

Economic Growth--Too Slow or Too Fast? Measuring the Value of Intangibles and AI

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Artificial intelligence and the next generation of competences :
How Digital – and Artificial Intelligence will impact jobs and competences profiles?

The World Conference on Intellectual Capital for Communities

UNESCO, 11 & 12 July 2019



Intellectual Capital
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Economy

Disclaimer

- These are my opinions and not those of the Federal Reserve Bank of Philadelphia or the Federal Reserve System

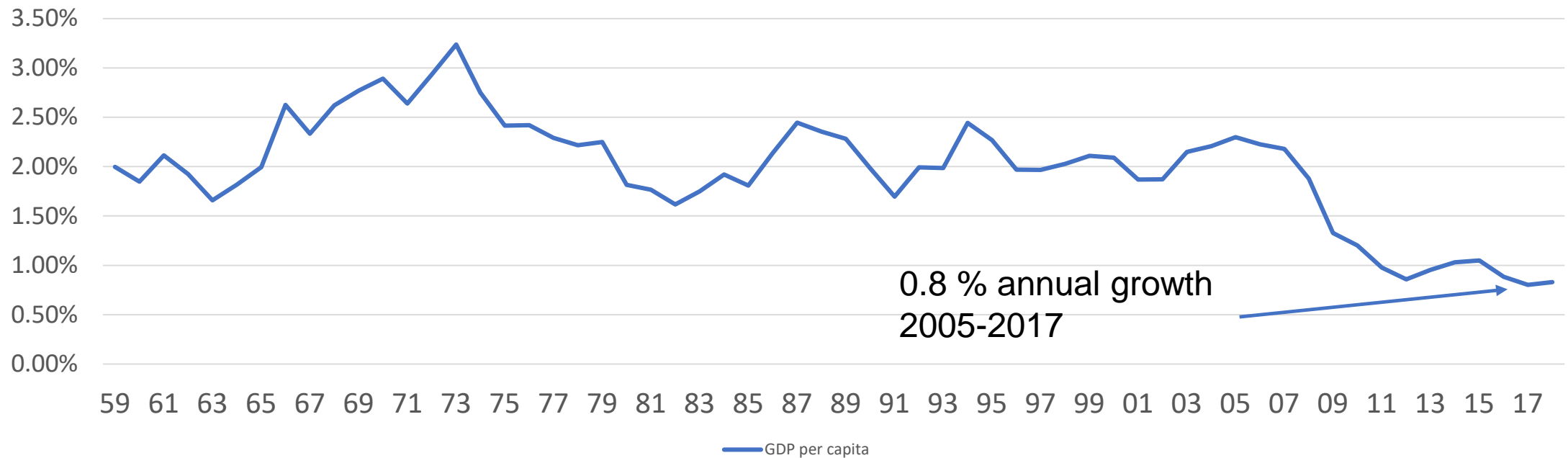
What Are the Benefits of AI?

- In this conference we will be discussing:
 - Can communities to keep up with the rapid pace of progress of the global economy?
- But what are we gaining from AI?
- Our national account statistics show that real growth per person is slow, not fast!
 - I argue we are mismeasuring digital activities
- Our statistics don't understand the digital age
- I will discuss US data, but this problem is endemic



