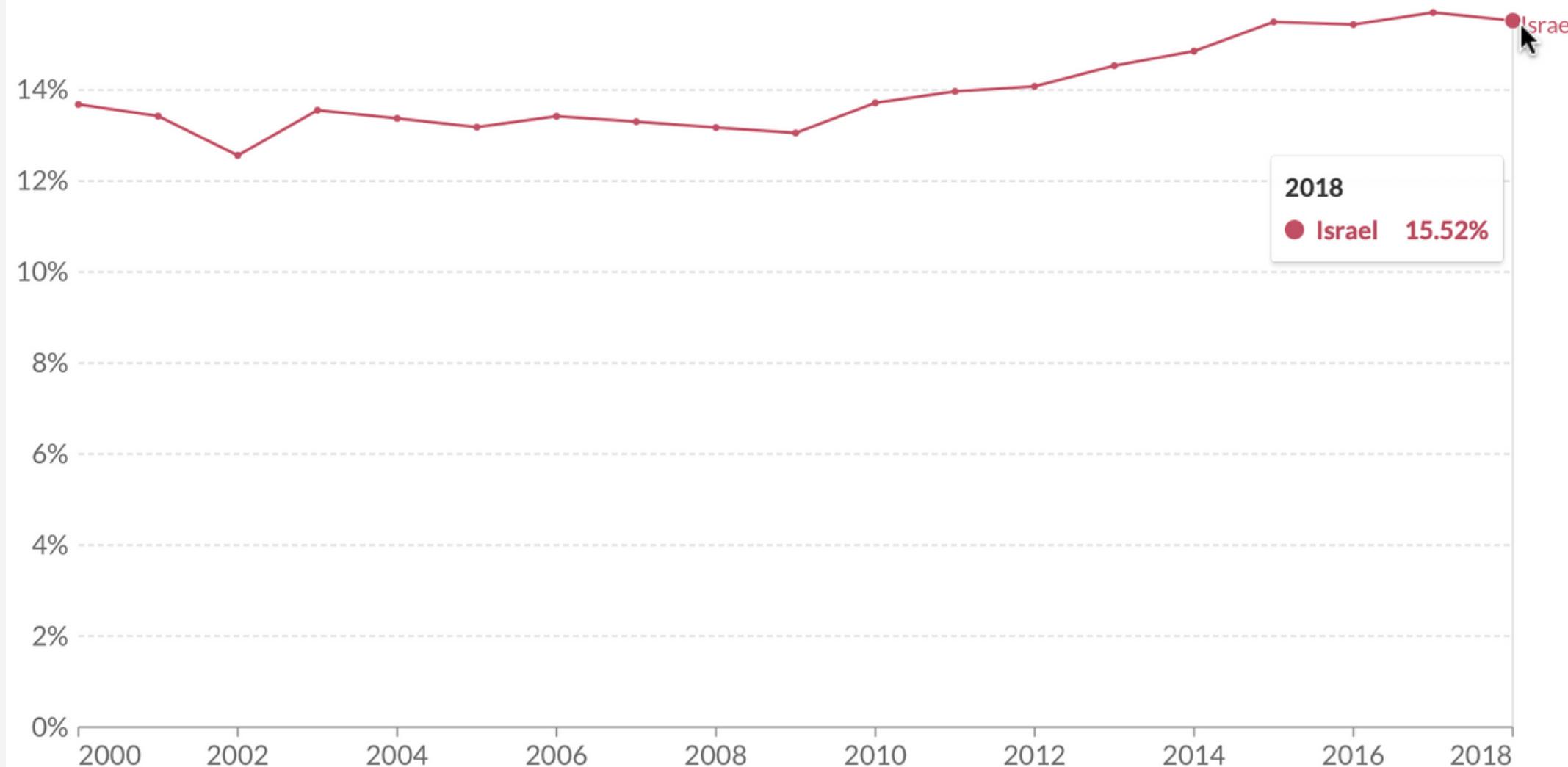
- The Israeli government has consistently invested in education, with education expenditure accounting for around 8% of the country's GDP.
- Encouragement in enrolment for higher education through grants and scholarships.
- Extreme focus on STEM

Education spending as a share of total government expenditure, 2000 to 2018

Total general government expenditure on education, expressed as a percentage of total general government expenditure on all sectors.

Our World
in Data

+ Add country



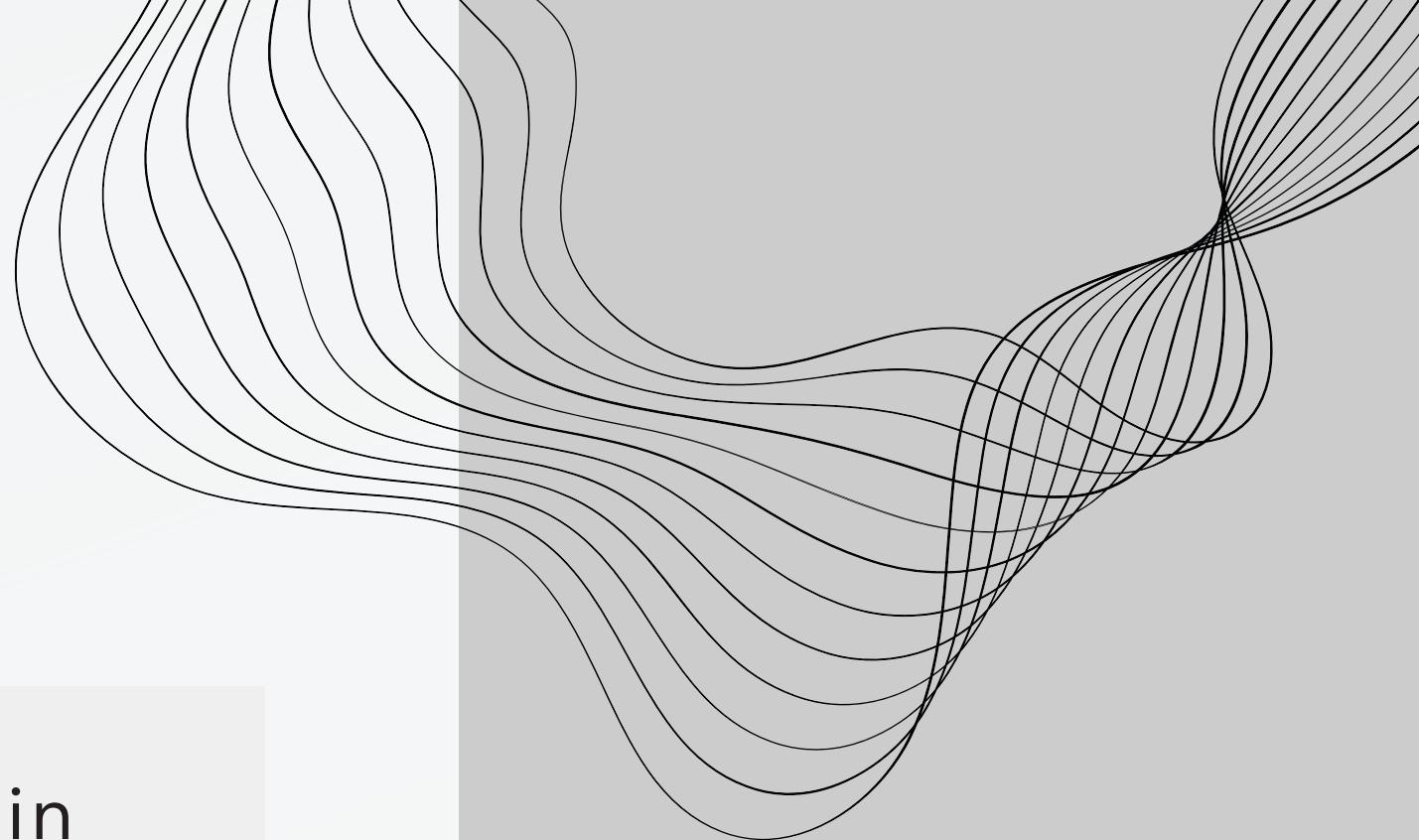
Source: UNESCO (via World Bank)

OurWorldInData.org/financing-education • CC BY



IMMIGRATION

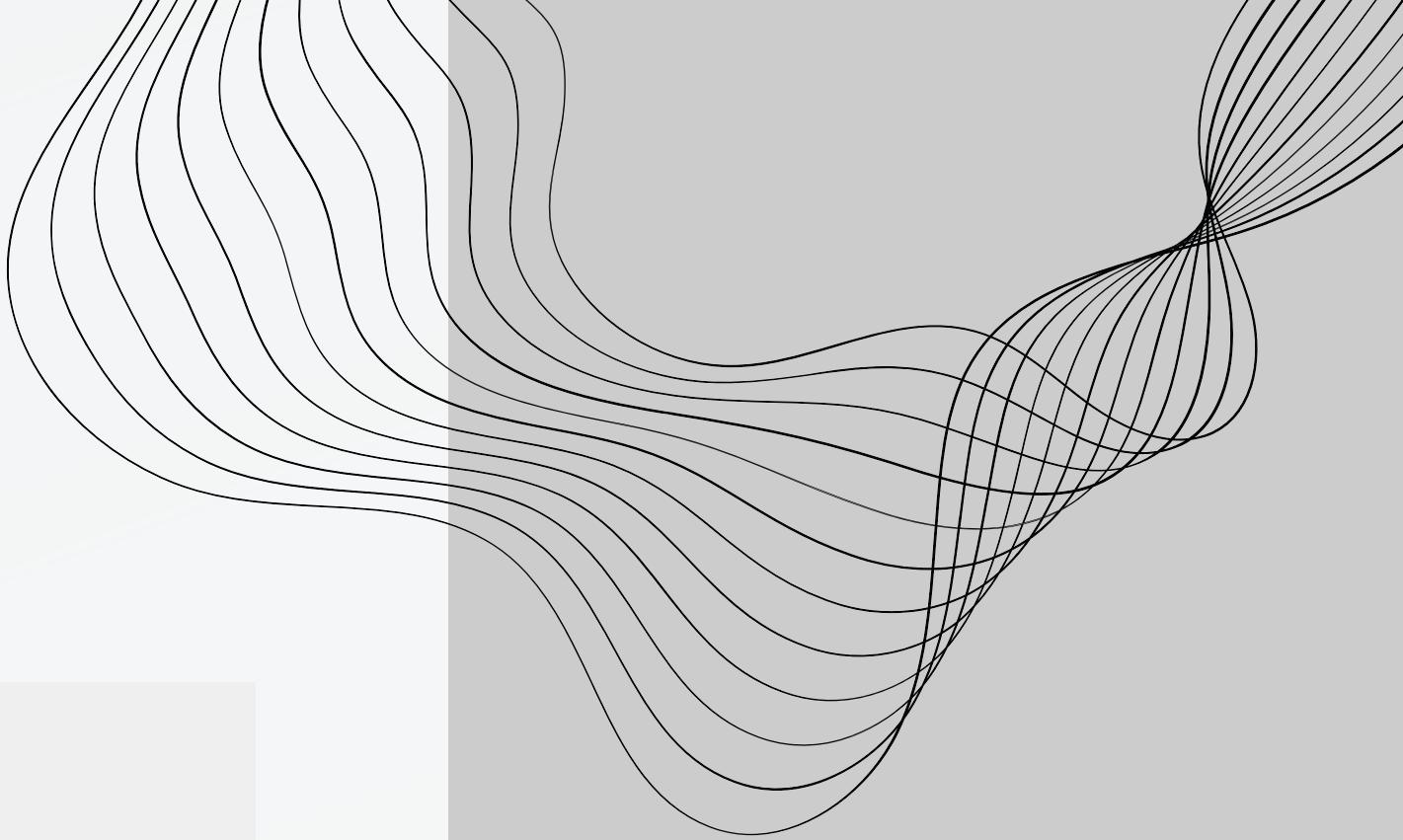
- Encouraging immigration of highly skilled individuals in science, technology, and other fields.
- Helped boost the country's talent pool and contribute to its economic growth.





