

# How should we measure the digital economy?

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# How Are We Doing?

Q SEARCH

The New York Times

## ECONOMY

## *U.S. Economy Grew at 3.2% Rate in 3rd Quarter*

By THE ASSOCIATED PRESS NOV. 29, 2016

The United States economy in the third quarter grew at the fastest pace in two years, according to a revised report that showed stronger consumer spending than first estimated.

Sections

The Washington Post  
*Democracy Dies in Darkness*

Wonkblog

## U.S. economy grew at sluggish 0.7 percent in first quarter of 2017

By Ana Swanson and Max Ehrenfreund April 28

***“The welfare of a nation can scarcely be inferred from a measurement of national income as defined [by the GDP.]”***  
***- Simon Kuznets, 1934***

“...a measure for standard of living: average real gross domestic product (GDP) per capita” – Boston Fed

“Productivity is the most important determinant of the standard of living” – Forbes

**GDP is a measure of production, not well-being!**

# IT & GDP

Explosion of free digital goods



United States

Information industry as share of GDP, %



# Free digital goods substituting paid goods

Smartphones substituted

- Camera
- Alarm Clock
- Music Player
- Calculator
- Computer
- Land Line
- Game Machine
- Movie Player
- Recording Device
- Video Camera

Plus:

- Data plan
- GPS Map and directions
- Web Browser
- E-book reader
- Fitness monitor
- Instant messaging





### \$1.2 million worth of applications in a smartphone today (2018 update)

Application	\$ 2018	Original Device Name	Year*	MSRP	\$ 2018
1 Video conferencing	Free	Compression Labs VC	1982	\$250,000	\$639,039
2 GPS	Free	TI 4100 NAVSTAR	1982	\$119,900	\$509,186
3 Digital voice recorder	Free	Sony PCM	1978	\$2,500	\$9,458
4 Digital watch	Free	Seiko 35SQ Astron	1969	\$1,250	\$8,402
5 10 MP camera	Free	Canon EOS-1Ds	2002	\$7,999	\$10,968
6 Scanner	Free	HP ScanJet Plus	1989	\$1,595	\$3,173
7 Video player	Free	Toshiba V-8000	1981	\$1,245	\$3,378
8 Video camera	Free	RCA CC010	1981	\$1,050	\$2,849
9 Music player	Free	Sony CDP-101 CD player	1982	\$900	\$2,301
10 Encyclopedia	Free	Compton's CD Encyclopedia	1989	\$750	\$1,492
11 Videogame console	Free	Atari 2600	1977	\$199	\$810
<b>Total</b>					<b>\$1,191,056</b>

\* Year of launch

rk

ref: @raykwong

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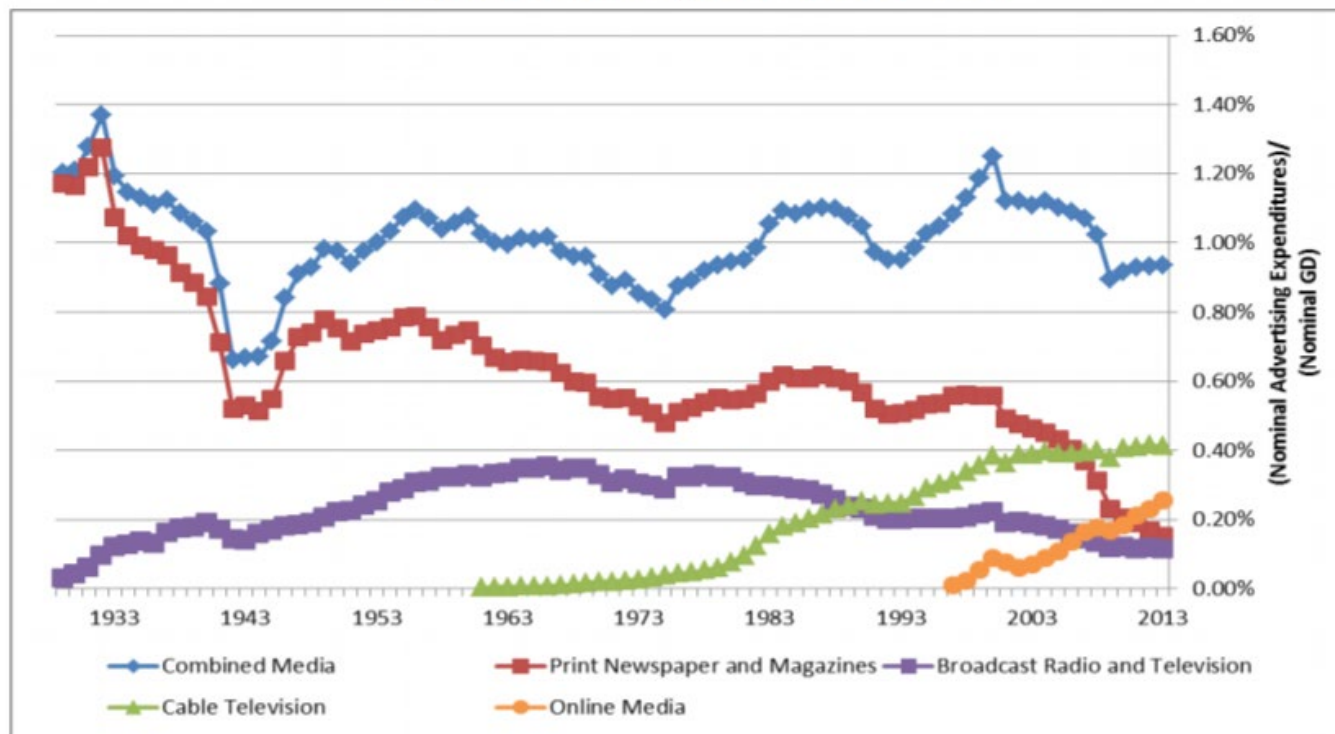
Brussels, 10-11 November 2022

