



## US Brain Drain and solutions

May 20, 2024

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Chief Economist, IBM

At IBM we believe in engaging in policy, not politics. A company “should not try to function as a political organization in any way,” IBM CEO Thomas Watson Jr. in 1968.

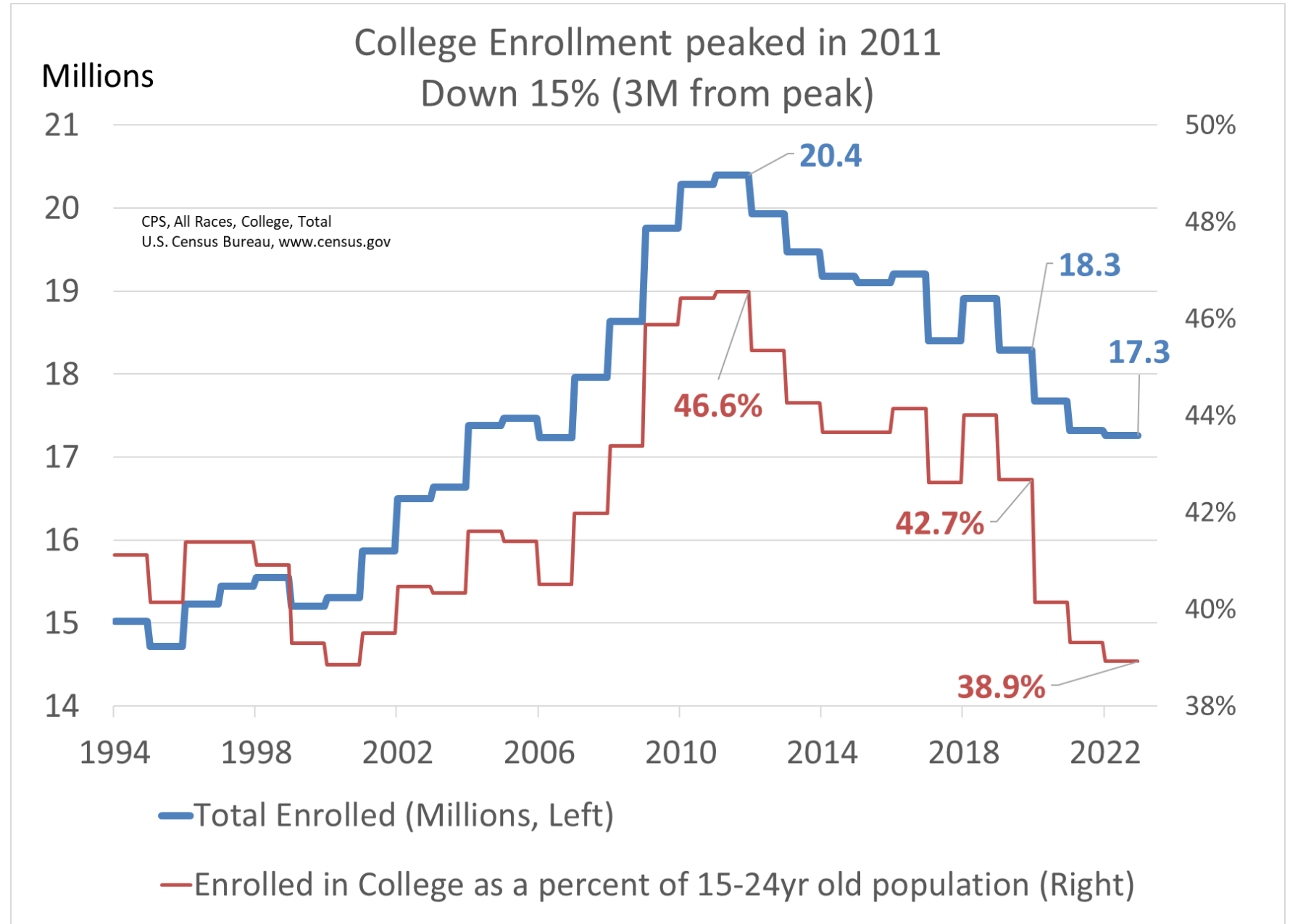
This is why in 110 years we have **never** had a political action committee, or PAC, and make no political donations.



# “What” College Enrollment is falling

Not due to fewer  
young people.

Enrollment in both  
absolute terms  
and as a percent  
of the population  
peaked in 2011.



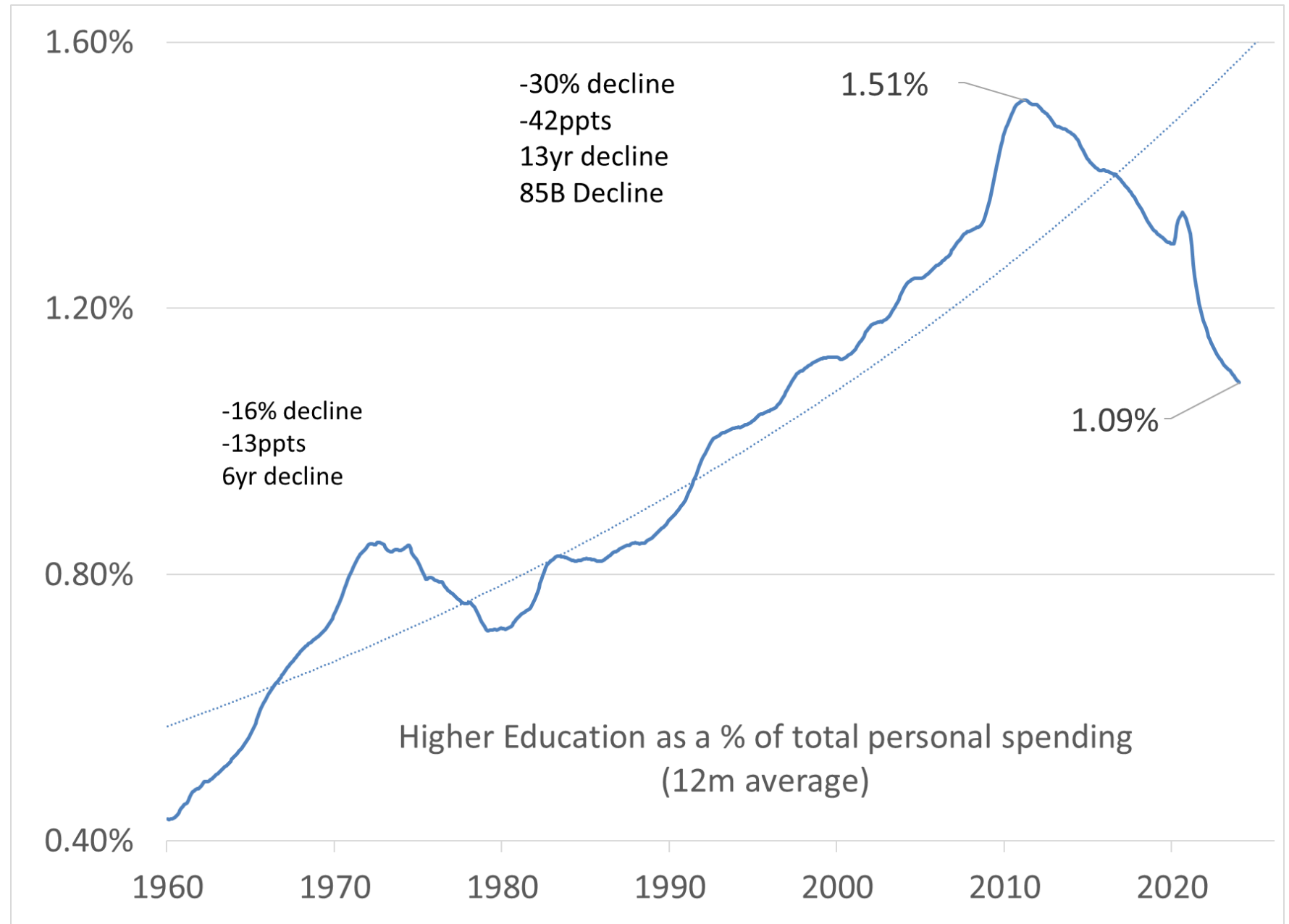
# “What” Spending

Rose for 55-yrs  
2011 peak

## Purse tightening

- New School sells \$20M townhouse
- St Francis sold campus for \$160M
- CUNY sells 2 Presidential houses
- Colleges (Albany Free sold 4 buildings) will start to close

**85B cut Investment  
isn't worth it**



# Brain Drain

- What - Fewer students
- How – How does it matter

The relative US international educational advantage has collapsed.

1950 - US had 8:1 ratio of college educated workers

2015 the ratio was 2:1

Productivity slowed, patent creation shrinking, and fewer new firms are launched. As productivity slows, living standards rise more slowly.

Giving rise to isolationism, protectionism and other societal ailments.