IMMIGRATION

- Razin, Assaf, Israel's Immigration Story: Globalization Lessons (March 2017). NBER Working Paper No. w23210, Available at SSRN: <https://ssrn.com/abstract=2938754>



Total number of international immigrants, 1960 to 2015

An immigrant is someone moving to a country that they were not born in.

Our World
in Data

+ Add country

2 million

1.5 million

1 million

500,000

0

1960 1970 1980 1990 2000 2010 2015

Source: UN Population Division (via World Bank)

OurWorldInData.org/migration • CC BY

Israel

0

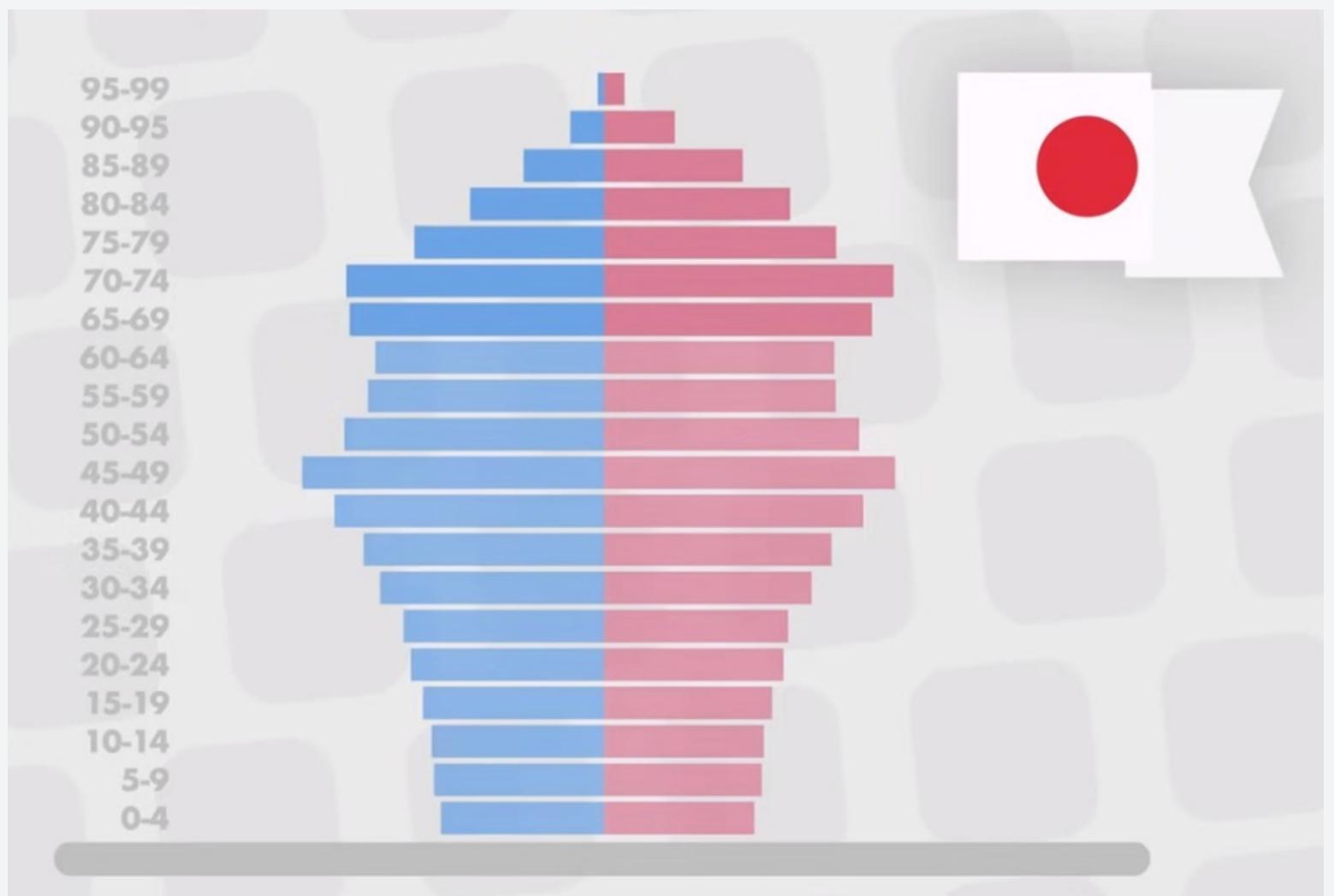
1960 1970 1980 1990 2000 2010 2015

Source: UN Population Division (via World Bank)

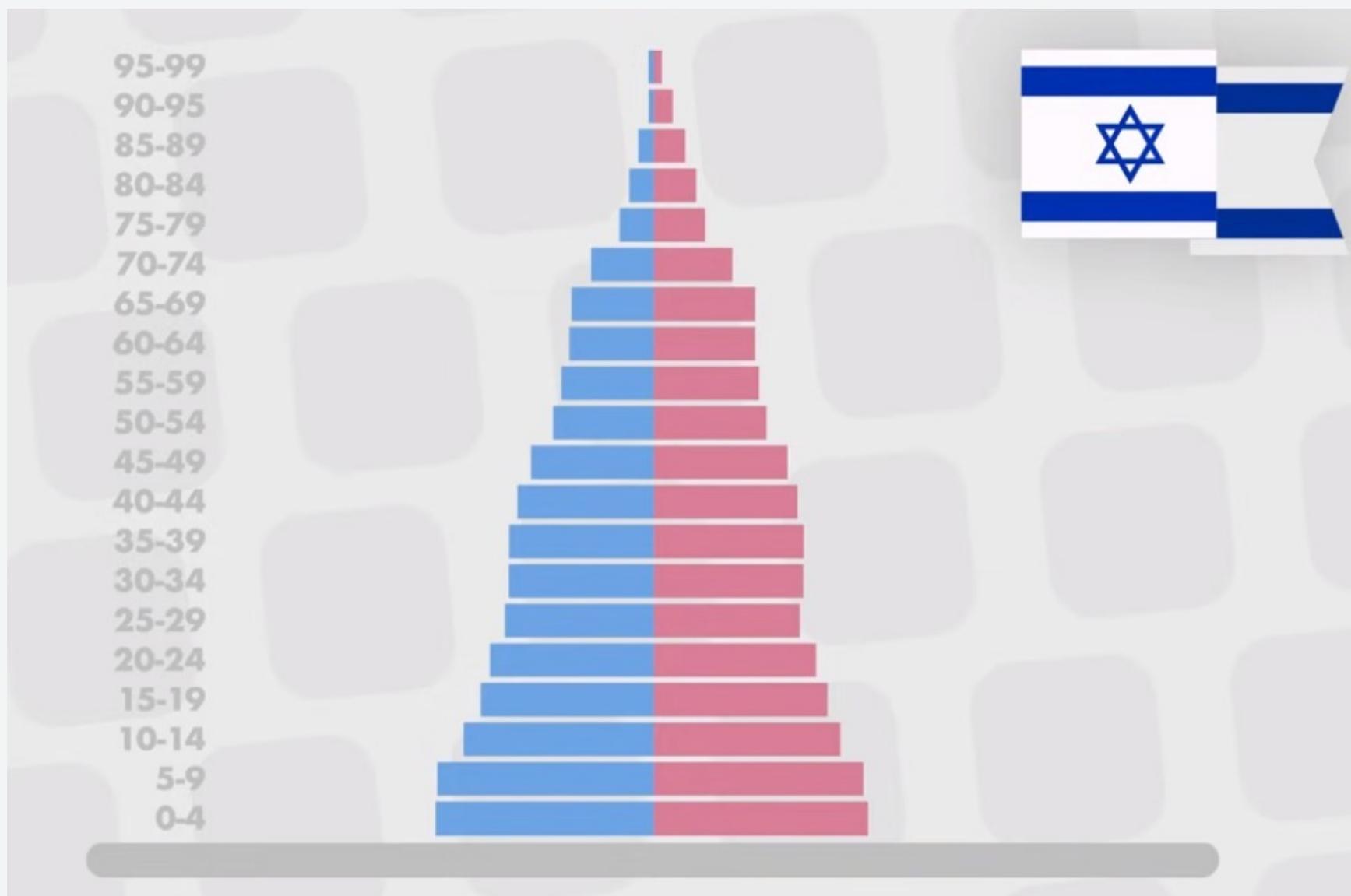
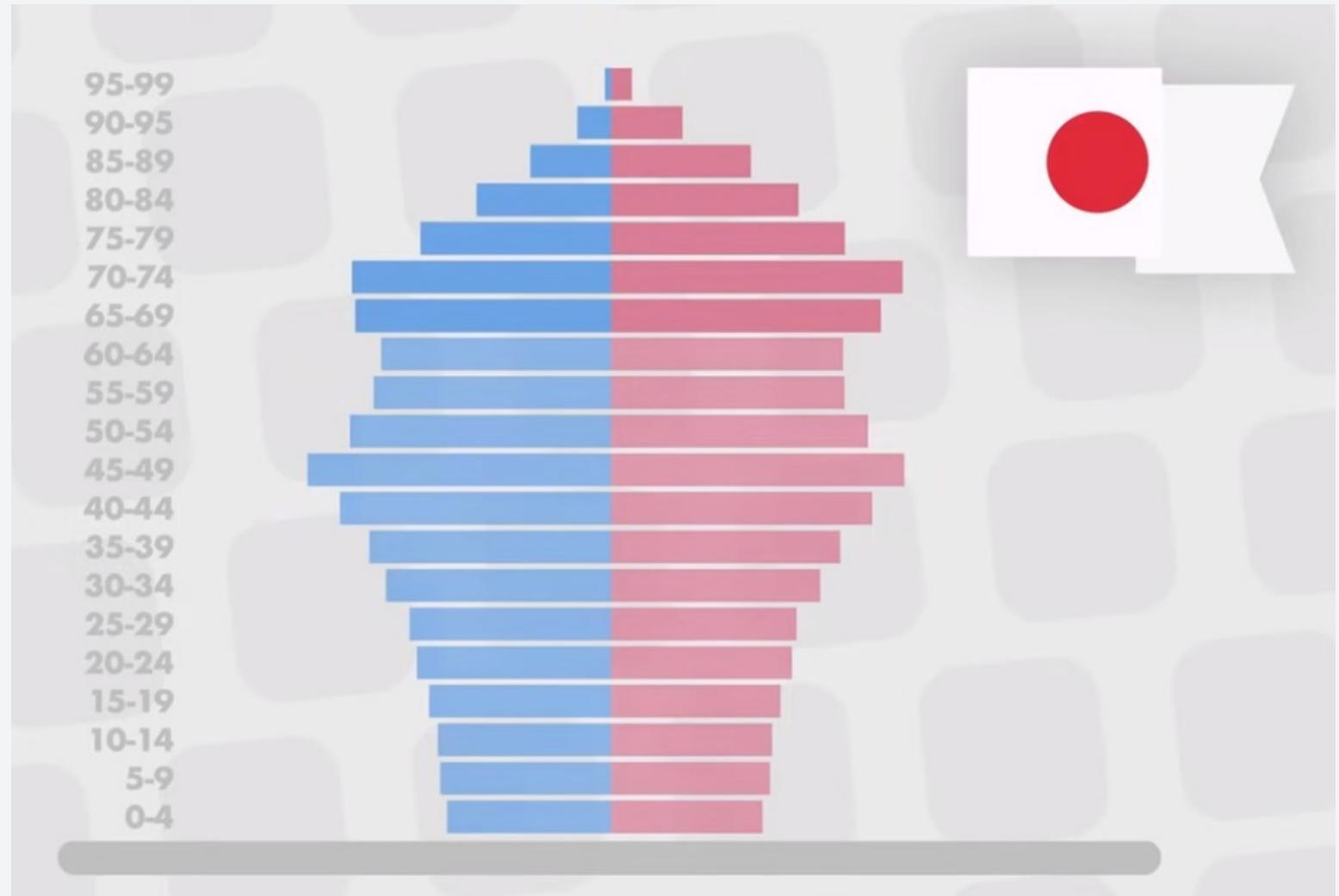
OurWorldInData.org/migration • CC BY

Israel

Any other factors?