GDP per capita in the US from 2005 to 2017 Slowest in the Post-war Period by far

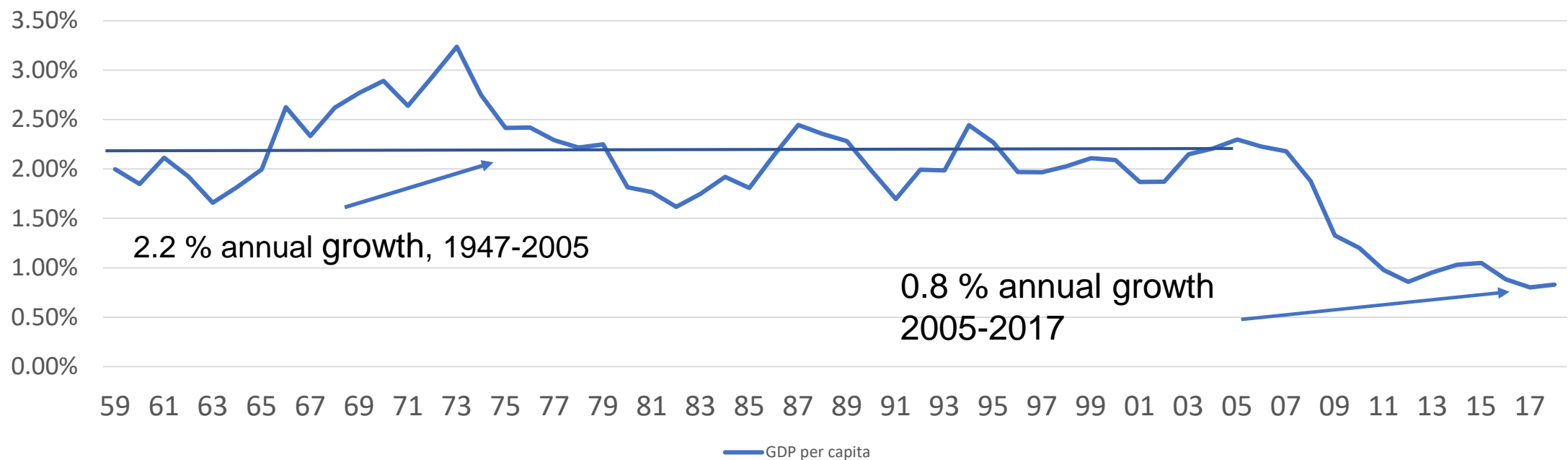
US GDP Growth per Person 12 year moving average, 1947 to 2018