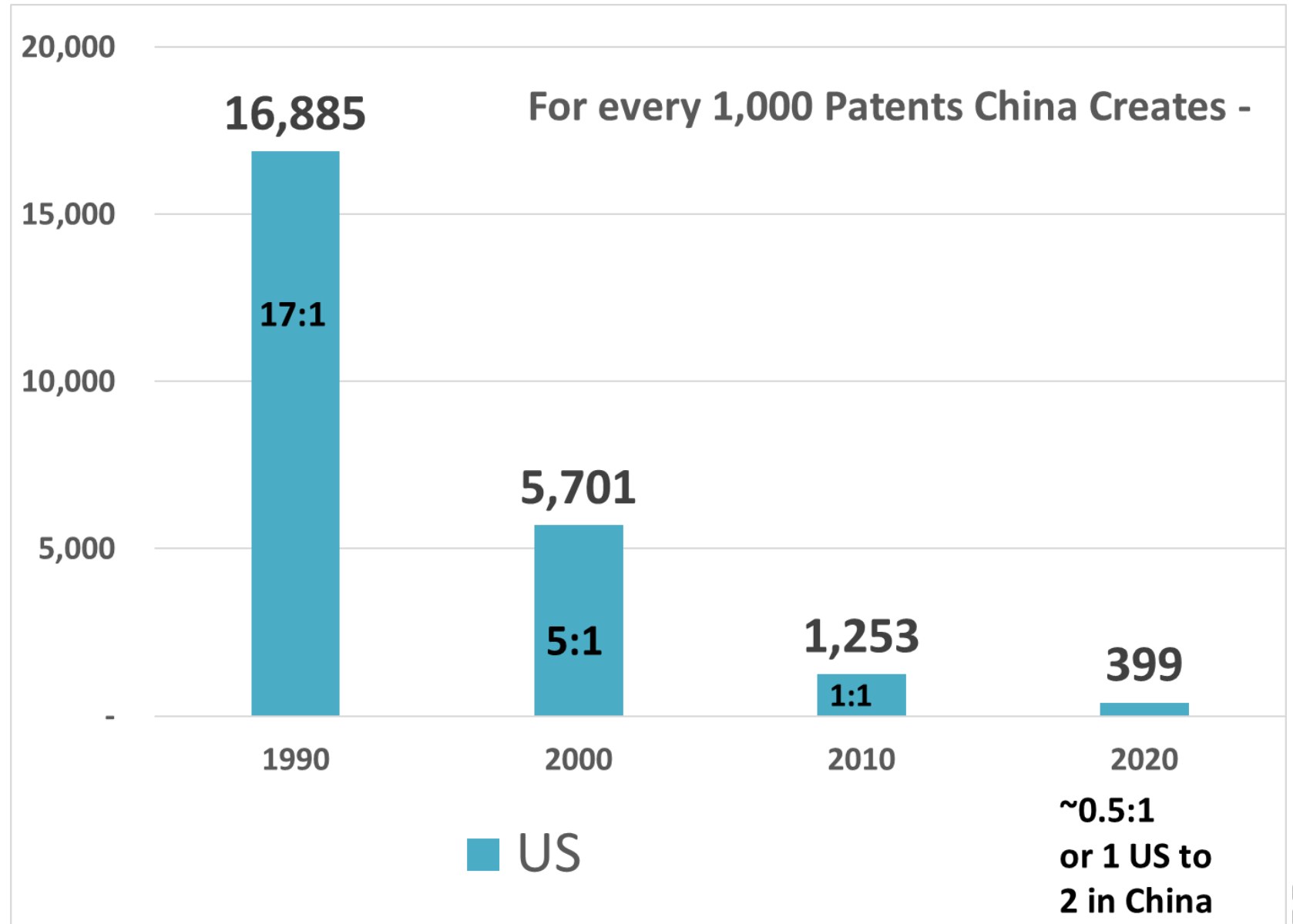
- Why
- Solutions



# “How” – Patent advantage is over

The US / China patent advantage disappeared in 2010.

Last few years has been a disadvantage

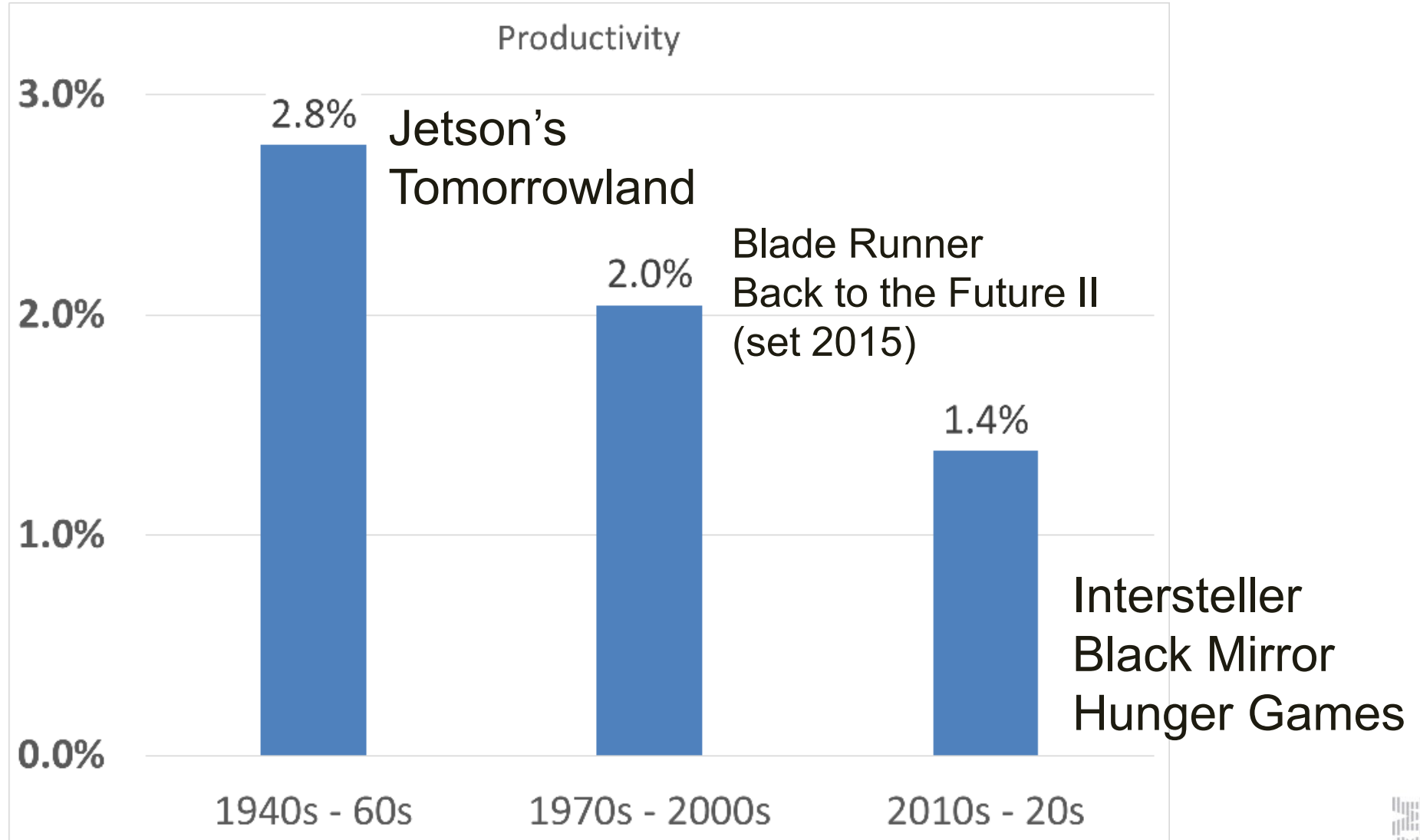


# “How” – Productivity improves living standards

Chart shows a decline in relative income and general welfare

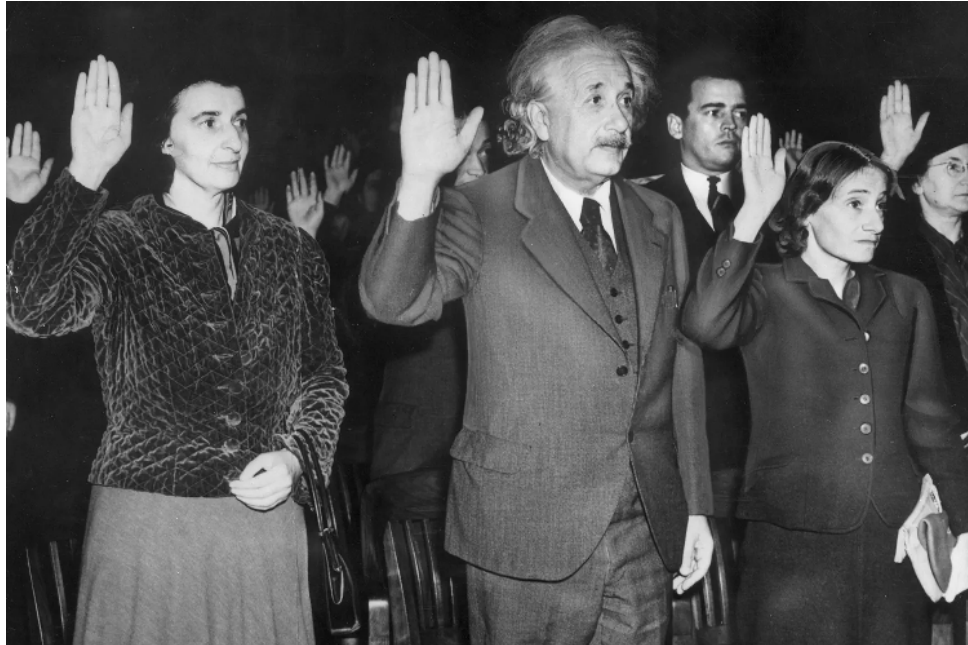
Increasing labor productivity is crucial for economic prosperity. It leads to higher output per worker, fostering economic growth and competitiveness.

Labor Productivity, Nonfarm Business Sector



## “How” Hostile to outsiders

US would have been the world leader in 5G Tech instead of China if we had just given \*one guy\* a green card when he needed one.



German-born physicist Albert Einstein; his secretary, Helen Dukas (left), and his daughter Margaret Einstein take the oath of U.S. citizenship in 1940

It's not just a matter of enticing new immigrants but of retaining bright minds already in the country. In 2009, a Turkish graduate of the California Institute of Technology and the Massachusetts Institute of Technology, Erdal Arikan, published a paper that solved a fundamental problem in information theory, allowing for much faster and more accurate data transfers. Unable to get an academic appointment or funding to work on this seemingly esoteric problem in the United States, he returned to his home country. As a foreign citizen, he would have had to find a U.S. employer interested in his project to be able to stay.

Thanks to immigrants, the US won 75% of Nobel prizes in 2023. Without them, we only would have won 25%.