Any other factors?





COMMITTED TO INNOVATION

- Industrial innovation policies to promote entrepreneurial financing.
- Implementation of cluster model which enabled institutions to facilitate the exchange of information and technology.
- High amount of resources devoted towards research and development(National Innovation System concept).



COMMITTED TO INNOVATION

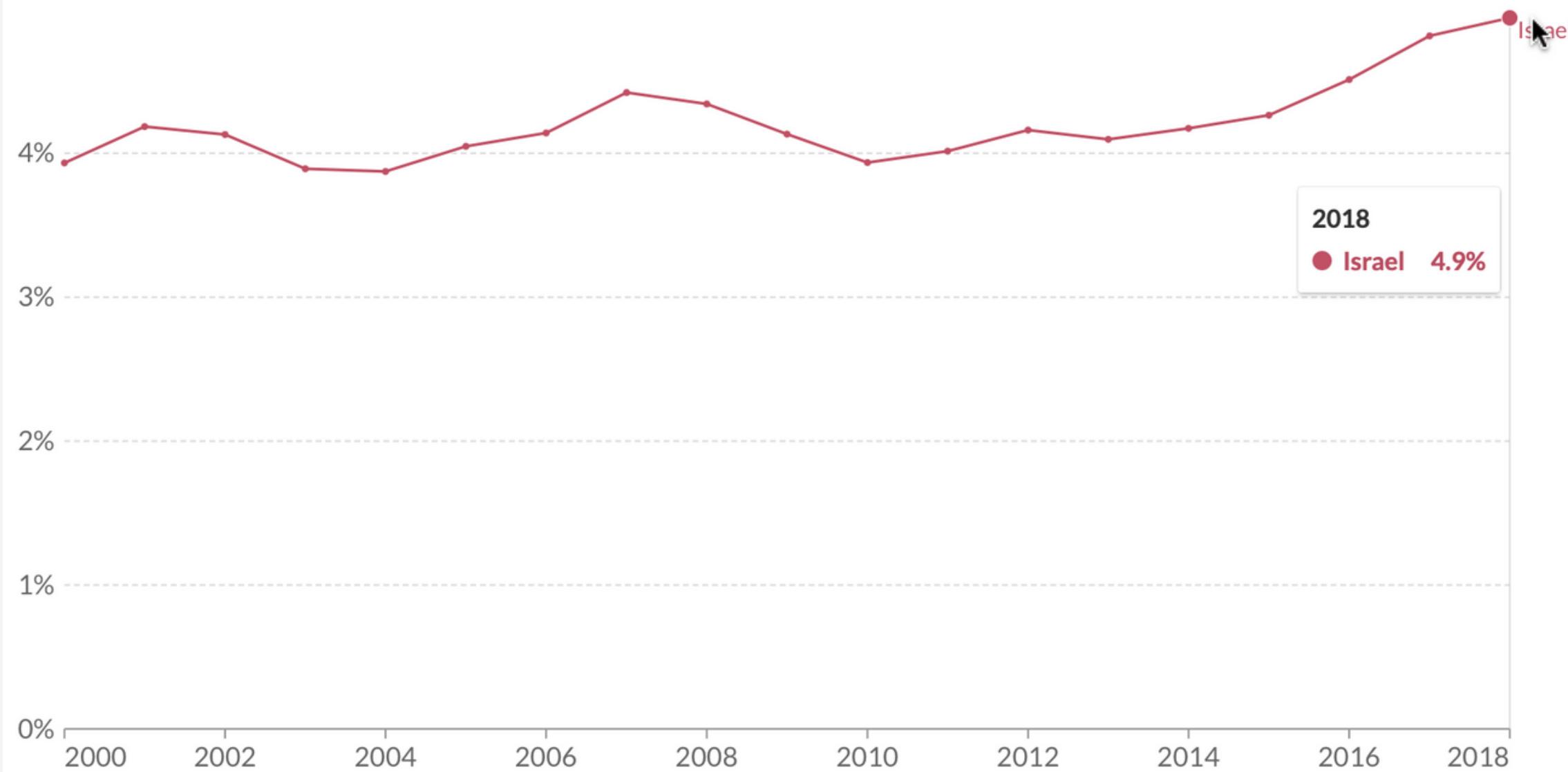
- Interesting read: Jarunee Wonglimpiyarat, Government policies towards Israel's high-tech powerhouse, Technovation, Volumes 52–53, 2016, Pages 18–27,

Research & development spending as a share of GDP

Includes basic research, applied research, and experimental development.

Our World
in Data

+ Add country



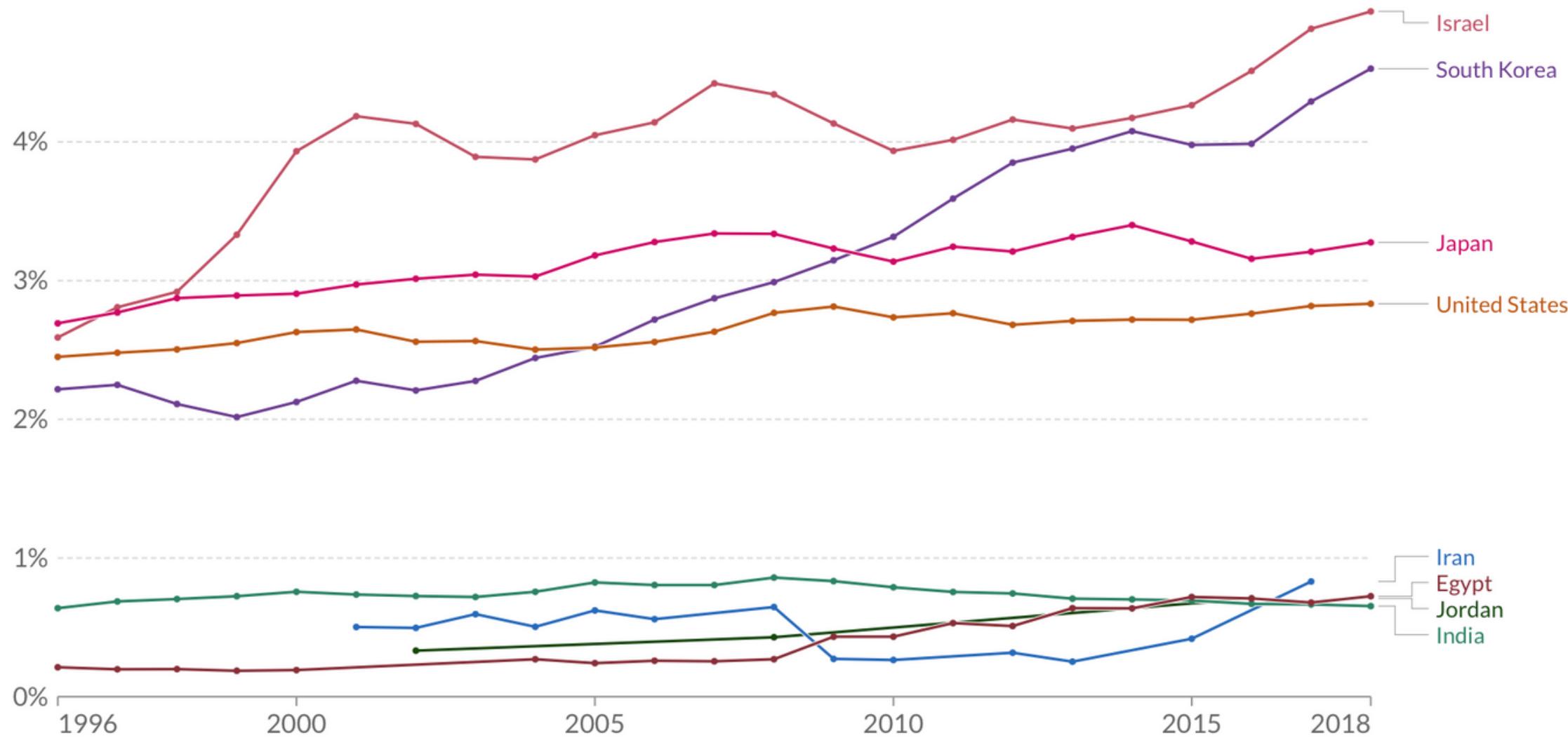
Research & development spending as a share of GDP

Includes basic research, applied research, and experimental development.