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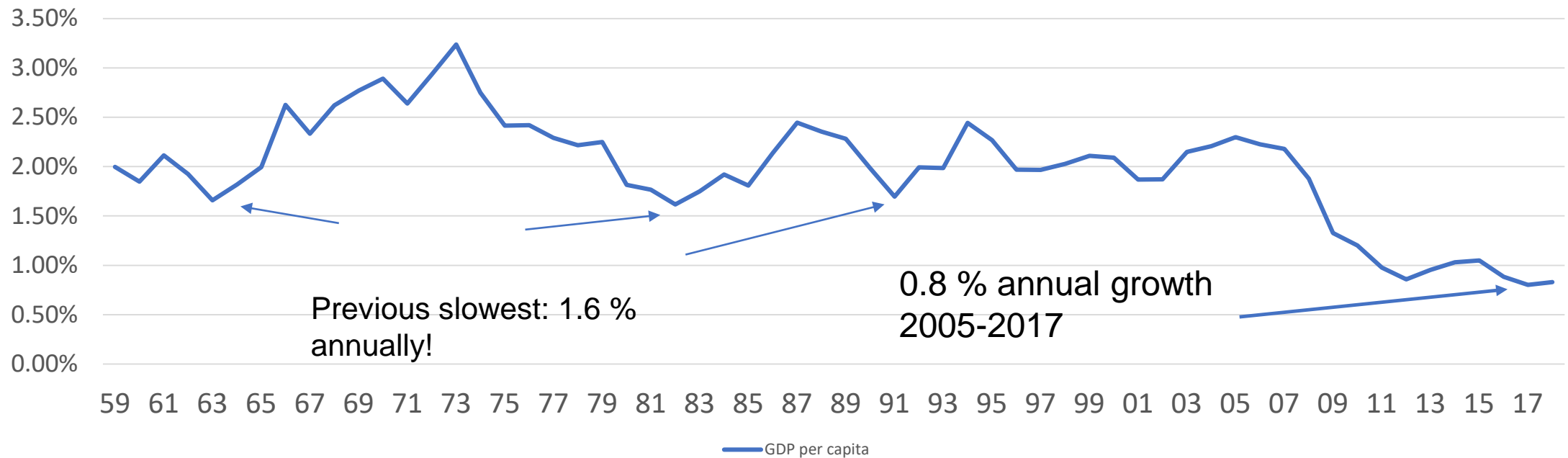
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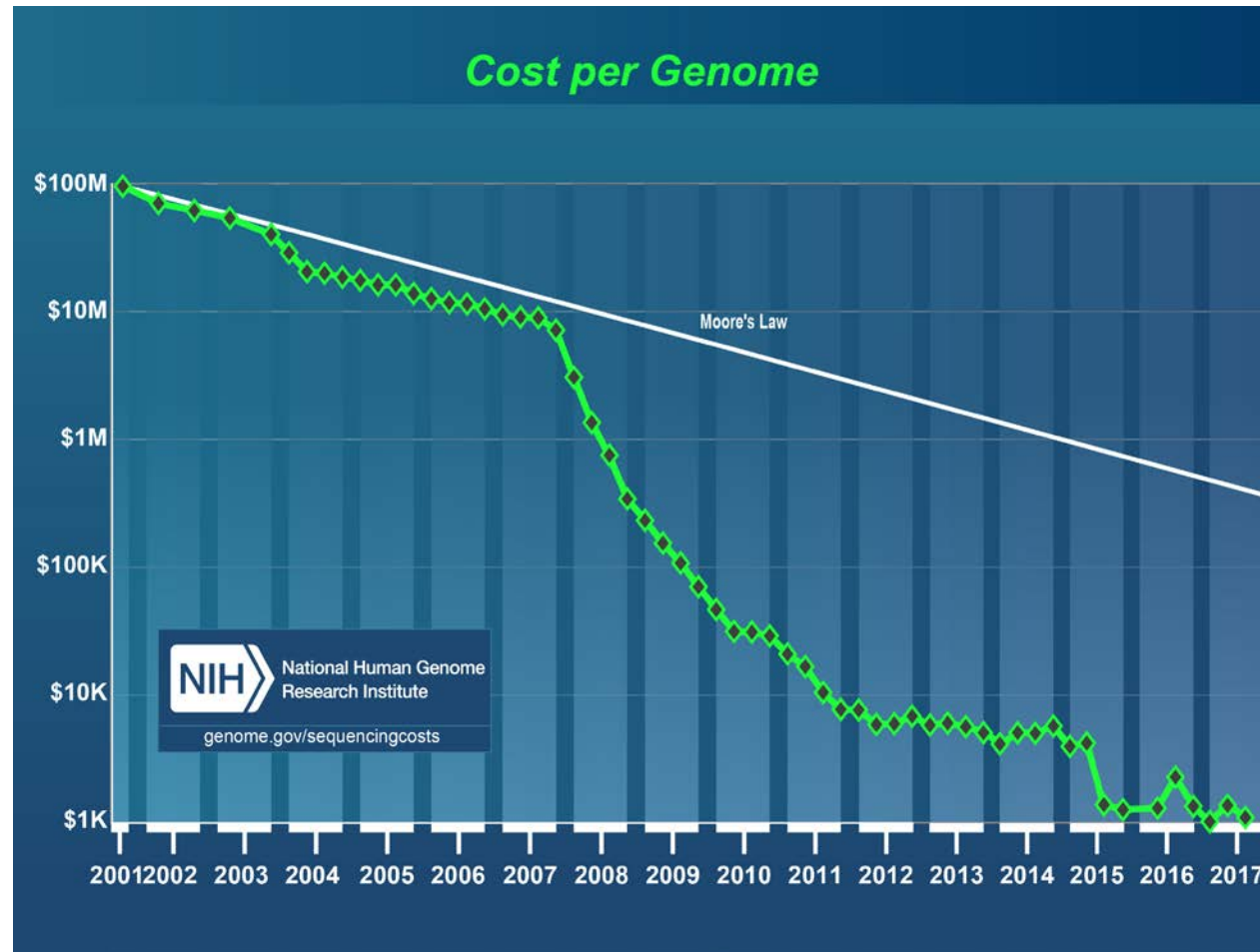
A dramatically dynamic economy! (SpaceX launches 60 satellites. May 24, 2019)