Back in Turkey, Arikan turned to China. It turned out that Arikan's insight was the breakthrough needed to leap from 4G telecommunications networks to much faster 5G mobile internet services. Four years later, China's national telecommunications champion, Huawei, was using Arikan's discovery to invent some of the first 5G technologies. Today, Huawei holds over two-thirds of the patents related to Arikan's solution—10 times more than its nearest competitor. And while Huawei has produced one-third of the 5G infrastructure now operating around the world, the United States does not have a single major company competing in this race. Had the United States been able to retain Arikan—simply by allowing him to stay in the country instead of making his visa contingent on immediately finding a sponsor for his work—this history might well have been different.

<https://foreignpolicy.com/2022/07/16/immigration-us-technology-companies-work-visas-china-talent-competition-universities/>



# Brain Drain

- What - Fewer students
- How – How does it matter
- **Why – Controversial**
- The Why includes rising college costs and reduced government investment, but also a diminishing return on investment (ROI) from education. Inequality and high mortality rates among young Americans further erode the value of higher education.
- When we had rapid productivity and growth the consensus outlook was a “win-win” openness and welcoming attitudes.
- Stagnant growth ushered in a fixed economic pie mentality which leads to zero-sum conflict. We see this in two areas:
  - 1) Value of education, science and investment becoming a partisan issue
  - 2) Immigration has withered.
    - Issuing 1 Green card would have given the US 5G technology, instead the creator went to China.
- Solutions





# Brain Drain

- What - Fewer students
  - How - does it matter
  - Why – see appendix
  - **Solutions**
- 
- The US needs higher productivity and growth to return to a “rising tide lifts all boats” mentality and its attendant positive externalities.
  - AI to boost productivity and living standards and increasing government support is crucial. We will need to rely on AI to replace the missing skills to bolster R&D and lift domestic wages which creates an openness to immigration and ensures widespread economic growth.

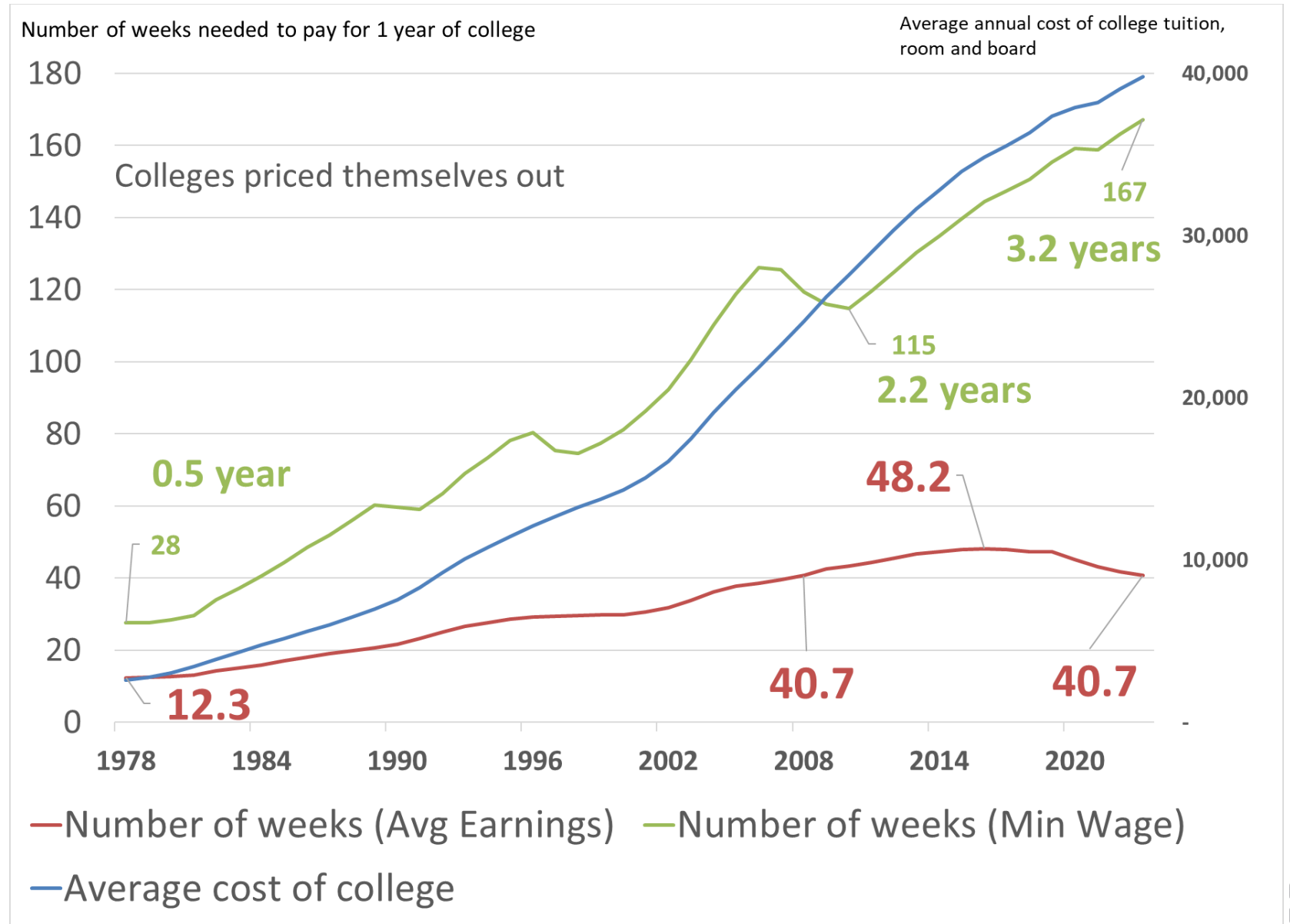


# Solution: Make college cheaper

1978-2009 the cost of college rose by a factor of 10, while average pay rose by a factor of 3.

**Relative price down from 2016.**  
**College is getting cheaper vs. avg wage.**

Average wage can pay for college with 7 fewer weeks of paychecks.



# Solution - Import talent, but overseas recruitment is ending

On a net migration basis (incoming vs. outgoing) Scientists traditionally flowed into the US, on net exited China, and on net exited the OECD.

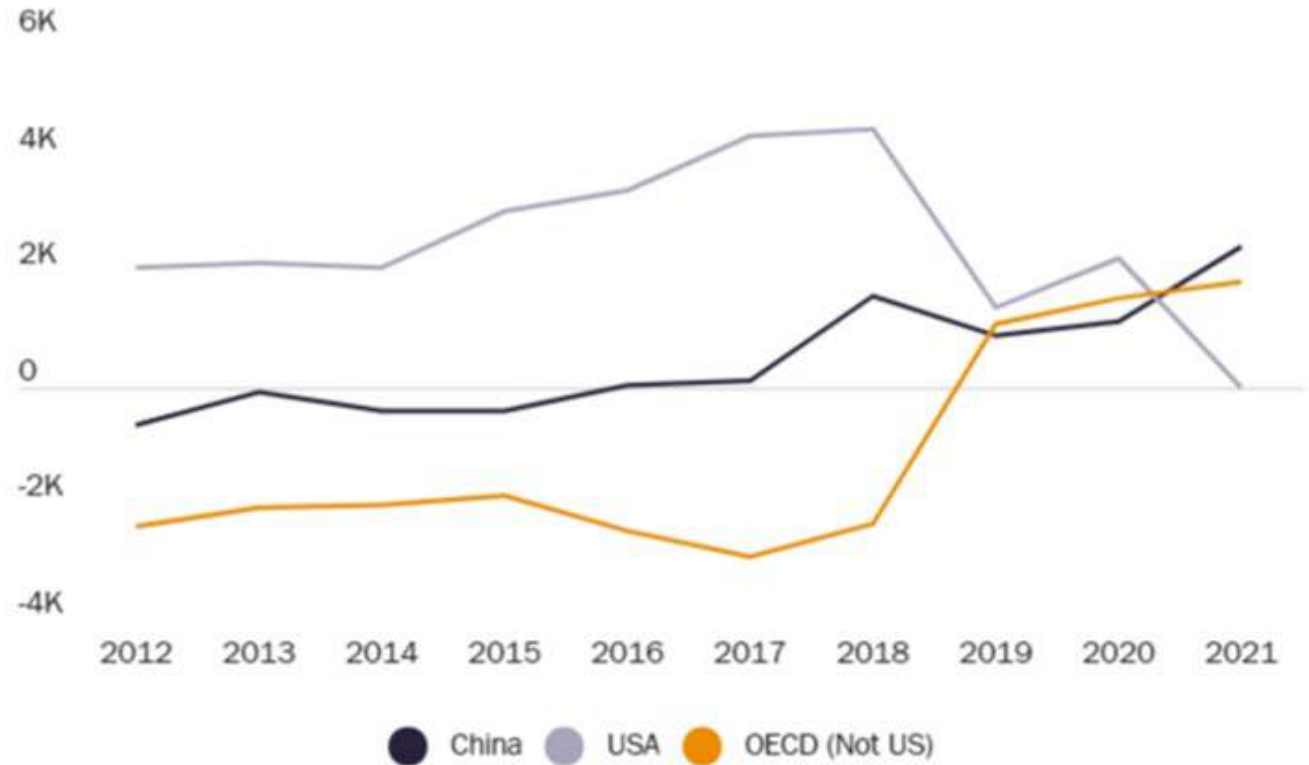
The peak US recruitment year was 2017. The US welcomed 4,292 published research scientists. (net migration basis) China welcomed 116; & non-US OECD nations lost 2,927.

By 2021, the US saw 4 scientists leave (again, on net); the non-US OECD welcomed 1,792; and China welcomed 2,408. This is “brain-drain” and a self-inflicted disaster.

Thanks to immigrants, the US won 75% of Nobel prizes in 2023. Without them, we only would have won 25%.

Figure 1

**Other countries surpass the United States in attracting published scientists in 2021**  
Net inflows of scientific authors, 2012-2021



[Download data](#)

Sources: OECD (2017), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation, OECD Publishing, Paris, <https://doi.org/10.1787/9789264268821-en>.