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# Some of these goods have ads

Advertising revenues are generally not proportional to consumer surplus and may reflect only a small share of it. (Spence and Owen 1977)

Figure 4: Advertising Revenues Over Time



Ref: Nakamura, Samuels and Soloviechik (2017)

# Our Approach

- Estimate Consumer Welfare Directly
- Key techniques: Online Choice Experiments and Lotteries
  1. Single Binary Discrete Choice Experiments
  2. Becker-DeGroot-Marschak Lotteries
  3. Best-Worst Scaling
- Both with and without incentive compatibility

# Single Binary Discrete Choice (SBDC) Experiments

Ask consumers to make a single choice among two options:

- ☐ Keeping the good
  - ☐ Give up the good and receive \$W in return
- Prices \$W systematically varied between consumers
  - Seek to reduce error by increasing quantity of responses
    - Aggregation of data leads to demand curves
    - Can be done with or without incentive compatible design

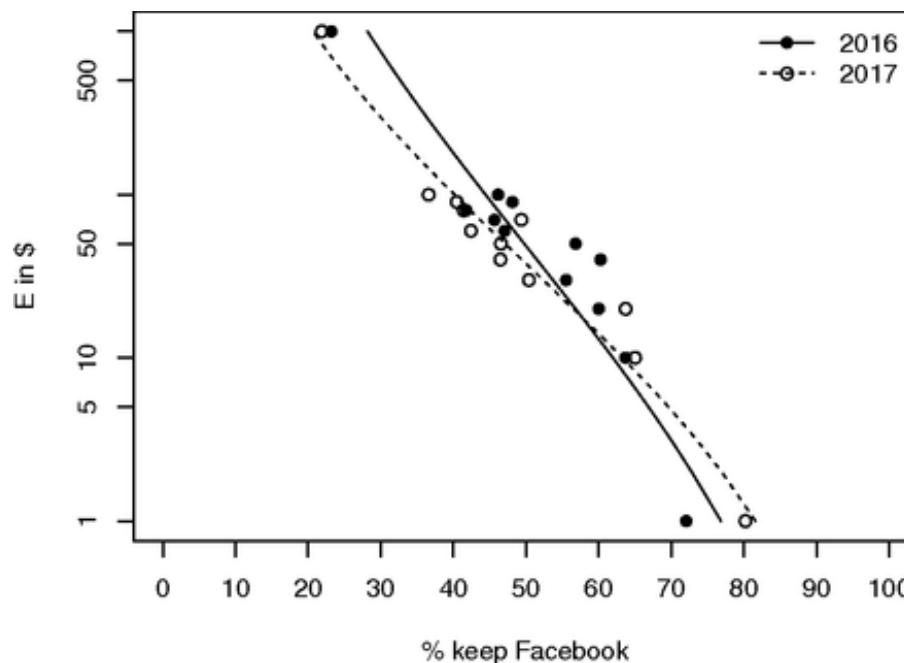
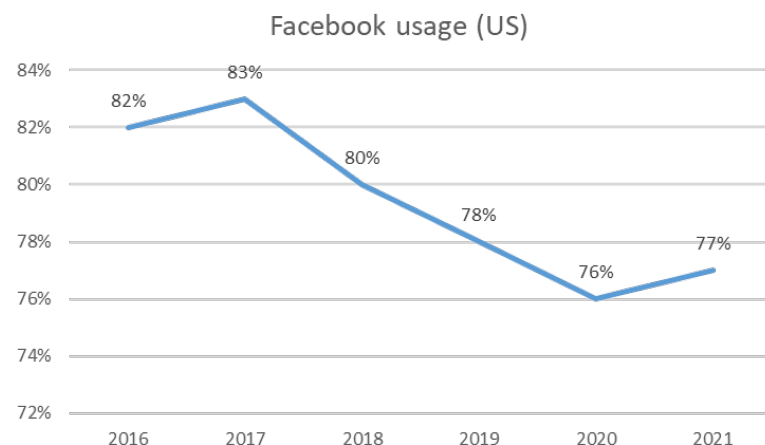
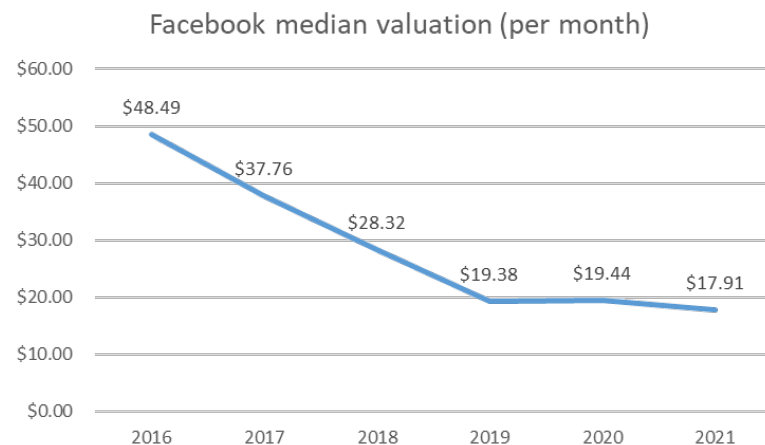
Using Massive Online Choice Experiments to Measure Changes in Well-being (Avinash Collis, Erik Brynjolfsson & Felix Eggers), *PNAS* 2019