Our World
in Data

+ Add country

All together ▾



Source: UNESCO (via World Bank)

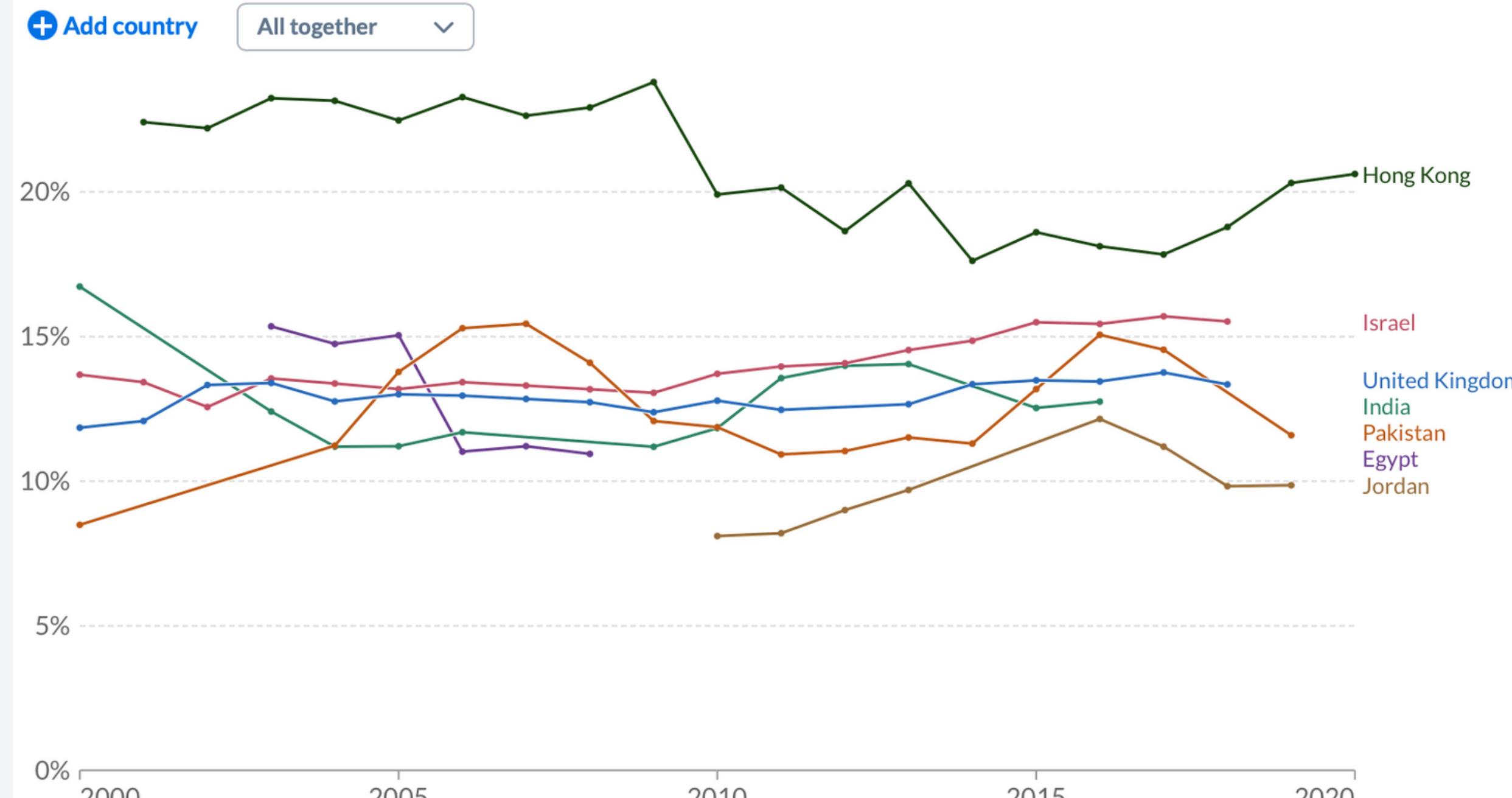
Note: Spending includes current and capital expenditures (public and private) on research.

OurWorldInData.org/research-and-development • CC BY

Education spending as a share of total government expenditure, 2000 to 2020

Total general government expenditure on education, expressed as a percentage of total general government expenditure on all sectors.

Our World
in Data



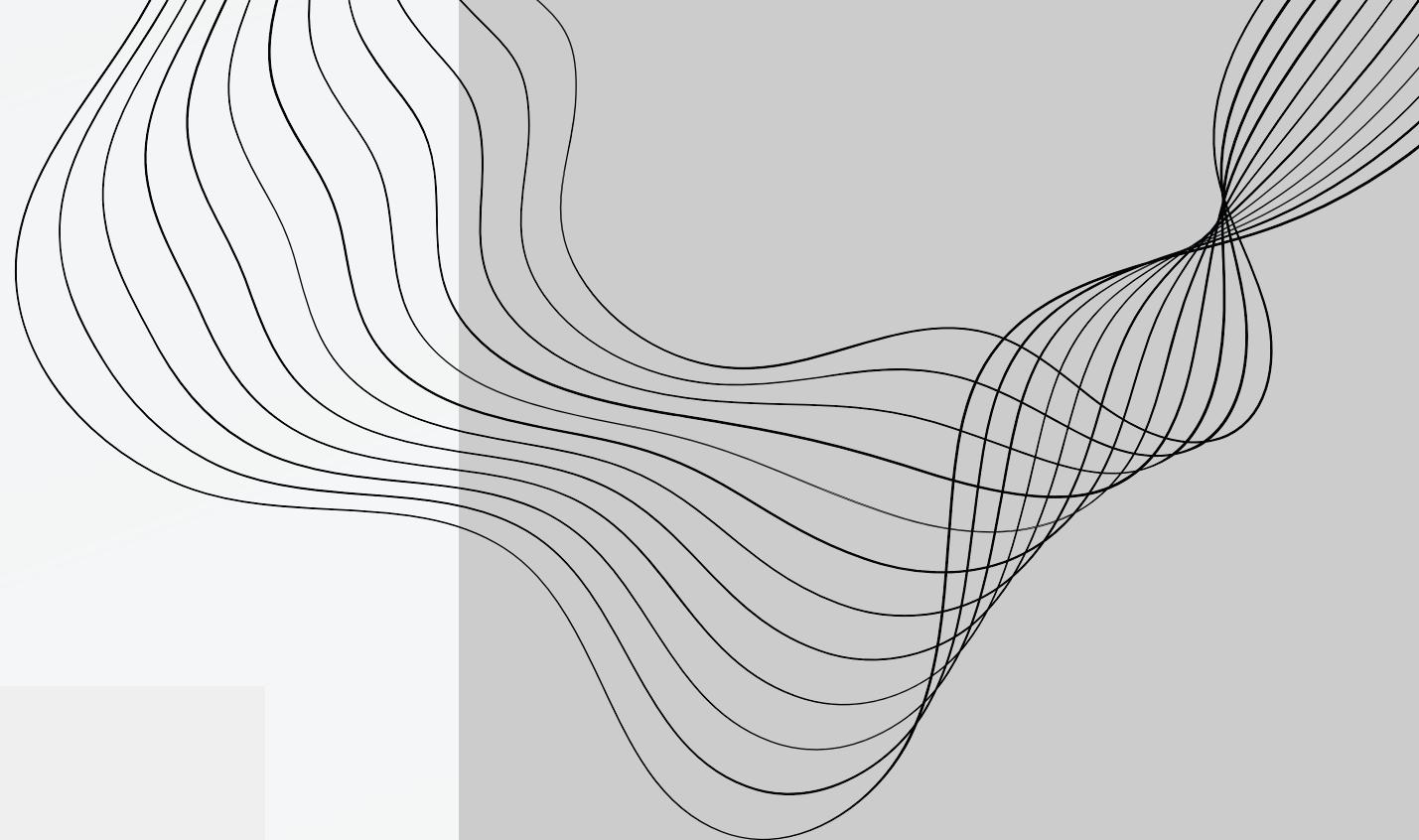
Source: UNESCO (via World Bank)