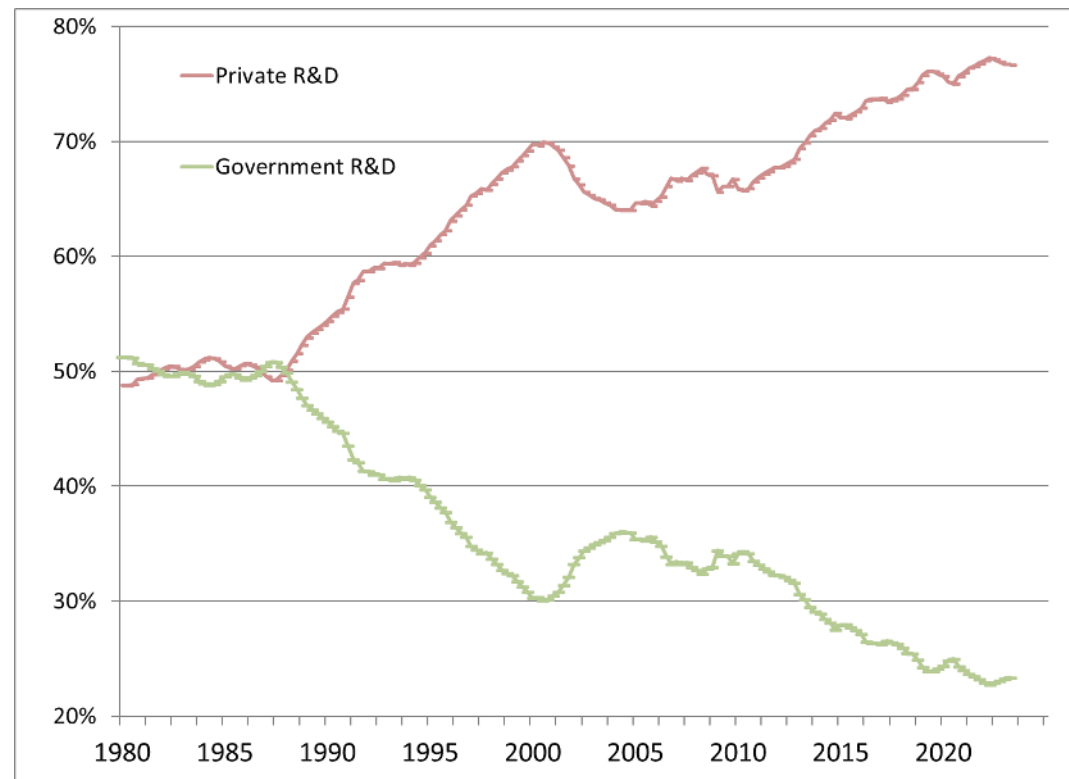


# Solutions

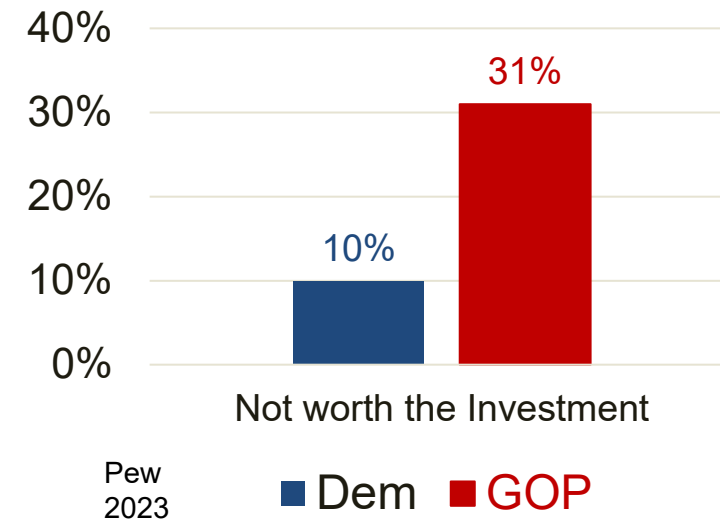
Short term – Productivity must rise

Government investment: At the end of the cold war the government stepped back from investing in research. In 1987, 51% of all R&D was done by the government. Supporting basic research spun off inventions and innovations that were not profitable for decades, a function the private sector is ill equipped to serve. Today the Government provides only 23% of all R&D. The share of software investment is similar. In 1992 the government accounted for 27% of all spending on software, this has dropped to 12%.

We need more workers (immigration) but for reasons outlined in the appendix that solution is off the table. We must embrace AI to enhance the output of the workers we have. We must ramp productivity to expand prosperity.



Government investment in scientific research:



# Solutions

Medium term solutions – Reaffirm the American values of Freedom of Religion and an openness to immigration. However, sharing the American “pie” of economic growth must be shared by all to create a nation receptive to welcoming others.

Argentina is a textbook example of negative feedback loop.

**The percentage of college educated workers in the workforce fell in half from 1990 to 2015.**



# Solutions

Long term solutions – A return to 1940-1980 America.

- 1) Remove the corrupting influence of money in politics “pay for play” and shrinks the remaining political fights to fringe culture war topics.
  - Corruption is negatively linked to the level of investment and economic growth, the more corruption, the less investment and the less economic growth. ([IMF](#))
  - Corrupt politicians choose investment projects not on the basis of their intrinsic economic worth, but on the opportunity for bribes these projects present. ([IMF](#))
  - Economic theory suggests that high levels of corruption are associated with lower quality goods and services the government provides ([Various](#))
  - Money gives big spenders [leverage to reshape the economy](#). The policies they want — low tax rates & underinvestment in the future



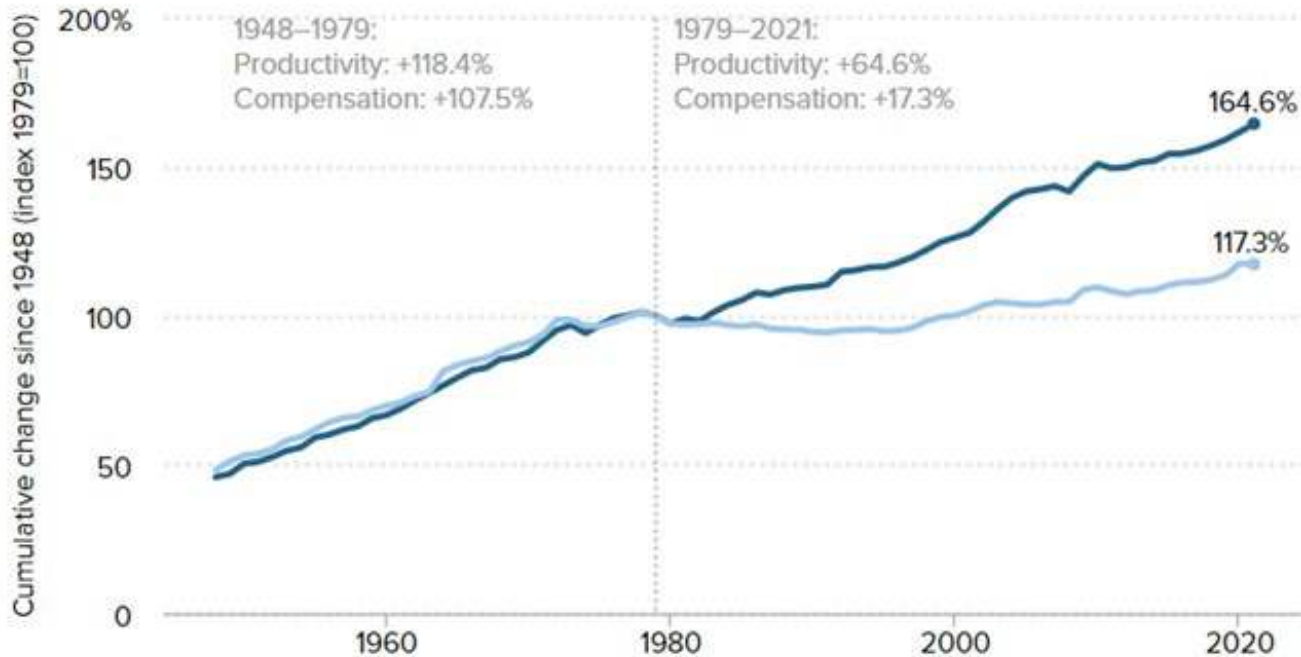
# Solutions

Long term solutions – A return to 1940-1980 America.