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Genome sequencing costs drop far faster than Moore's Law



What is happening? Since 2005 these innovations have been introduced by the Big Four Internet firms

- **Apple**
 - iPhone (2007), iPhone Apps (2008), iPad (2010), Siri (2011)
 - 2 billion iPhones and Androids world wide 2018, 2-3 hours daily use
- **Google**
 - Google maps (2005), Android (2008), Waymo (2009), Deepmind (2010)
- **Amazon**
 - Amazon Prime (2005), AWS (2006), Kindle (2007), Alexa (2012)
- **Facebook**
 - Open to all (2006), WhatsApp (2009), Snapchat(2011)
 - 1.5 billion daily active users each on Facebook and Whatsapp!



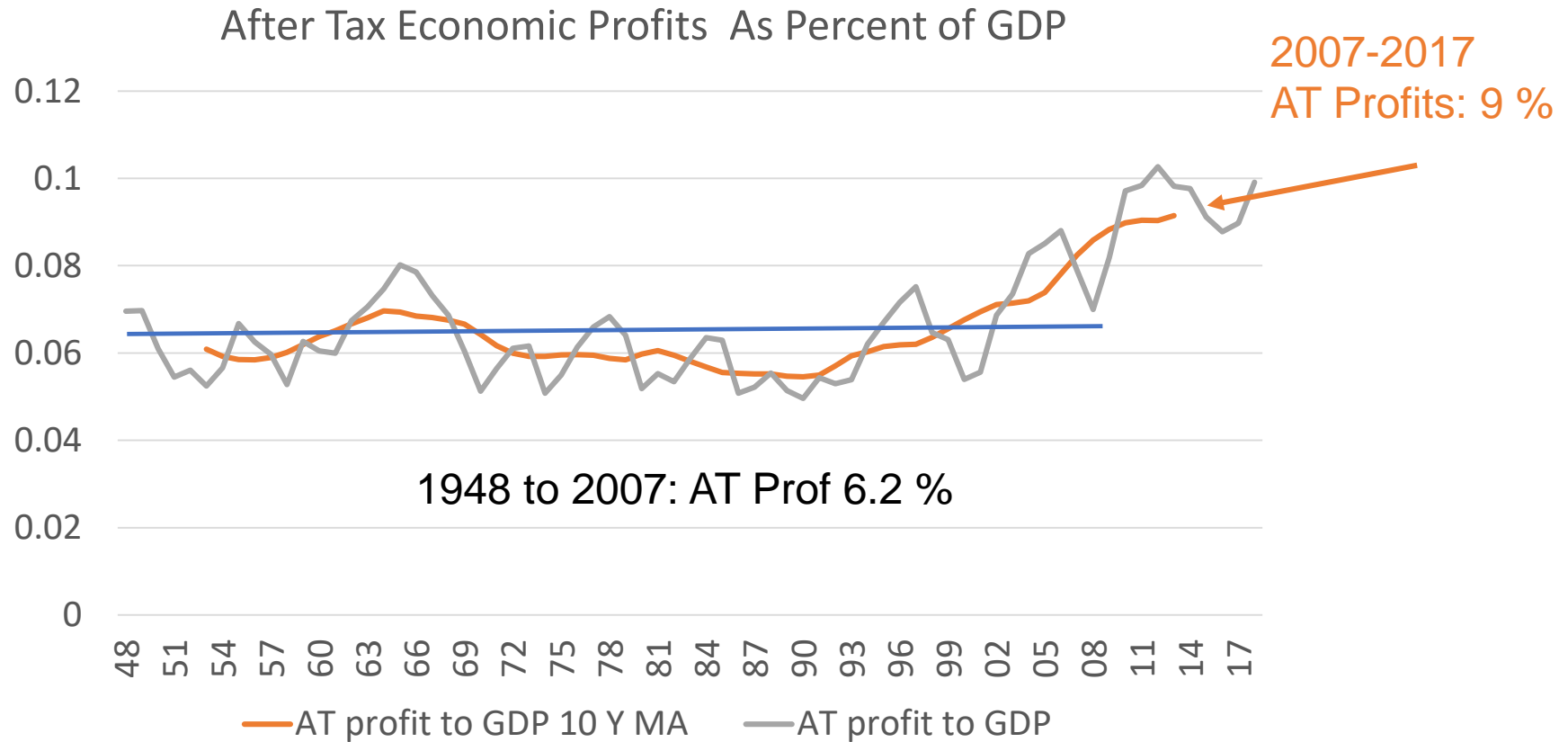
And others:

- Tesla first model (2008), SpaceX first launch (2008)
- Entertainment and social: Reddit, Youtube and Apple podcasts: (2005), Twitter (2006), Netflix streaming (2007)
- Travel: Airbnb (2008), Uber (2011), Lyft (2012)
- DNA: Illumina begins 2nd generation genome sequencing and 23andMe and Ancestry begin spit DNA tests in 2007
 - 20 million human genomes partially decoded in US alone
 - 1 million genomes fully sequenced world wide

Driven by hyperincentives

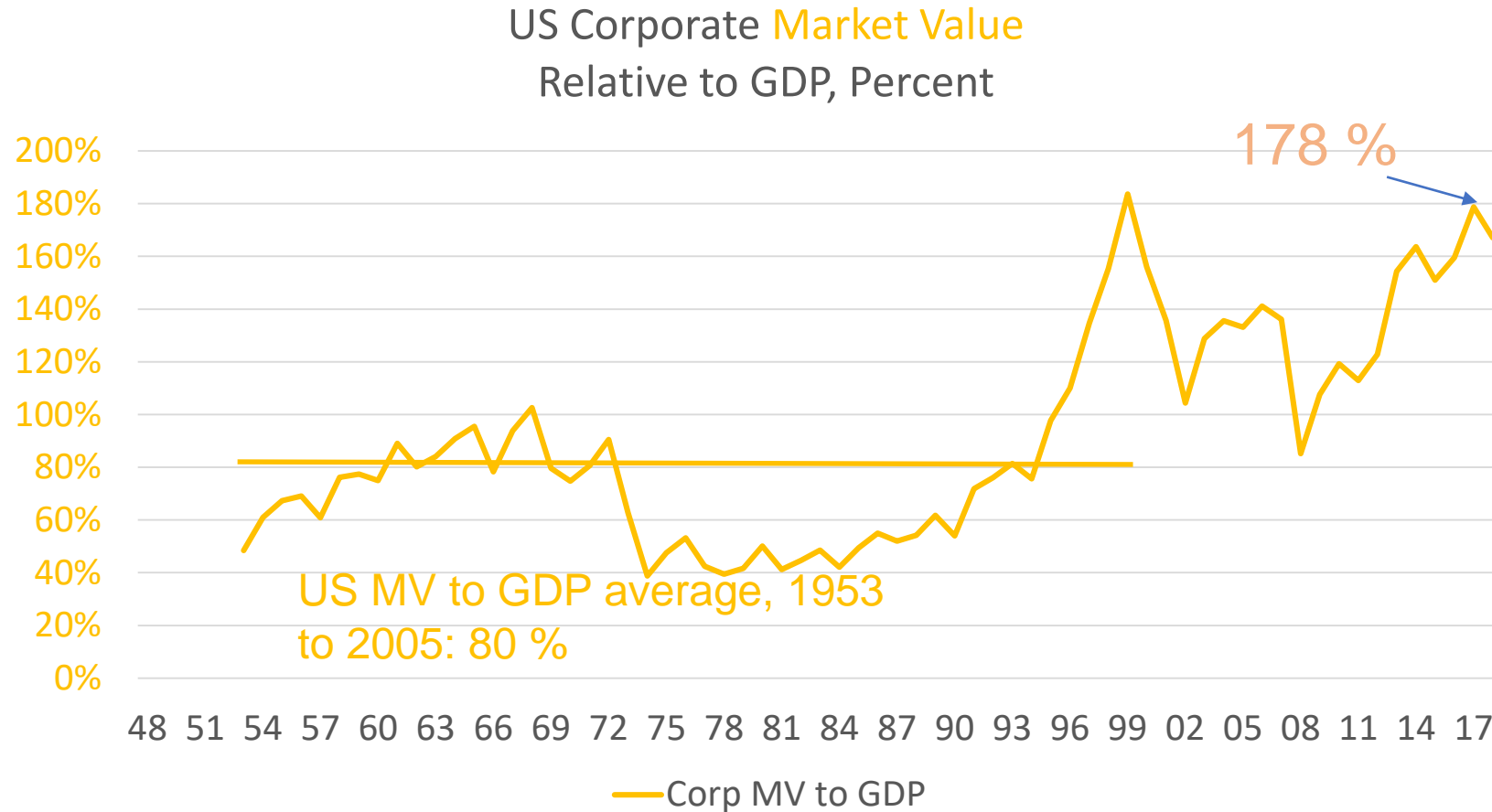
- Huge Global Markets
- Platforms and intellectual property create monopoly profits
 - Multiplied by globalization
 - 2 billion smartphones world wide, all reached with a click!
- US corporations rewarded for innovation with immense profits and even larger market values
 - Apple, Amazon, Google, Facebook: \$3.2 trillion market cap, 2017
 - 2005 market cap: \$200 billion