OurWorldInData.org/financing-education • CC BY



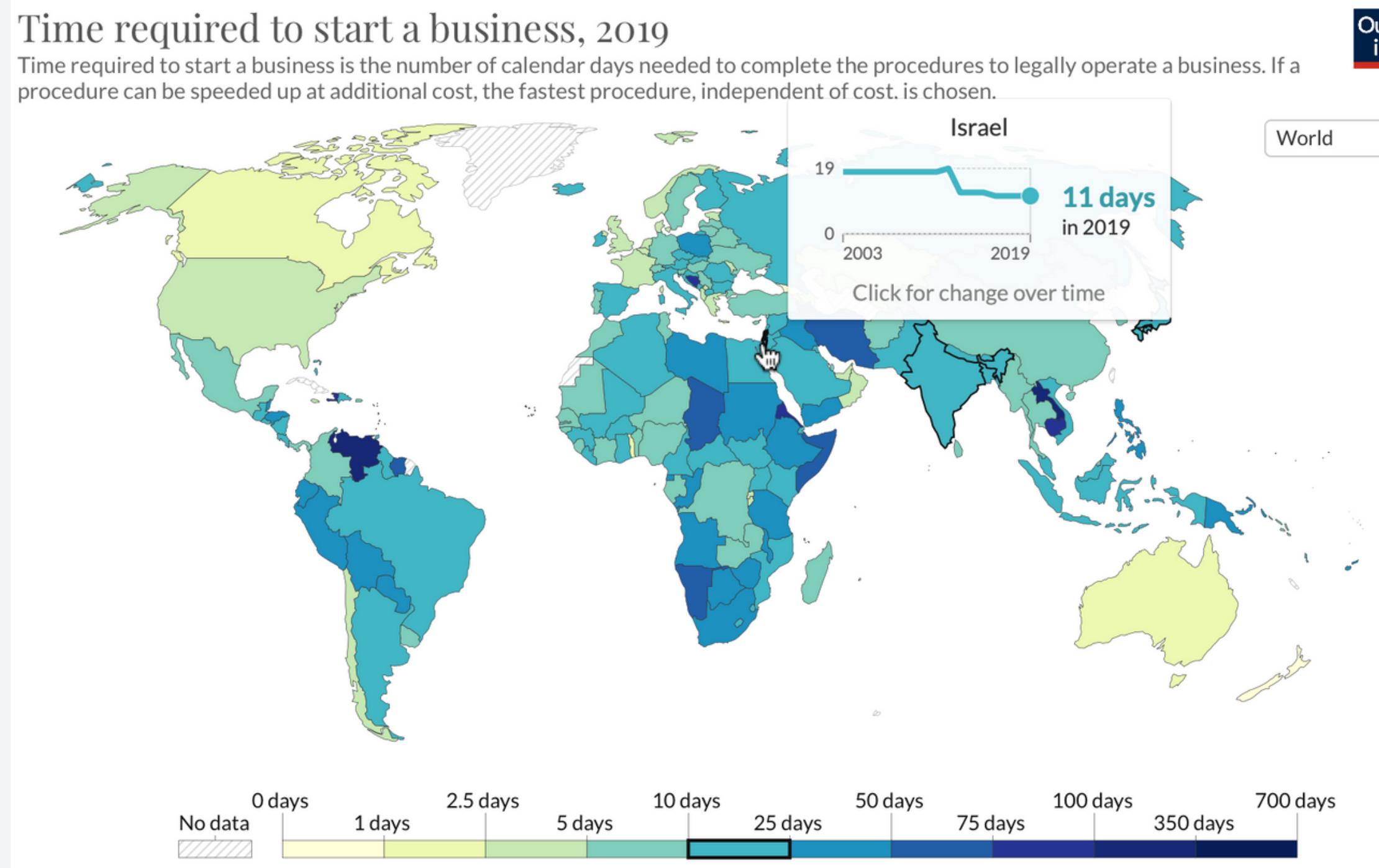
ECONOMIC POLICIES

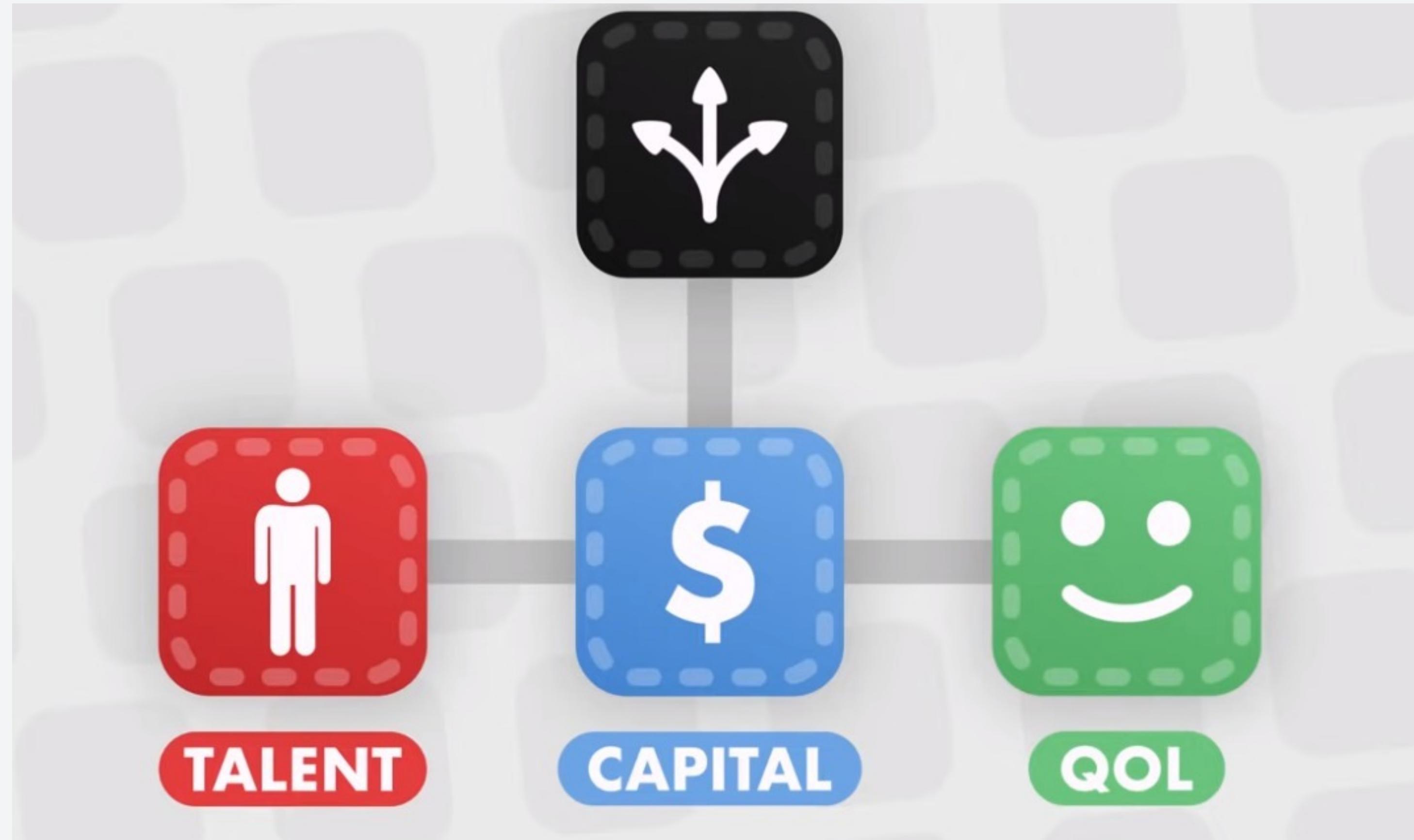
- Liberal policies encouraging Foreign investment (Privatisation, Free Trade, Regularisation).
- Israel has a liberal investment system and most activities are open to both private national and foreign investors, ranking the country 12th among the top 20 host countries.



Time required to start a business, 2019

Time required to start a business is the number of calendar days needed to complete the procedures to legally operate a business. If a procedure can be speeded up at additional cost, the fastest procedure, independent of cost, is chosen.







SILICON WADI





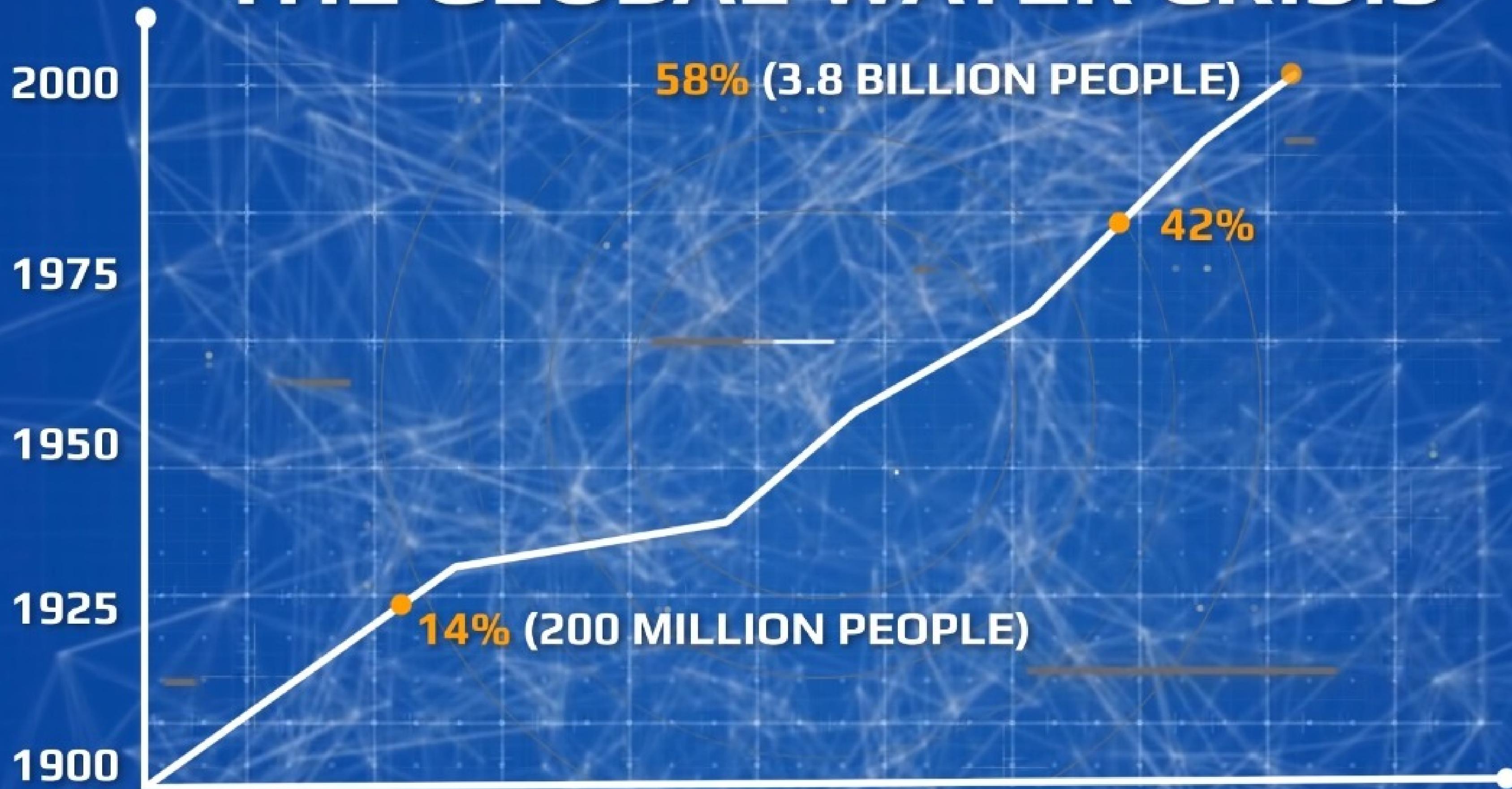
The story of Israel's Silicon Wadi

The story of Israel's Silicon Wadi; how one small nation has big ideas and contributes 80% of the investment of the entire Middle East into Fintech.

Disruption Banking / Apr 22, 2018



THE GLOBAL WATER CRISIS



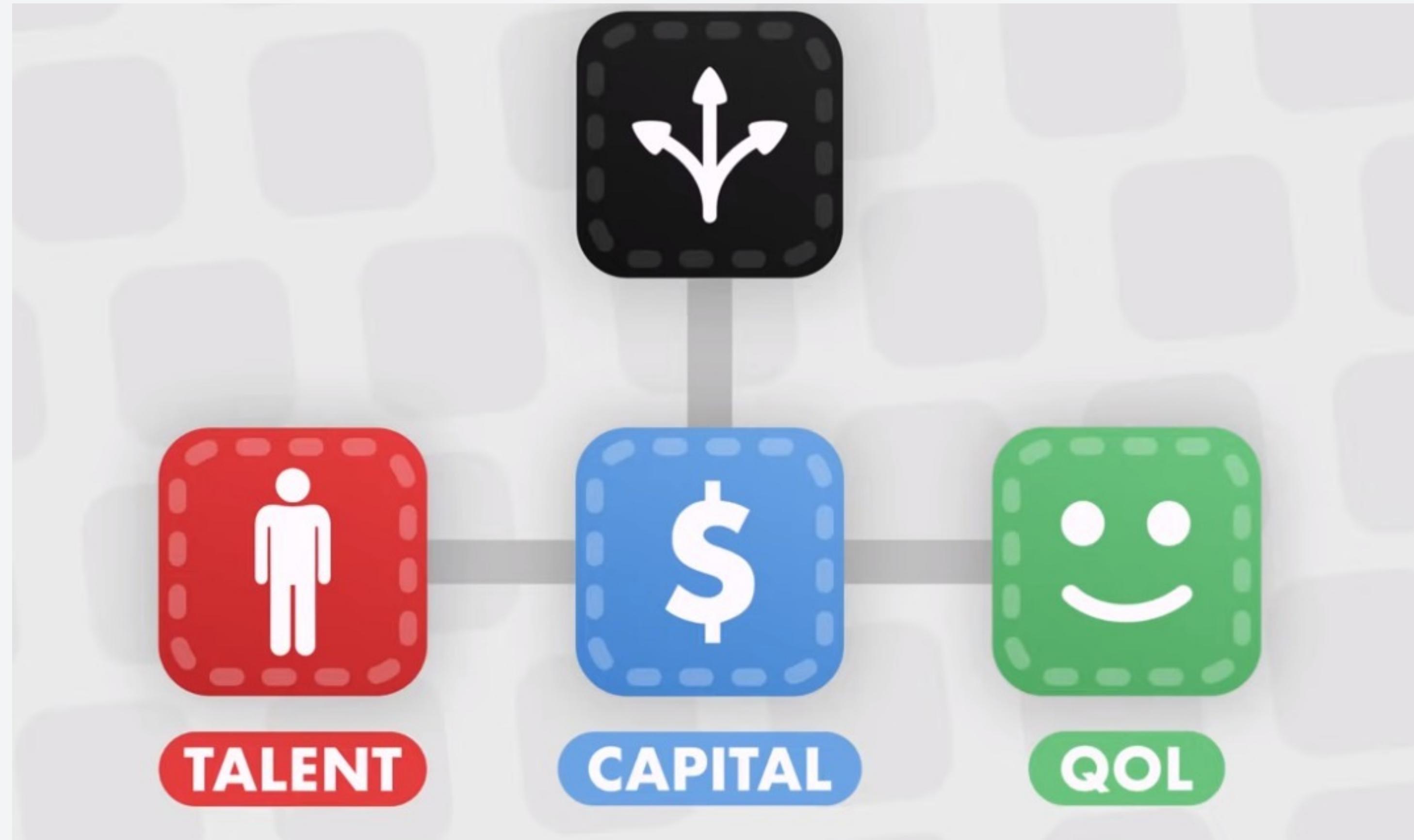




%

GDP

**ON R&D
(TOP 4)**





UNDERSTANDING ISRAEL'S GROWTH USING MODELS

DIFFERENT GROWTH MODELS

Overview of growth models and examples of their relevance and application in different countries.