- 2) Return to wages linked to productivity. Pay for output.  
Our brains are hard wired for “fairness”

The gap between productivity and a typical worker’s compensation has increased dramatically since 1979

Productivity growth and hourly compensation growth, 1948–2021



Capuchins  
reject  
unequal  
pay

w/ Dr. Sarah Brosnan

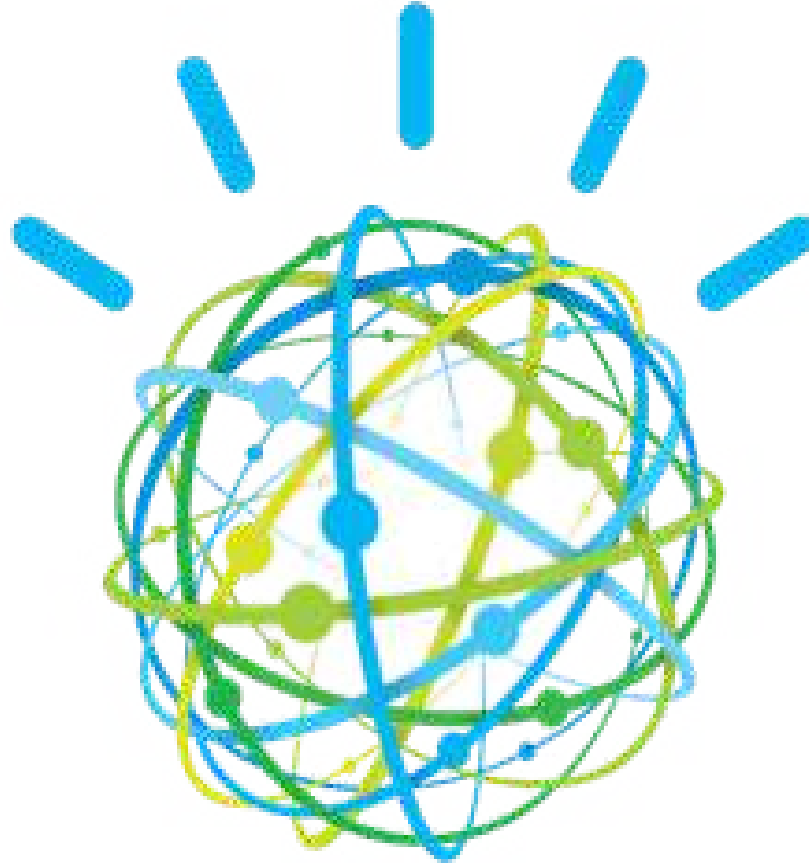


[TED talk](#)

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# Q&A

## Appendix





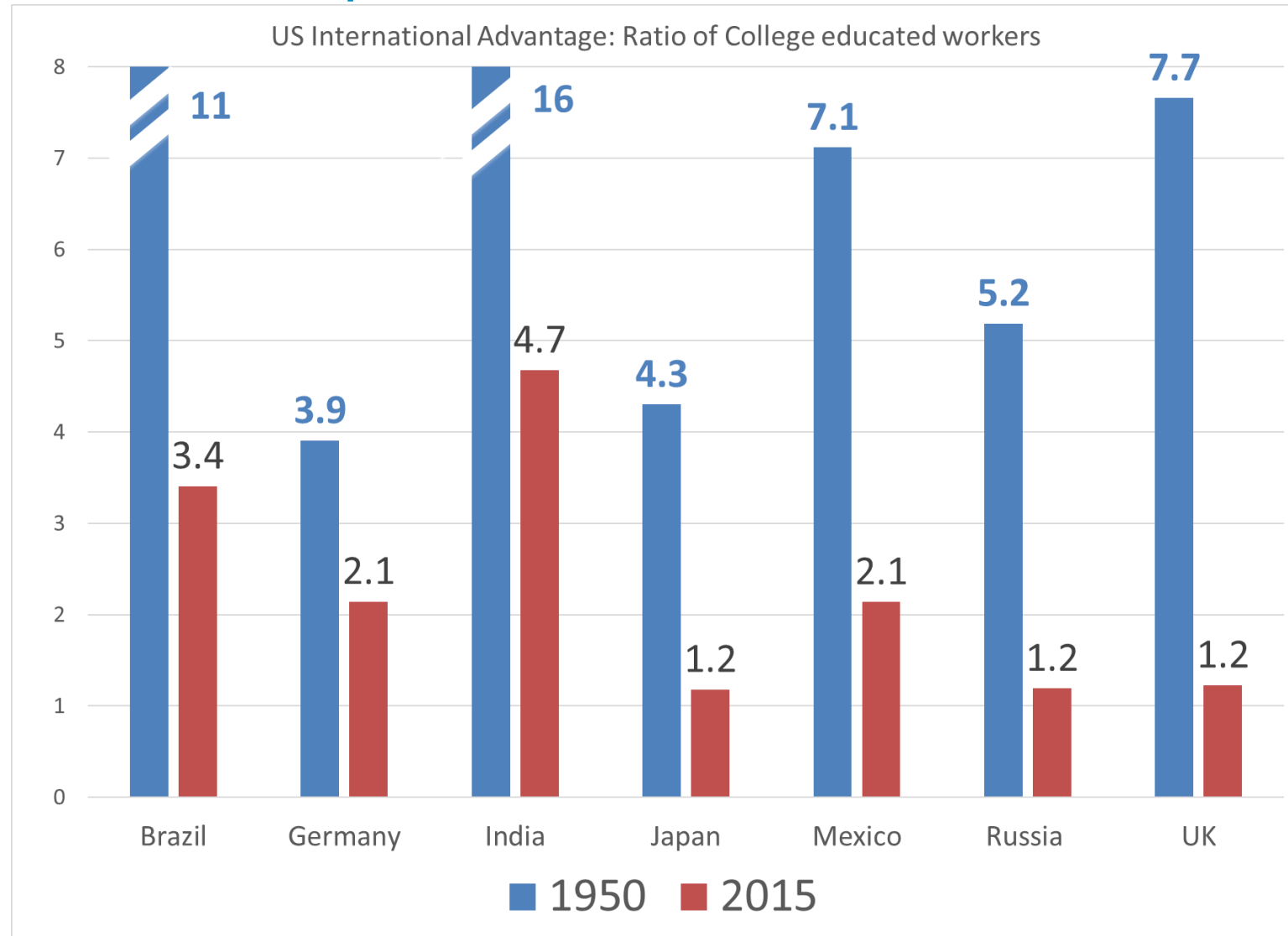
# College and Productivity: How is this a problem

US had 8:1 ratio of college educated workers as these nations. 16x as many as India and 4x as many as Germany.

By 2015 the ratio was 2:1.

Ex: Japan 4.3x to 1:2x

|       | 1950: | 2015: |
|-------|-------|-------|
| Japan | 2.0%  | 29%   |
| US    | 8.0%  | 34%   |



# “Why” Higher education is a partisan issue

## Voters are split on whether college is good for society

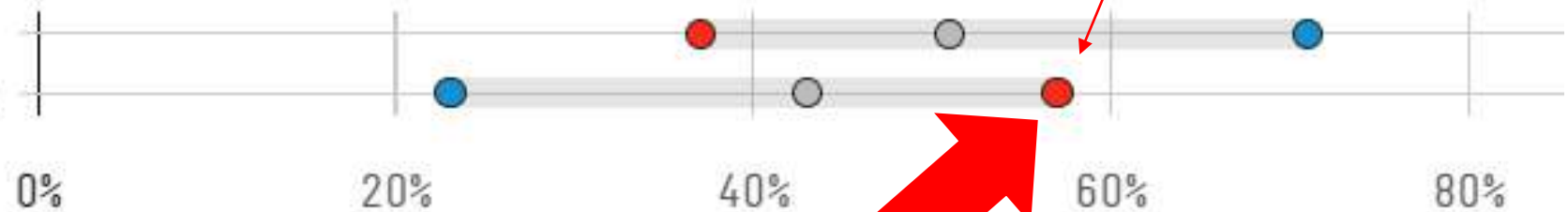
Share of likely voters who agreed with the following statements, by party