After-tax US Economic Profits have Soared in 2007-2017 to nearly 50% above previous 60 years



US Market Caps Have Soared Relative to GDP

2017: 100 percent higher than 1953 to 2005 average



Where Do These Soaring Corporate Profits and Market Values Come From? Intangibles

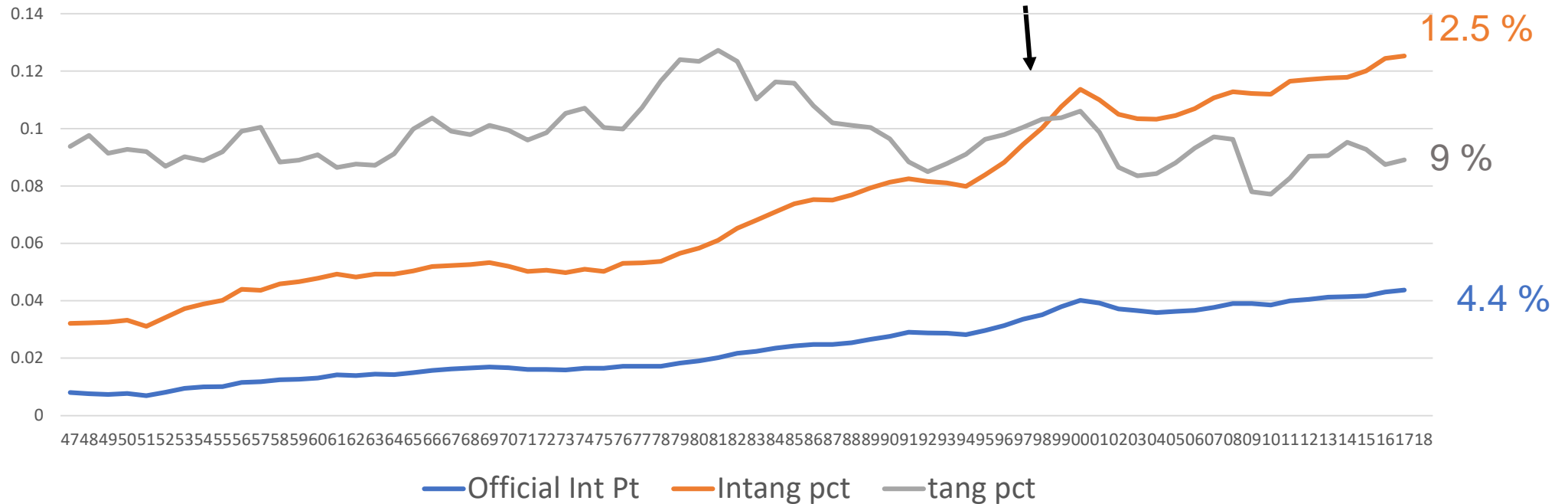
- Intangible investment, which creates intellectual property, in the US is over \$2 trillion annually -- \$23 trillion from 2006 to 2017
 - These are investments in creating improved quality of life: innovative products, knowledge and entertainment
- It substantially exceeds business investment in tangible capital
- Quantity is less important: we have too much food, too much clothes
 - Quality is now what matters—and improvements in quality arise from investment in new products, that is, intangible investment
- My measure of intangibles includes marketing and puts higher weight on R&D and software than in standard accounts