Linear Growth Model

- The linear growth model assumes that the **growth rate of a phenomenon is constant over time**. This model is often used to describe the growth of a population, the number of products sold, or the GDP of a country.
- The growth rate of output (Y) is a function of the growth rate of the exogenous factor (X) and the economy's share of capital (K): $dY/dt = \alpha XK$

Example: **Sweden's** GDP growth rate has been relatively steady between 1-3% per year since the 1990s, which can be described by a linear growth model.

Why not Linear used?

- Not very realistic for long-term growth, as most economies experience fluctuations and changes in their growth rates over time.
- The linear growth model suggests that sustained economic growth can only be achieved through continued accumulation of the exogenous factor, which can be capital or technological progress. It **does not take into account diminishing returns to capital or the effect of population growth on economic growth.**

THE SLOW-NEOCLASSICAL

- A basic reference point for the literature on growth and development.
- The Solow model assumes that economies are driven by Two factors: **labor and capital**. It suggests that economic growth can be achieved through increases in any or all of these two factors.
- The aggregate production function, $Y = F(K,L)$ is assumed characterized by constant returns to scale

THE SLOW-NEOCLASSICAL

- Because of constant returns to scale, if all inputs are increased by the same amount then output will increase by the same amount.

$$\gamma Y = F(\gamma K, \gamma L)$$

- Because γ can be any positive real number, We set $\gamma = 1/L$ so that

$$Y/L = f(K/L, 1) \text{ or } y = f(k)$$

- Increase in capital at a decreasing rate will reflects diminishing returns to capital per worker

WHY NOT FOR ISRAEL

- While the Solow model can provide some insight into Israel's growth, it is important to note that the model assumes a **closed economy** and **does not account for factors such as institutions, and technological innovations**, which has always been a central aspect to isreal's growth.
- Another aspect being that the solow model does not incorporate the technical skills people gain with time, i.e. **the rise in human capital**, which is another key aspect Israel has focused its efforts in.

Endogenous Growth Model:

- Suggests that **technological progress and innovation are key drivers** of economic growth.
- This model **emphasizes the role of knowledge and human capital** in driving economic growth, rather than just physical capital and labor.
- Endogenous growth models suggest that investments in education, research, development, and innovation can lead to sustained long-term growth.

Example: **Israel** has experienced sustained long-term economic growth since the 1990s, and can explain this growth model due to the country's investment in research and development, innovation, and education.

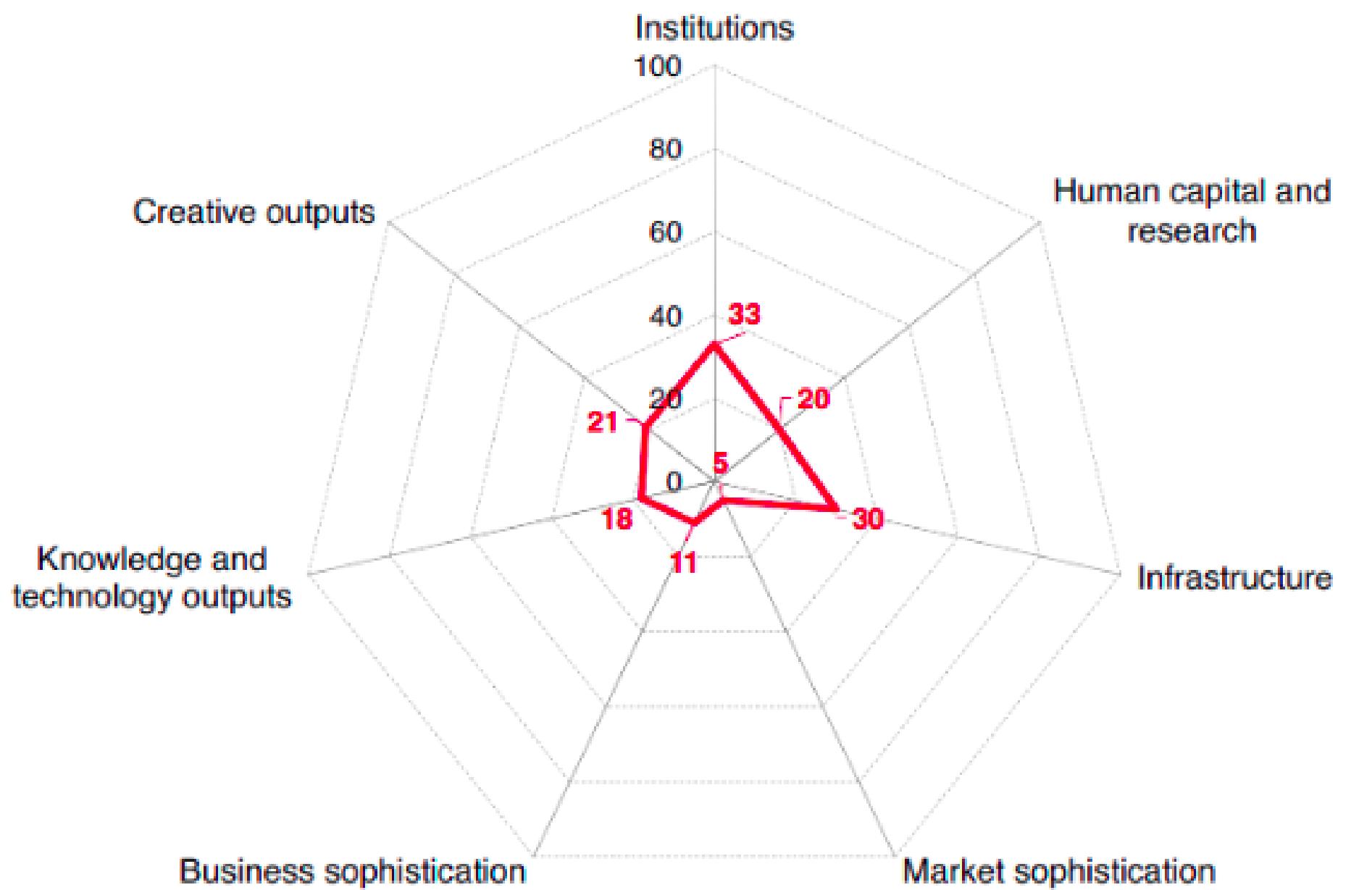


Figure 13: Israel's scores (0–100) for each individual pillar of innovation taking into account the estimation of the Global Innovation Index. Source: INSEAD et al. (2015)

- Since 1999, wages in the high-technology manufacturing sector and in the high-technology service sector have been 1.9–2.2 times higher than the national average.
- Analysis of the data shows that the gap between high-technology service sector wages and national average wages narrowed slightly in 2010 but widened again in 2011 and in 2013.



STUDY OF ISRAEL USING THE ENDOGENOUS GROWTH MODEL

OVERVIEW

- The study of Israel's growth can be approached using the endogenous growth model, which **emphasizes the role of human capital, technology, and innovation in driving long-term economic growth.**
- Israel has invested heavily in these areas, with significant government support for research and development, strong ties between academia and industry, and a culture that encourages entrepreneurship and risk-taking.
- Israel's high-tech sector has been a major driver of economic growth, and the country has become known as the "**Start-Up Nation.**"
- The study can help to shed light on the factors that have contributed to the country's success in driving economic growth and development.

Aggregate Production Function with Human Capital

Production function (Cobb-Douglas specification):

$$Y_t = AK_t^a L_t^b, \quad 0 < a < 1, 0 < b < 1,$$

- Here Y, K, and L, are output, capital, and labor, respectively, and A is a technology factor.
- The convergence hypothesis implied by the model can be revisited by the rate of return (r) as the difference between marginal product and the depreciation rate (d)

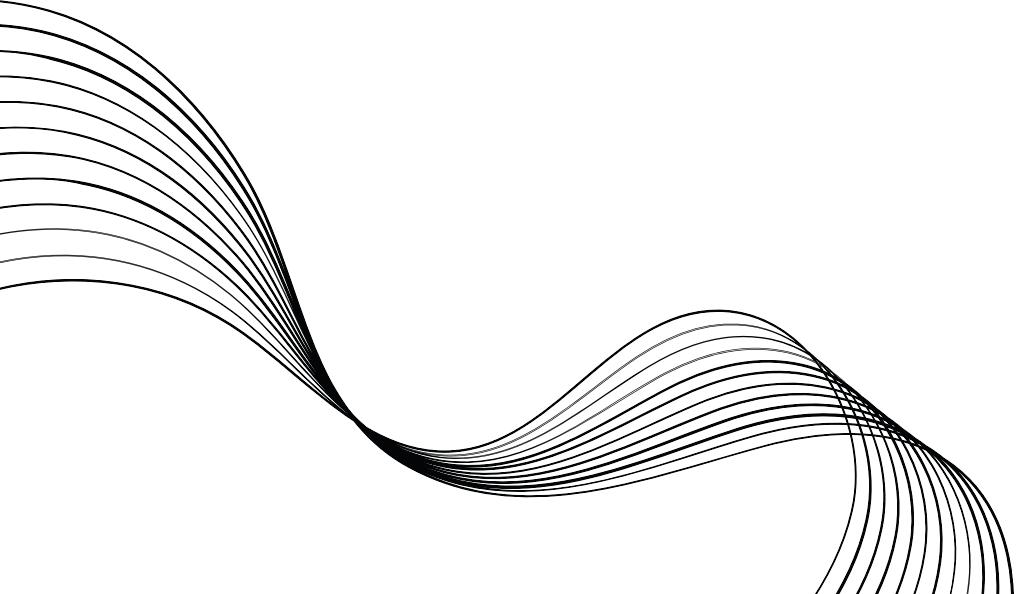
$$r = aAK_t^{a-1} L_t^b - d.$$

- If the growth rate of labor is exogenously given as n , the following condition must be satisfied to keep r at a constant level:

Condition for constant return on Investment

$$(dK/dt)/K = bn/(1 - a),$$

- which implies the steady state growth rate of capital stocks.
- If capital stocks are low relative to the population and, therefore, a higher rate of return prevails, then the growth rate of capital will be higher.
- As capital is accumulated, the rate of return will fall to the steady state level.
- In short, a developing economy with lower per capita capital stocks is expected to grow faster and to “converge” to the steady state achieved by advanced economies.



The new growth theory, which focuses on the role of human capital, such as the first model in Lucas (1988), Stokey (1991), and Tamura (1991) endogenizes the technology factor as follows:

$$A_t = BH_t^c, \quad 0 < c < 1,$$

- H = Human Capital Stocks
- If H increases by 1 percent A is increased by c percent

We assume labor input is allocated between physical output production and human capital production by xL , and $(1 - x)L$, respectively

Production Function with Human Capital

$$Y_t = BK_t^a H_t^c (xL_t)^b.$$

- The production function of the endogenous growth model is relevant to Israel in the 21st century due to the country's continued focus on investment in physical and human capital, as well as technological progress, which are key drivers of economic growth in the endogenous growth framework.