● ALL ● DEMOCRATS ● REPUBLICANS

### A COLLEGE EDUCATION IS THE BEST WAY TO GET AHEAD IN THE U.S.

Strongly or somewhat **agree**

Strongly or somewhat **disagree**



A negative ROI



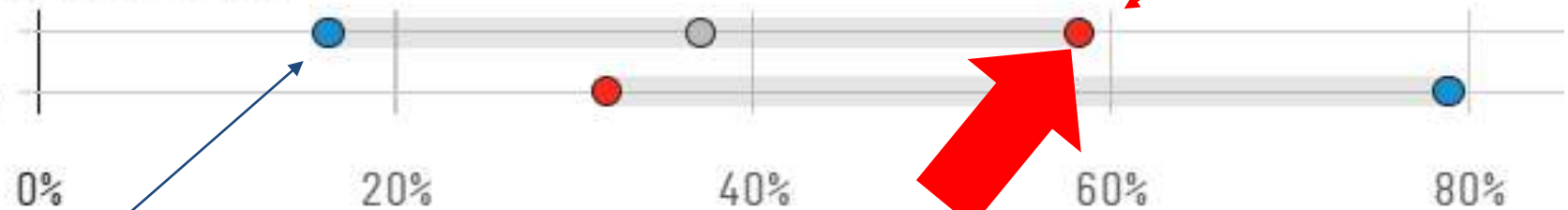
Culturally a bad idea



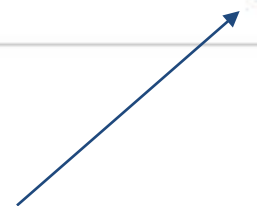
### COLLEGE MAKES YOU LOSE COMMON SENSE

Strongly or somewhat **agree**

Strongly or somewhat **disagree**



Culturally a good idea



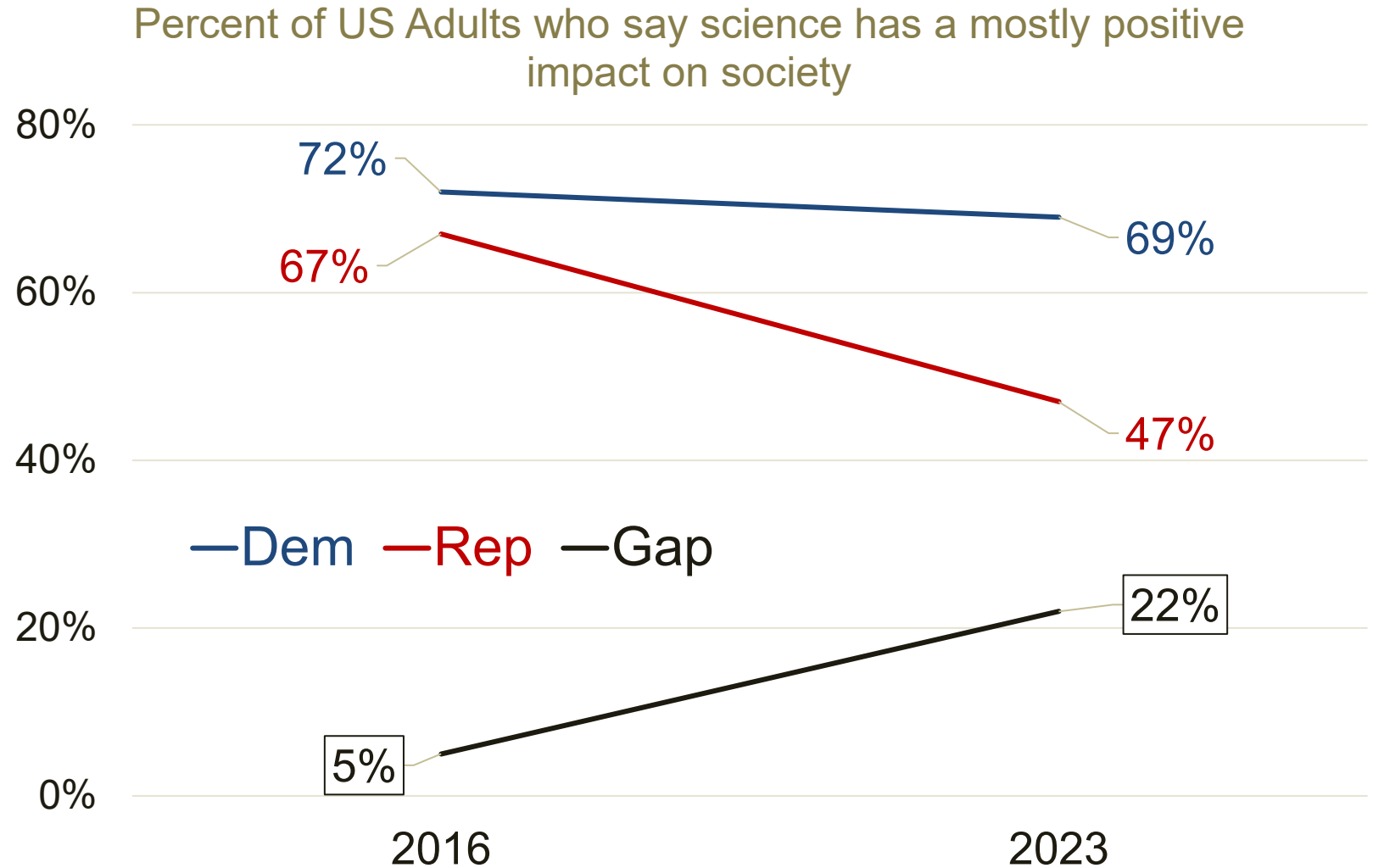
538: Is College Worth It? October 2022



# “Why” Not just college. Science is a partisan issue

College, science  
and investment

All partisan issues.



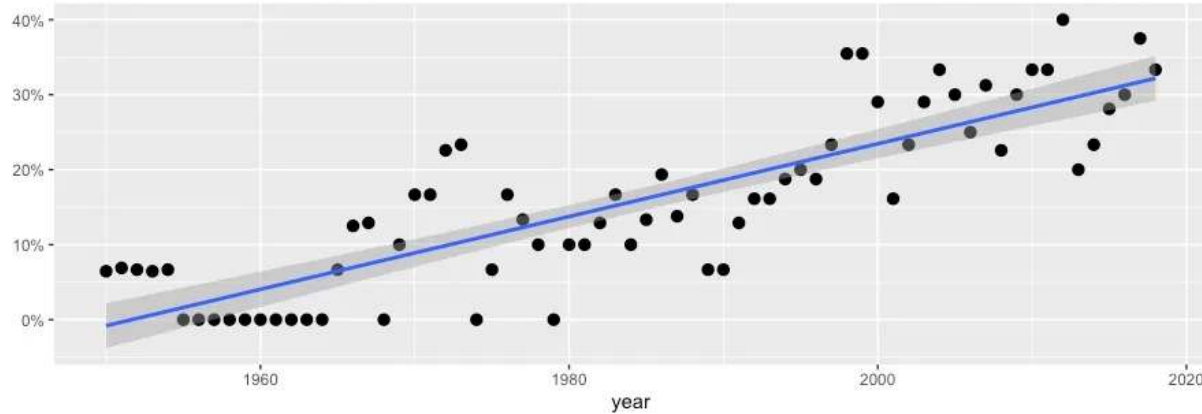
Pew Research Center October 2023



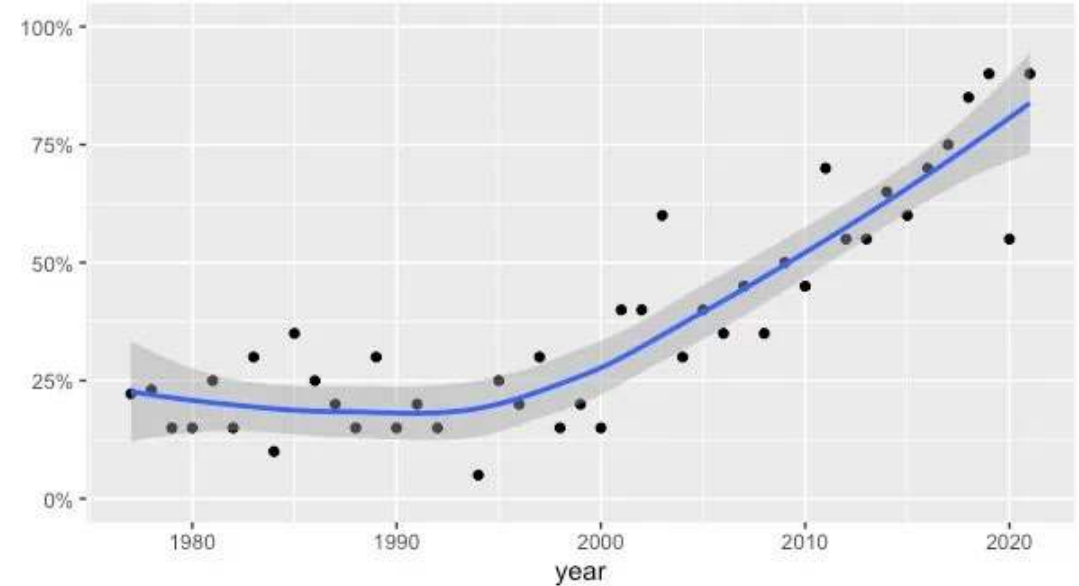
# “How” it matters – a decline in new ideas = rehash of old ideas

Sequels, spinoffs, reboots, remakes dominate TV, Movies, Books, Music

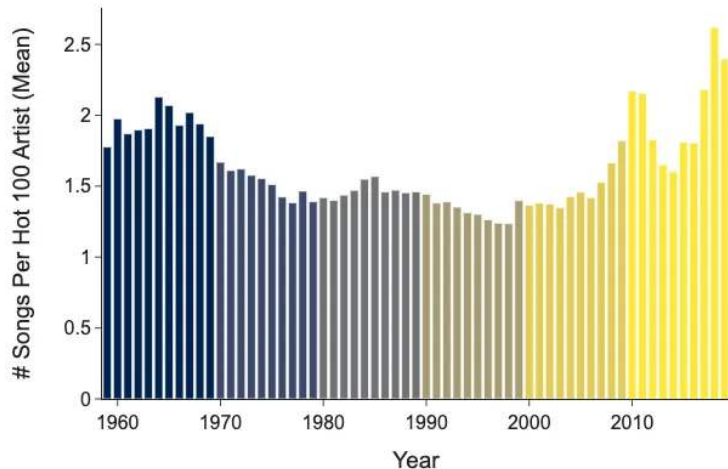
TV shows in the top 30 (by viewership) that are either:  
 -spinoffs of other shows in the top 30 that year (e.g. CSI & CSI: Miami),  
 -multiple broadcasts of the same show (e.g. American Idol on Monday & American Idol on Wednesday)



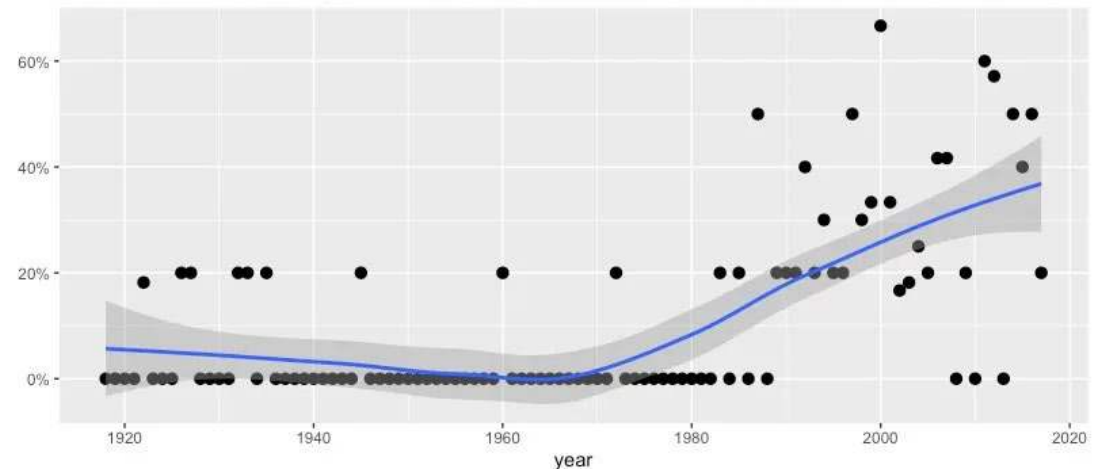
Movies in the top 20 (by revenue) that are prequels, sequels, spinoffs, remakes, reboots, or cinematic universe expansions



How Many Songs Does a Hot 100 Artist Have Chart Each Year?