High Profitability is fueled by Intangible Investment and Globalization

US Tangibles, official Intangibles, and all intangibles

As Percent of GDP

Crossing point: 1999



Why are market values even higher than profits?

- Intangibles lower profits in the short run relative to true profitability
 - R&D, software, and marketing expenses grow faster than profitability
- URL: Ubiquity now, Revenues Later
 - Many innovative firms prioritize growth over profitability
 - Amazon, Uber, Tesla, etc.
- Also, these firms drive down the profits of existing firms such as Walmart

An explosion of knowledge and creativity and access: but we don't know how to measure it

- The mobile internet provides us with 24/7 access to the latest entertainment and news
 - We don't know how to measure the value of what we get for free
 - Producing science, technology, entertainment and news has become much, much cheaper
- Education and medicine are increasingly important in all our lives
 - But we don't know how to measure the value of the knowledge of doctors and professors
 - We don't know how to value access to Khan Academy and MOOCs
- Information typically travels without a transaction to evaluate

How Can we Have Fast Change and slow GDP growth?

- New Business Models and Fast Quality Change
- Free Products: Google and Facebook, Youtube
 - Zero prices incompatible with inflation measures
 - Free products replace tangible merchandise such as CDs and film
- Unmeasured quality change: Amazon, Telecom,
 - Low costs translate into lower output, not lower inflation
- Outsourcing: Apple
 - Apple looks like an importing wholesaler in economic statistics
- Better information without IP: Wikipedia, opensource,
 - Wikipedia provides lots of information, edited by volunteers
 - Opensource software speeds much economic activity without IP

How have our standards of living been changed by all these new products?

- Not easy to quantify!
 - It is very hard to answer the question: how much better off do all these changes make us?
 - Economist efforts to value the Internet:
 - Surveys: Brynjolfsson et al ask respondents value of Internet to them
 - Median answer: \$5000 a year per person
 - Facebook alone: \$200 a year
 - Evaluate with time use: value is 3% of full income (Goolsbee-Klenow)
 - \$2000 per year per year
 - Evaluate with cost: Nakamura et al, \$400 per year per person

Mismeasurement in US is reflected in mismeasurement worldwide

- Real GDP and real productivity growth do not reflect benefits of global innovation
- Imports of rising quality products (smart phones and tablets) result in improved consumer well-being
 - Example: Ethiopia trades coffee beans to South Korea in exchange for smartphones
 - If the technology for coffee beans doesn't improve, Ethiopian households have rising standards of living because of technology gains in smartphones
 - But this doesn't show up in GDP, because imports are excluded from domestic product, and it doesn't show up in productivity measures

How big might mistakes be?

- We do not know but
 - If our economies did not really slow down, then US real GDP growth is 2 % faster and inflation is 2 % lower
 - Likely similar impacts on other countries
 - US, EU and Asia are deflating
 - Historically low nominal interest rates may have close to normal real rates

What is AI doing for us?

- Possibly adding 2 % to annual rates of growth!
- Possibly driving deflation
- How do we get better answers?
- Survey users of the Internet
 - How much time does access to the Internet save you?
 - How valuable is the information you get from the Internet?
 - What would you have to be paid to give up access to the Internet?
 - Brynjolfsson et al (2019, PNAS) over \$5000 per user

This is very much work in progress

- Some of the best economists and statisticians in the world are working on these issues
 - But these are very difficult problems to solve
 - More money needs to be devoted to statistics!
 - We are in a very new economy!
- Thank you for your attention!