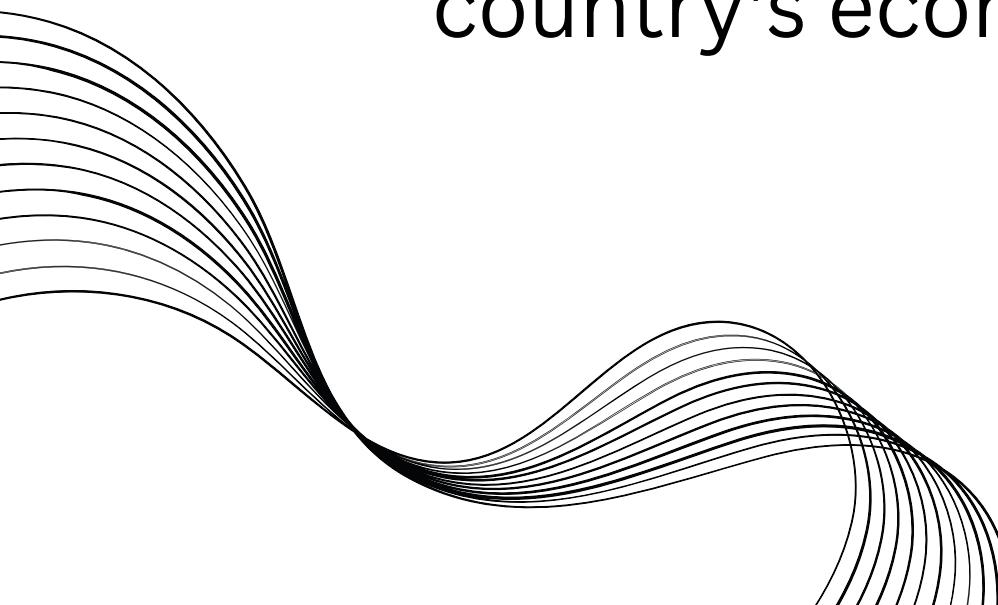
Assumption about Human capital Accumulation

- In this model, endogenous growth is possible as long as there is continuous investment in human capital even if it keeps being accumulated. In other words, models of this kind introduce a critical assumption that there is no diminishing returns in the production of human capital.
- The assumption is embodied in the following form of the human capital production function:

$$\begin{aligned} dH/dt &= j(1 - x)L_t(H_t/L_t) \\ &= j(1 - x)H_t, \end{aligned}$$

- where **(1 - x)L is the labor input into the production of human capital** and **j is a productivity parameter**. In addition, the productivity in human capital production is assumed to be proportional to the level of per capita human capital stocks (H_t/L_t) at time t.

- Human capital includes skills, knowledge, and education, and is an important factor in economic growth.
- The model assumes that the accumulation of human capital is subject to no diminishing returns.
- As a result, the optimal level of investment in education and training is determined by the balance between the costs and benefits of human capital accumulation.
- In the case of Israel, the human capital accumulation equation could capture the investment in education and training, which is a key priority for the country's economy.



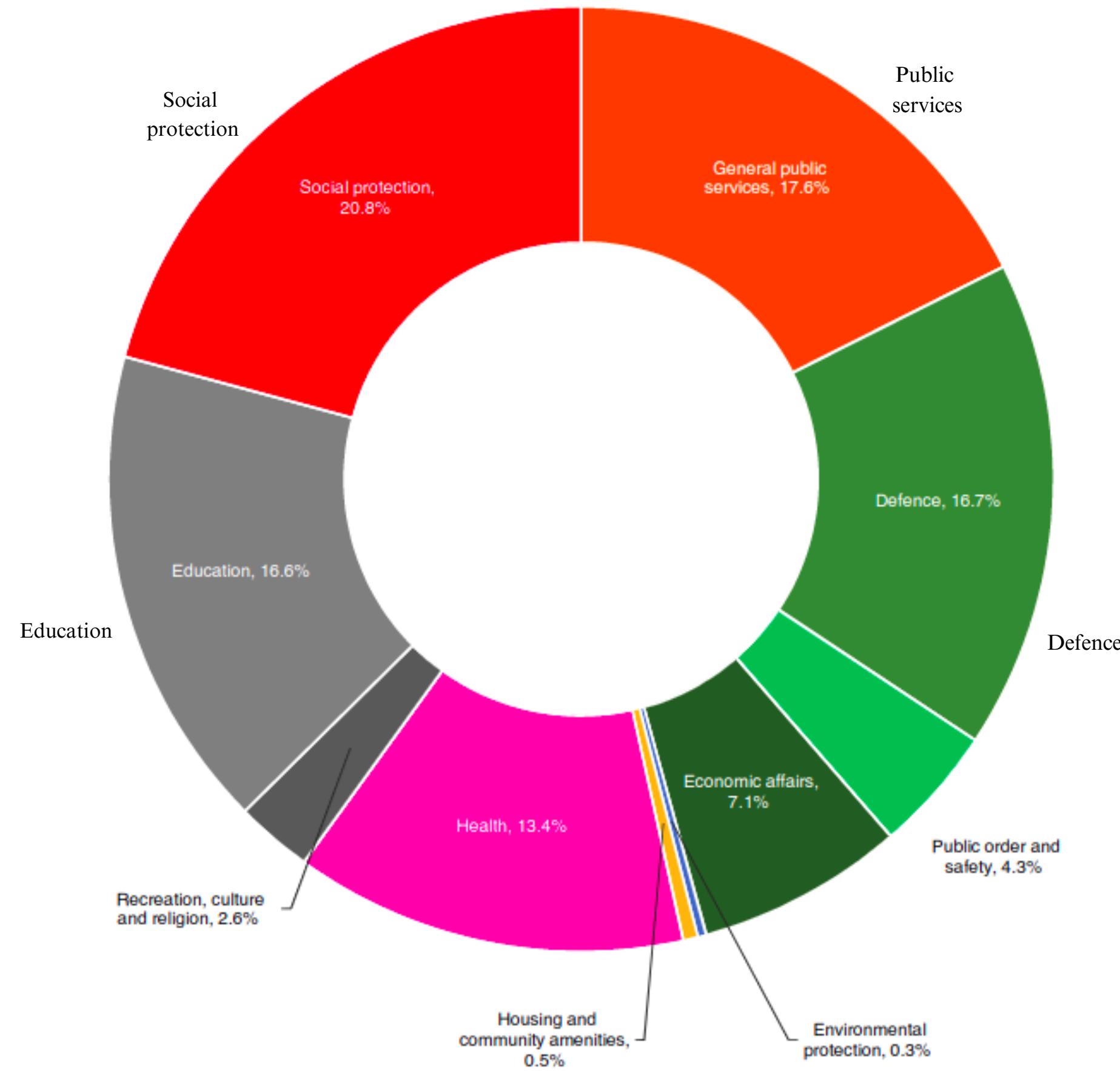
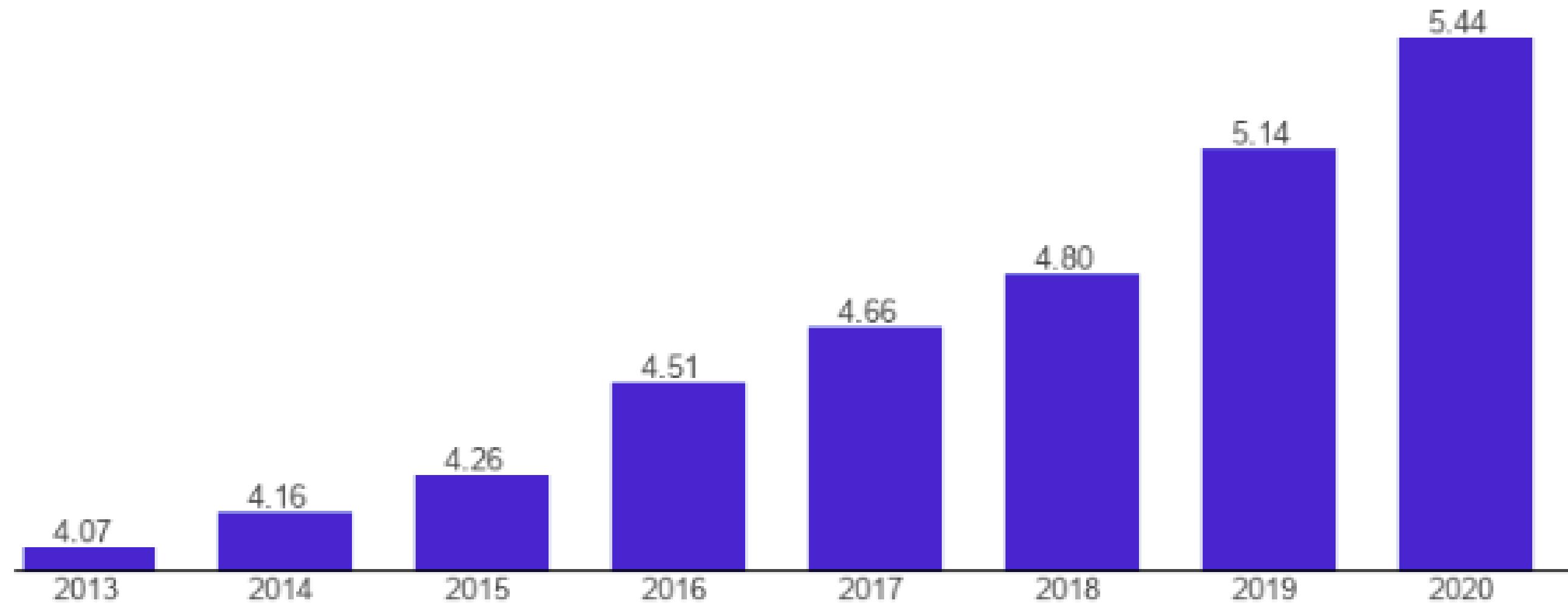