Books in the top 10 (by sales) written by an author with multiple books in the top 10 that year



[Experimental History](#)

Adam Mastroianni - May 2, 2022



# Q&A from the live Q&A feature

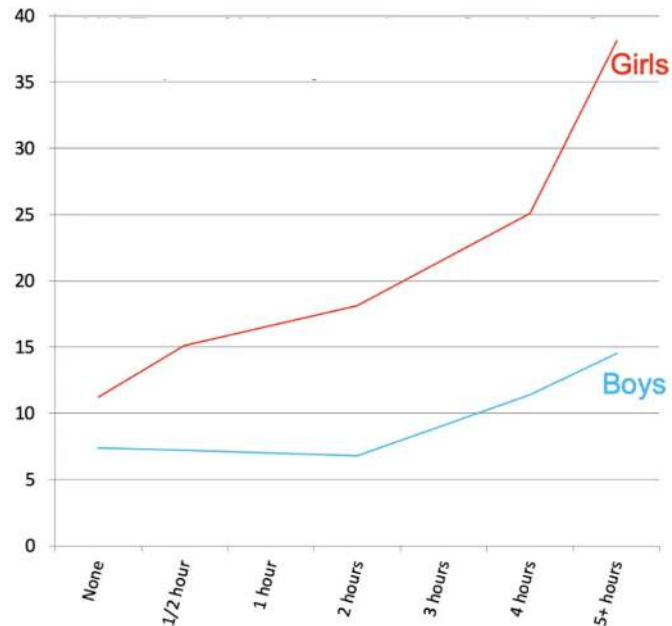
BSPENCER: Question for Mike: I missed some of the beginning so I might have just missed this - but what are would-be college students doing instead of enrolling?

Response: Not working or working without advanced education, online, depressed and dying see “Diseases of despair”

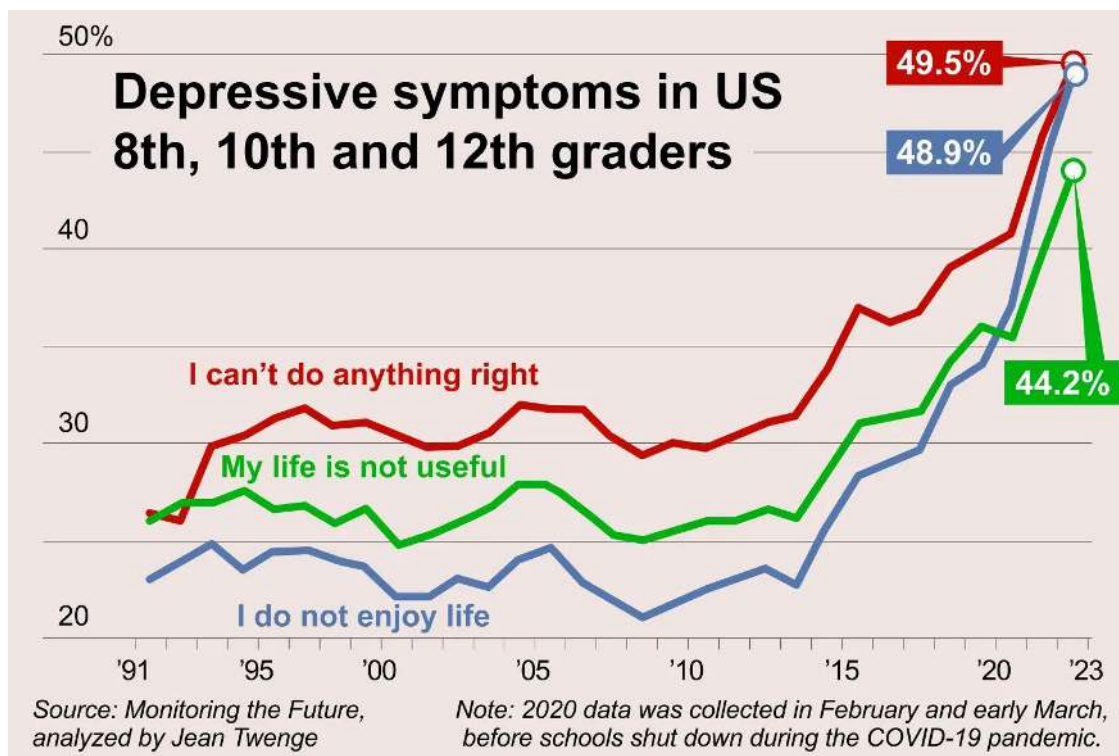
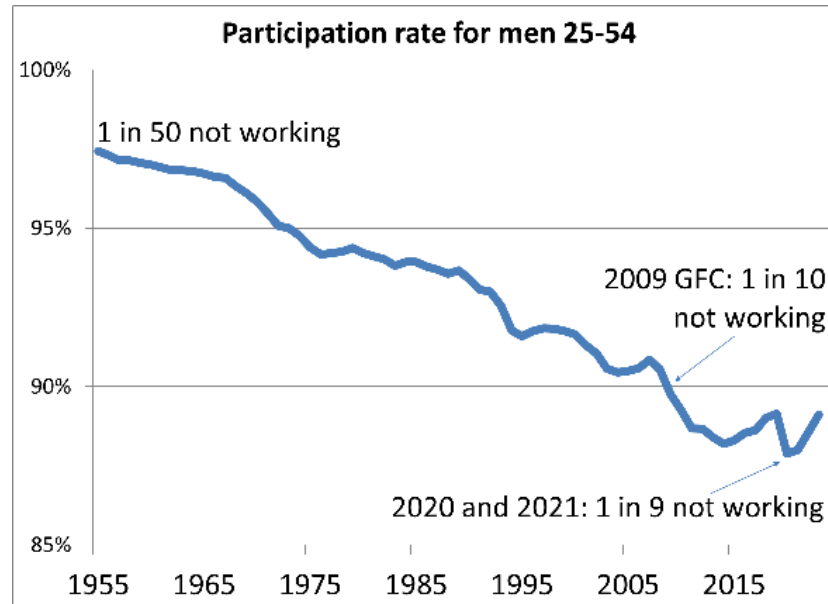
Studies show screen time is not just correlated with depression it is casual it creates depression, particularly in women

<https://jonathanhaidt.substack.com/p/social-media-mental-illness-epidemic>

Percent of UK Teens Depressed as a Function of Hours per Weekday on Social Media



## Social status



Look at slide 41. Nearly 60% of Republicans don't think College is the way to get ahead. Morbidly, **dying** see slide 38. Young Americans are dying at 4X the rate of other rich countries.

<https://www.noahpinion.blog/p/americans-are-coping-ourselves-to>

For men, not working. Lower engagement, participation rate, in the workforce compared to decades past.



## Q&A – write in

How do you see the declining enrollment and spending trends impacting the workforce and skills needed by businesses in the coming years?

- Response: The declining enrollment could lead to a shortage of skilled workers in various industries. Businesses might face challenges finding talent with the required skills, which could potentially slow down innovation and growth. Investing in workforce development and collaborating with educational institutions to align curricula with industry needs will be crucial.

You mentioned the role of AI in boosting productivity. What specific examples or areas within businesses do you see AI making the most impact?

- Response: AI has the potential to revolutionize various business functions. For instance, in manufacturing, AI-driven automation can enhance efficiency and reduce costs. In customer service, chatbots powered by AI can provide personalized support. Moreover, AI can analyze large datasets to uncover insights, aiding in strategic decision-making.

Given the changing landscape, how should businesses adapt their strategies to address the challenges posed by declining productivity and an evolving workforce?

- Response: Businesses should focus on upskilling and reskilling their employees to keep up with technological advancements. Embracing remote work options and flexible arrangements can attract a wider talent pool. Collaborating with educational institutions and participating in initiatives that bridge the skills gap will be essential for sustained growth.

You mentioned that college education has become a partisan issue (slide 32). How might this political divide impact business operations and policies, especially in industries that require specialized knowledge?

- Response: Political divisions surrounding education could lead to policy uncertainty that affects industries reliant on specialized skills (attracting foreign Ph.D's, hard to find physical skills and technical knowledge) Businesses should engage in constructive dialogues with policymakers to ensure that educational policies align with industry needs. This will help create a more stable environment for business planning and growth.



## Q&A – write in

In light of the declining US international educational advantage, how might this impact global business partnerships and collaborations?

- Response: The diminishing educational advantage could impact the US's ability to attract international talent and researchers. This might lead to a reduction in cross-border collaborations, potentially slowing down innovation and knowledge exchange. To counter this, businesses can actively foster global partnerships and seek out talent beyond borders.

Given the multifaceted nature of the challenges you've discussed, can you elaborate on any recent academic research or theoretical frameworks that shed light on the underlying causes of the declining trends and potential strategies for addressing them?

- Response: Recent research has delved into the interplay between economic, social, and policy factors contributing to these trends. Scholars have explored the concept of "education-technology-productivity nexus," investigating how technological advancement affects education's role in driving productivity. Moreover, some researchers have proposed innovative financing models for higher education to alleviate the burden of rising costs. These studies collectively provide a comprehensive understanding of the issue and suggest ways to mitigate its impacts.

In your discussion about AI's potential to boost productivity and address skill gaps, could you provide insights into the ethical considerations surrounding the integration of AI in education and the workforce? How might these ethical concerns impact the effectiveness and fairness of AI-driven solutions?

- Response: The integration of AI in education and the workforce raises ethical considerations such as algorithmic bias, data privacy, and the potential for exacerbating existing inequalities. Research in the field of AI ethics emphasizes the need for transparency, accountability, and proactive measures to mitigate biases in AI algorithms. Striking a balance between the benefits of AI-driven solutions and ensuring equitable access and outcomes is a complex challenge that requires interdisciplinary collaboration and robust ethical frameworks.



## Q&A from the live Q&A feature

Mark W: There is a huge shortage of trades...carpenters, masons, painters, electricians, plumbers, etc. Does your presentation relate to trade schools as well? In the construction industry, we lost apprentices...simply didn't develop...during the Great Recession. Old (workers) doing tasks beneath their capability simply to stay busy/employed...so, no youngsters working along side. Thoughts?

Response: Thanks Mark, “College” is a catch-all for higher education which includes vocational school, training certificates, etc. Any education or training after High School. How much of the decline in spending on “Higher Education” from 2008 – 2023 is less apprenticeship / hands on training ? I don’t know how much of the decline in spending is due to this, but I’d bet its significant.

Wes: How do you see the looming China recession from unemployment, real estates over leveraging and banking issues effecting our economy moving forward?

Response: Not as much as you’d think. US banks don’t have much exposure to China. UK banks do, hello HSBC...

Supply chain impact PRO: higher China unemployment means lower wages (brutal but a benefit to US), good for US imports.

CON: China doesn’t purchase as much from our other trade partners, so a secondary impact on places like Brazil and Australia.

THREAT: ? If you economy is in the tank, maybe a war is the way out and maybe if I’m not trading as much a war isn’t as painful ??

Hope not.

Edwin J: How will this BRICS collaboration for new currency impact us.

Response: None. BRICS is a joke.

<https://www.noahpinion.blog/p/brics-is-fake>

A multi-polar world / deglobalization / geo-fracture does have some impact on the dollar, but some good some bad impacts.

Emin: for Mike -- Do you see electric powered vehicles as a temporary measure ultimately replaced by hydrogen powered vehicles?

Much like music cassettes transition to CDs, then to streaming?

Response: I hope so. Rare earth mining and refining uses too much water in places where there is no water.





## Q&A from the live Q&A feature

Stan B: Who owns the winnings from the lottery ticket? The "person" who bought it?

Response: Yes, but not for long. As the US moved the technological frontier outwards the US benefited from satellites, computers and the internet. But others can eventually come along and enjoy that benefit. However don't worry so much. A rising tide lifts all boats, this is a win-win world.

Victoria H: Can an argument be made that increased reliance on AI might exacerbate problems with innovation and the skills necessary for innovative thinking?

Greg P: How do we address a brain drain given a recommended solution of AI that could defer or disincentivize the development of specific skills using the AI as a crutch?

Response to both questions: Yes. Did you see Wall-E ? <https://en.wikipedia.org/wiki/WALL-E> That is the dystopian future possibility.

However, what have new technologies generally done? Computers, Machines, Industrial robots, self-driving cars, people have moved to higher skill jobs and given drudgery to the tools they have invested in. This is the positive future possibility. One more example. I used to have memorized in my brain (in the 1990s) perhaps 20 or more phone numbers, maybe 40 phone numbers. I use my smart phone as a crutch and let it remember the phone numbers. I now know only 3 phone numbers, that's it. But I don't see it as a crutch, I see it as expanding my brain capacity.

Carlos H: Mike, would you please discuss the vulnerabilities of ai/chatgpt.

Response: AI can hallucinate and add fake things into a document or answer. Our AI added a fake internet link to my research, the Journal it linked to was real, but my article was not published in that Journal. It also can't do basic math.



# Q&A from the live Q&A feature

Noah R: Do you think China's zero COVID policy caused American board rooms to start looking for production at home?

Response: Last week in my internal IBM letter I talked about the 12 problems in China. I will quote from that.

Zero-Covid fallout. Two years of regulatory crackdown has heightened policy uncertainty for the entire private sector, effectively imposing a sizable risk premium on private business investment. **Fixed asset investment by private enterprises has thus remained listless since the zero-COVID policy ended.** The urban depositor survey by China's central bank showed that 58% of depositors planned to allot more of their income in saving deposits in 2Q2023, same as 1Q and 14ppts higher than the pre-pandemic average.

Adam Posen, Peterson Institute for International Economics, describes this as "[economic long Covid](#)," (Foreign Affairs paywall) a decline in corporate confidence due to capricious government intervention.

**Covid or more accurately Covid-fears are not over.** In casual photos, videos and background pictures in China the ratio of masks to unmasked runs 1:3. A jarring 1:1 ratio in a July 2023 photo of Secretary [Yellen in China](#) and travel data confirm our Covid-fear theory. The disease may have run its course, but **the population remains hesitant.** Tourism revenue and travel person trips are up compared to 2022 but are still below pre-pandemic levels.

Re-shoring, deglobalization and new supply chains away from China are having a major impact in economic activity in **Mexico and India, but not China?** (White House [CHIP act](#) impact statement) When companies produce far less than normal, firms start cutting prices to induce sales. At a national level this is called an output gap and can cause **deflation** during a recession.

The [US State Department issued a level 3 warning to avoid travel to China](#). (Level 4 is the highest warning) "**Reconsider travel to China due to the arbitrary enforcement of local laws.**" Anecdotally CEOs and investors tell us they are **unwilling to travel to China** due to security fears. [Exit bans](#) are a policy tool increasingly used by the authorities to prevent people from leaving the country. [CEOs won't invest in a country they can't or are afraid to visit.](#)



## Q&A from the live Q&A feature

Ese E: For Mike: As a CIS major, I've integrated AI into various scholastic projects, including cultivating a professional email tone, conducting research, and creating paper outlines. How can I effectively showcase my AI proficiency on my resume?

Response: Not easy, I'd say your LinkedIn profile is the first step, and get some professors and experts to endorse your skills. Second, I'd fully expect you have a GitHub account that an employer can view.

Third, Have you attended AI conferences, include it. Have you presented anywhere ? Highlight that.

Fourth, CIS or AI isn't enough for an American, I can hire a cheaper person elsewhere in the world to write basic code or just have an AI do it. You have to HYPER-specialize. You better know 1 subject very deep example: Cyber security. You better have read a book on this subject and listen to a podcast on this subject.

Noah R: Do either of you see a reduction in college costs in the future?

Response: Yes see slide 34,

- 1) the cost to the average household is on the decline and its easier to get into college see slide 20,
- 2) the new tests are easier
- 3) Colleges will go out of business – already selling real estate

Issac B: As more and more AI is being pushed to the labor force, should we take note of Gartner's "hype cycle" or do you feel that some industries will innovate themselves out of a job?

Response: We should hope so! Elevator operators, AT&T switchboard operators, and most farm work are all gone.



## Q&A from the live Q&A feature

Fatimah M: Are increases in entrepreneurship and small business also reasons for decreases in the workforce? If so, what is being done to respectfully motivate the workforce?

Response: People are working that isn't the issue. Unemployment rate is TINY, and the labor force participation rate has fully recovered. The US whips people into the workforce, work or you don't have healthcare and people respond. Heck the US is unique – we don't take vacation. We work.

The problem is what kind of work, a lot of medium to large firm jobs which are safe (safer and have healthcare) and less jobs at small firms where risk taking happens. Less new ideas, less innovation.

I'd argue **we should not tie healthcare to employment**, that would give more incentive to starting your own company if you don't lose your healthcare.



# Q&A from the live Q&A feature

David C: For Mike: Do you view the animosity between the US and increasingly authoritarian East as a boon for American productive capacity, especially considering we've provided significant incentives for chip production?

Response: Yes, but it is expensive to have JIC just in case, rather than JIT just in time. However, for security and domestic employment having a second supply chain has been made a national priority and the US Government is the only person who can afford it, with Biden at least the government is footing the bill. Trump who knows...

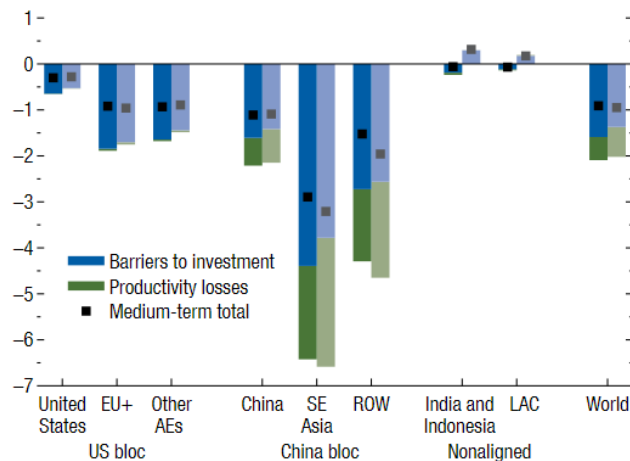
Some links to the [Chapter 4](#) GeoFracture study from the IMF

<https://www.elibrary.imf.org/display/book/9798400224119/CH004.xml>

<https://www.imf.org/-/media/Files/Publications/WEO/2023/April/English/ch4.ashx>

**Figure 4.14. Impact of Investment Flow Barriers on GDP**  
(Percent deviation from no-fragmentation scenario)

Fragmentation could lower global output by up to 2 percent.



Not as painful to the US

China the big loser

<https://www.imf.org/en/Blogs/Articles/2023/04/05/fragmenting-foreign-direct-investment-hits-emerging-economies-hardest>

**Figure 4.5. Foreign Direct Investment Reallocation across Regions, 2020:Q2–22:Q4 versus 2015:Q1–20:Q1**  
(Percentage point deviation from aggregate change)

The regional shift in foreign direct investment flows shows winners and losers.

| Source regions      | United States | Americas excl. US | Advanced Europe | Emerging Europe | Asia excl. China | China | Rest of the world |
|---------------------|---------------|-------------------|-----------------|-----------------|------------------|-------|-------------------|
| Rest of the world   | 26.4          | 7.1               | 5.3             | 11.4            | -3.7             | -24.7 | 18.6              |
| China               | -22.1         | -6.9              | -17.8           | -31.3           | -44.3            |       | -31.9             |
| Asia excl. China    | -3.2          | -8.7              | -11.7           | -2.4            | -23.7            | -49.2 | -4.4              |
| Emerging Europe     | 27.6          | 2.9               | 9.9             | 18.1            | -22.3            | 13.9  | -11.5             |
| Advanced Europe     | 7.5           | -11.7             | 9.3             | -0.9            | -9.8             | -19.7 | 8.6               |
| Americas excl. US   | 18.6          | 27.3              | 14.9            | 34.0            | 5.9              | -13.3 | 27.6              |
| United States       |               | 9.2               | 0.6             | 19.4            | 2.3              | -40.6 | 21.6              |
| Destination regions |               |                   |                 |                 |                  |       |                   |



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# Appendix