Figure 6: Structure of central government expenditures, 2013. Source OECDStats

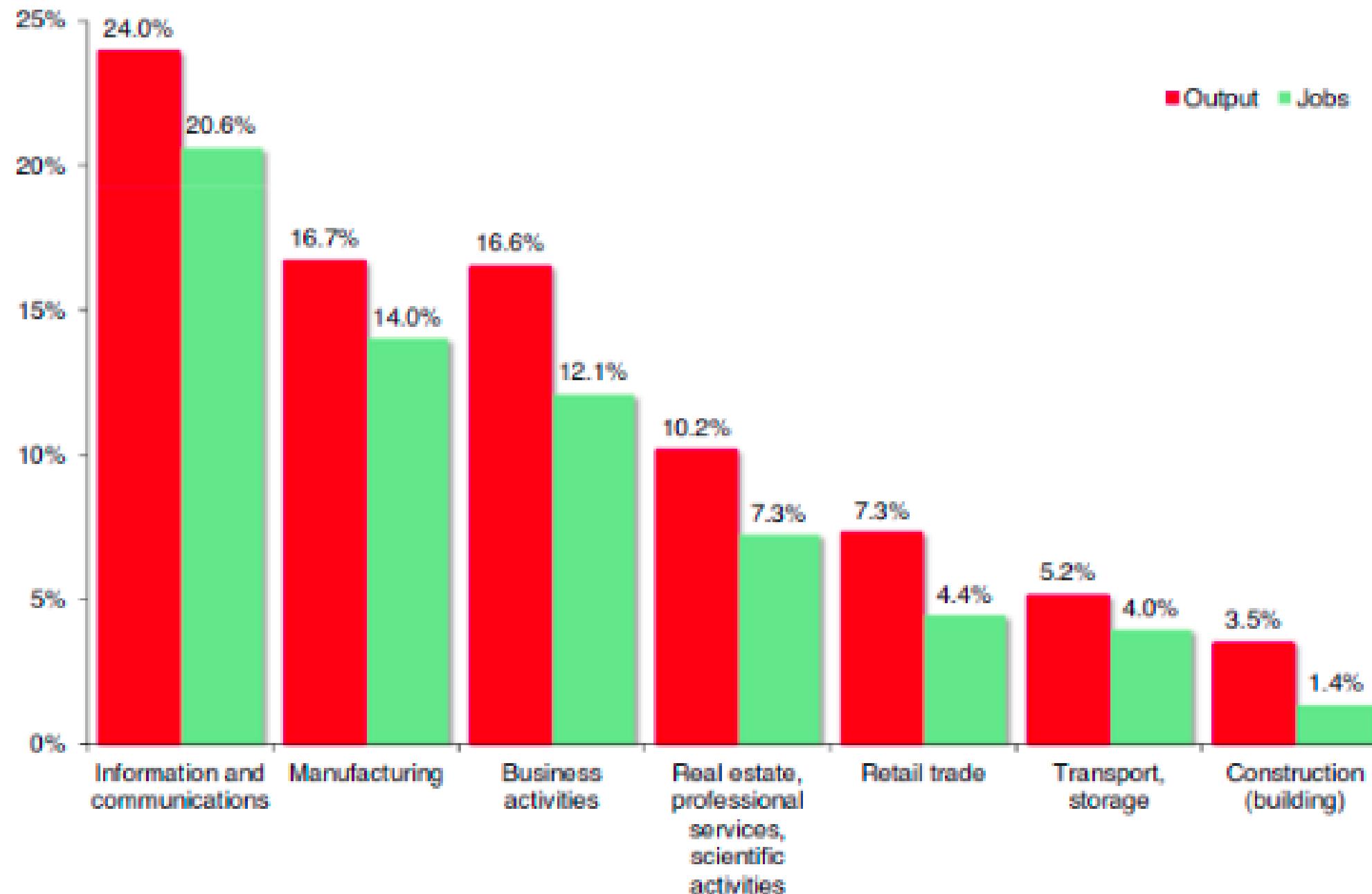
- In recent years, Israel has continued to **invest heavily in education and technology**, which has resulted in a highly skilled workforce and a thriving technology sector.

Investment trends in Research and Development in recent years



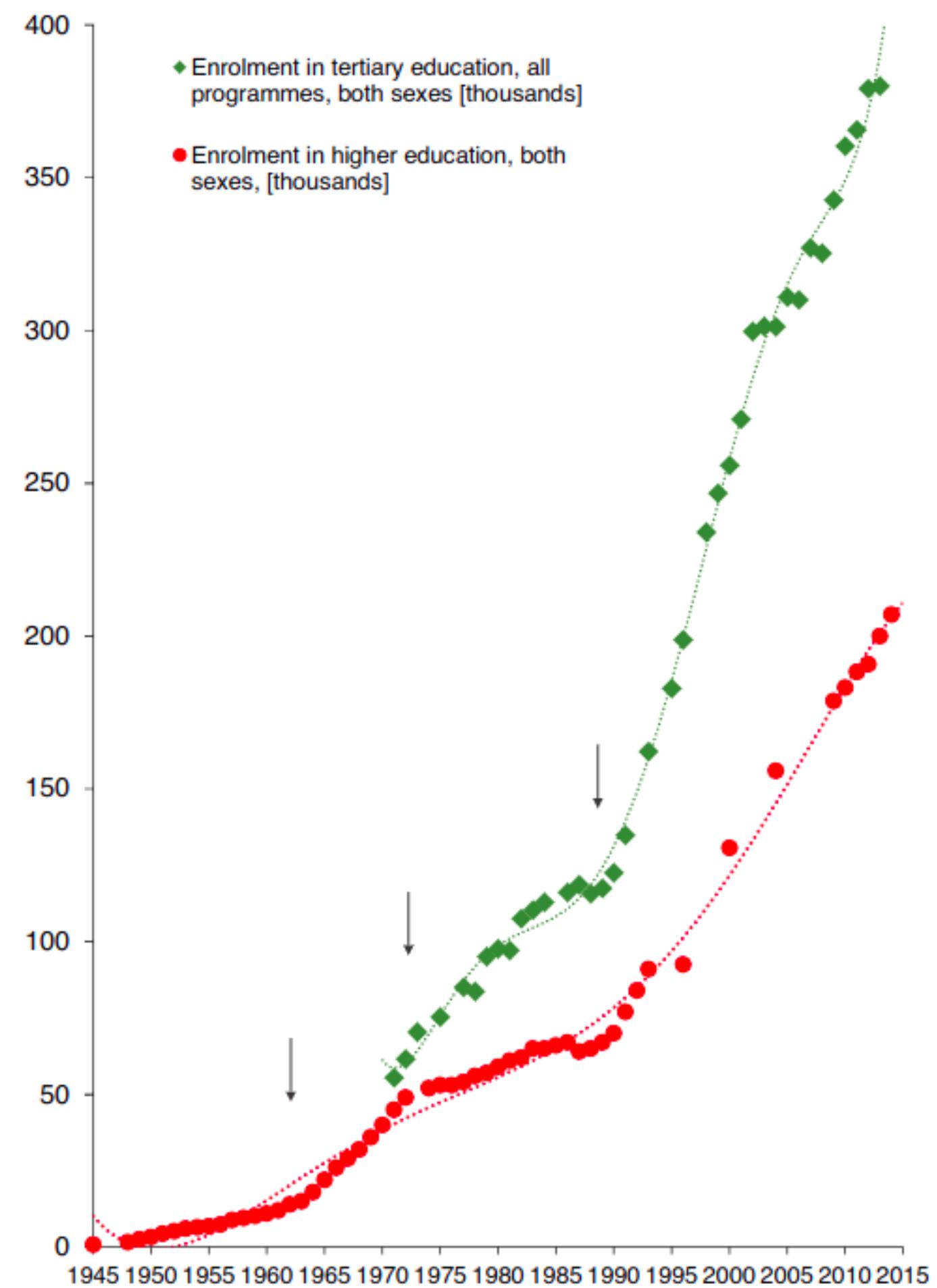
Investment trends in Research and Development over the long term





- In 2011, foreign multinational companies were responsible for the **employment of 33,000 workers through local subsidiaries in R&D jobs**.
- The share of foreign-controlled corporations out of total output and total jobs in the manufacturing sector in this year stood on 16.7% and 14%, respectively

Figure 22: Share of foreign controlled corporations of total output and of total jobs, 2011. Source: Central Bureau of Statistics, 2014b



- The human-capital pool is composed of current human capital and a reserve in which the state invests, by **providing education and higher schooling, to assure quality human capital in the future.**
- Most basic research takes place in the higher-education system and is crucial for the development of the economy and tomorrow's research labour force.

Figure 33: Total tertiary education (ISCED 5, 6, 7 and 8) enrolment in all programmes and in higher education (ISCED 6, 7 and 8) for both sexes in Israel 1945–2014. The dotted lines are the best-fitting curves.
Source: UNESCO based on raw data available at UNESCO archives and UNESCO Institute for Statistics

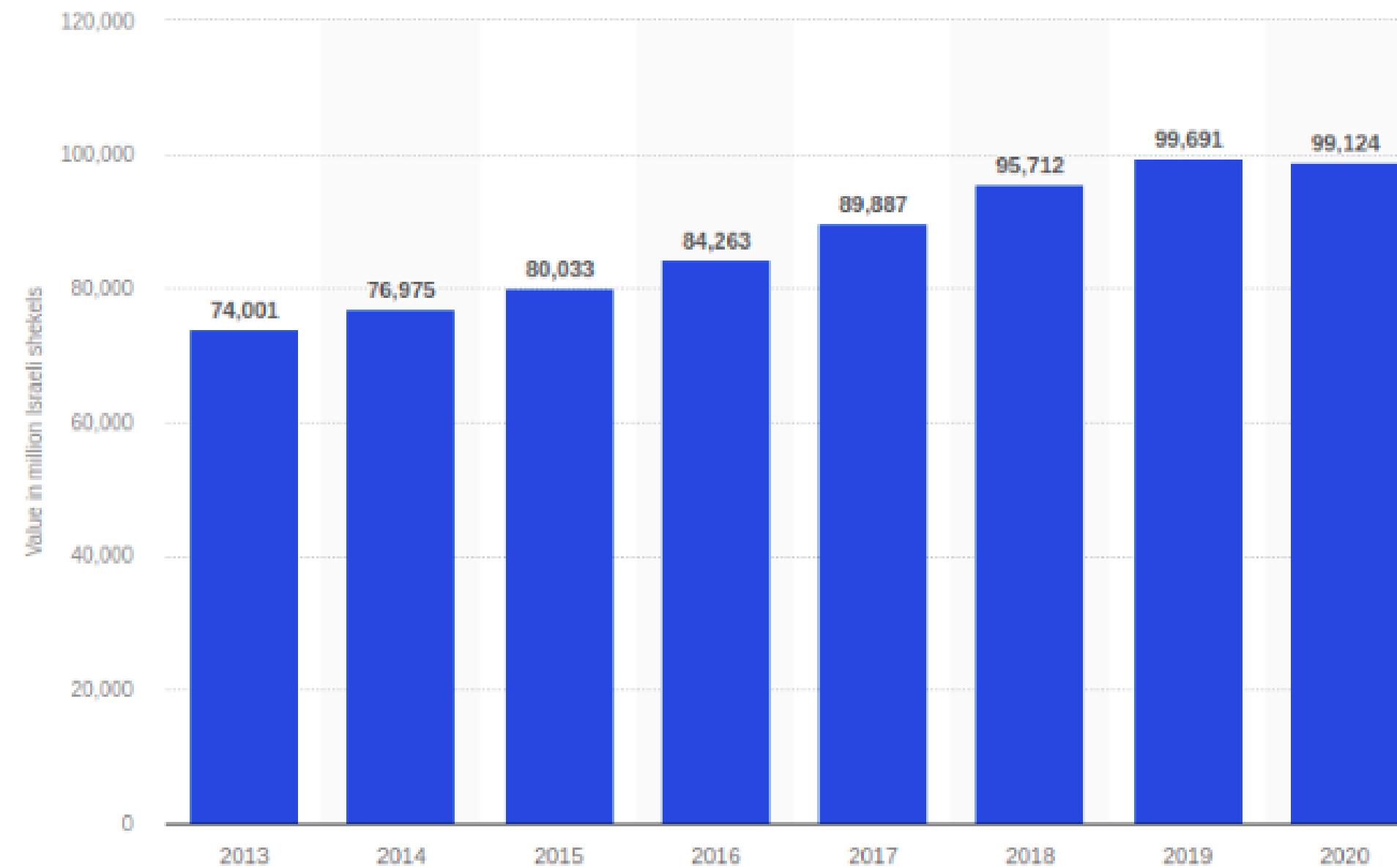
Employment trends in different industries

- Larger proportion of people employed under human capital accumulation industries such as education, social work etc.



Government expenditure on education in Israel from 2013 to 2020

(in million Israeli shekels)



- Large investments in education is a form of investment in human capital **to assure quality human capital in the future.**

CONCLUSIONI

**THANK YOU FOR
LISTENING!**