# Estimating welfare gains from Facebook

- SBDC experiments on a representative sample of US internet population
- Enforcing incentive compatibility:
  - Randomly pick some respondents and fulfill their selection
    - If user chose to keep Facebook, do nothing
    - If user chose to give up Facebook, then
      1. Ask them to give it up for 1 month
      2. After 1 month, verify whether they have used Facebook in the past month and reward them with \$W

# Estimating welfare gains from Facebook (2016-21)



## Heterogeneity in valuation

Higher valuations for people with

- More time spent on Facebook
- More friends they have
- More frequent posting
- More videos watched
- Female
- Older
- Less use of Instagram or Youtube

# Accounting for the benefits from digitization

- Two features of the Digital Economy:
  1. Free goods
    - E.g. Facebook, Wikipedia
  2. New goods
    - E.g. Smartphones
- Welfare gains/ benefits from free goods and new goods are poorly captured in GDP
- We introduce a new metric, we call “GDP-B” to account for the benefits of free goods and new goods

GDP-B: Accounting for the Value of New and Free Goods in the Digital Economy  
Avinash Collis, Erik Brynjolfsson, Erwin Diewert, Felix Eggers & Kevin Fox, 2022

# Facebook's contribution to GDP-B

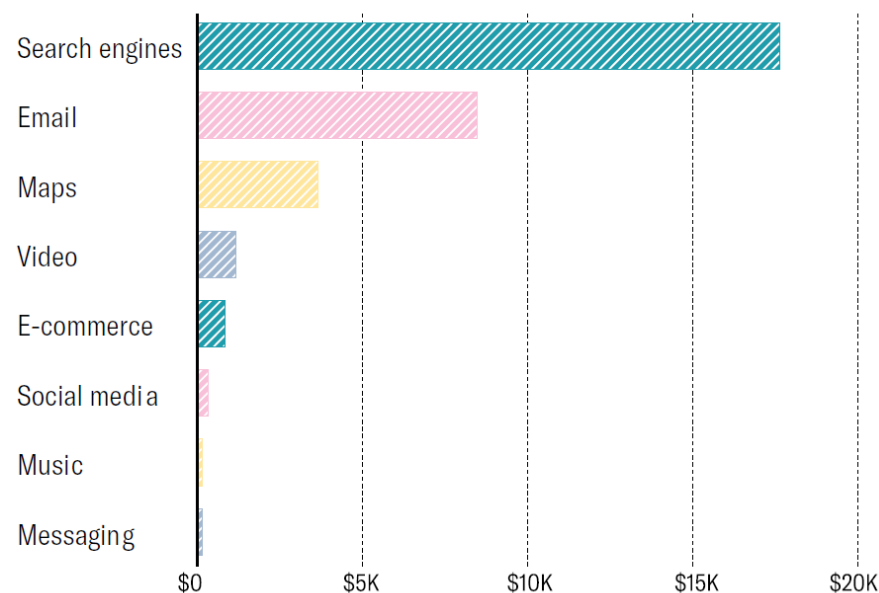
	GDP-B growth
Percentage Points, 2003-2017	0.68
Per year	0.05
GDP-B Growth per year without Facebook (i.e. GDP growth)	1.83
GDP-B Growth per year with Facebook	1.87



# Most popular categories of digital goods

## Consumer Surplus Effect by Digital Category

Consumers value some digital categories more than others. Search engines, email, and maps, for example, have no comparable off-line substitutes, propelling them to the top of the list.



# Other popular digital goods in Europe

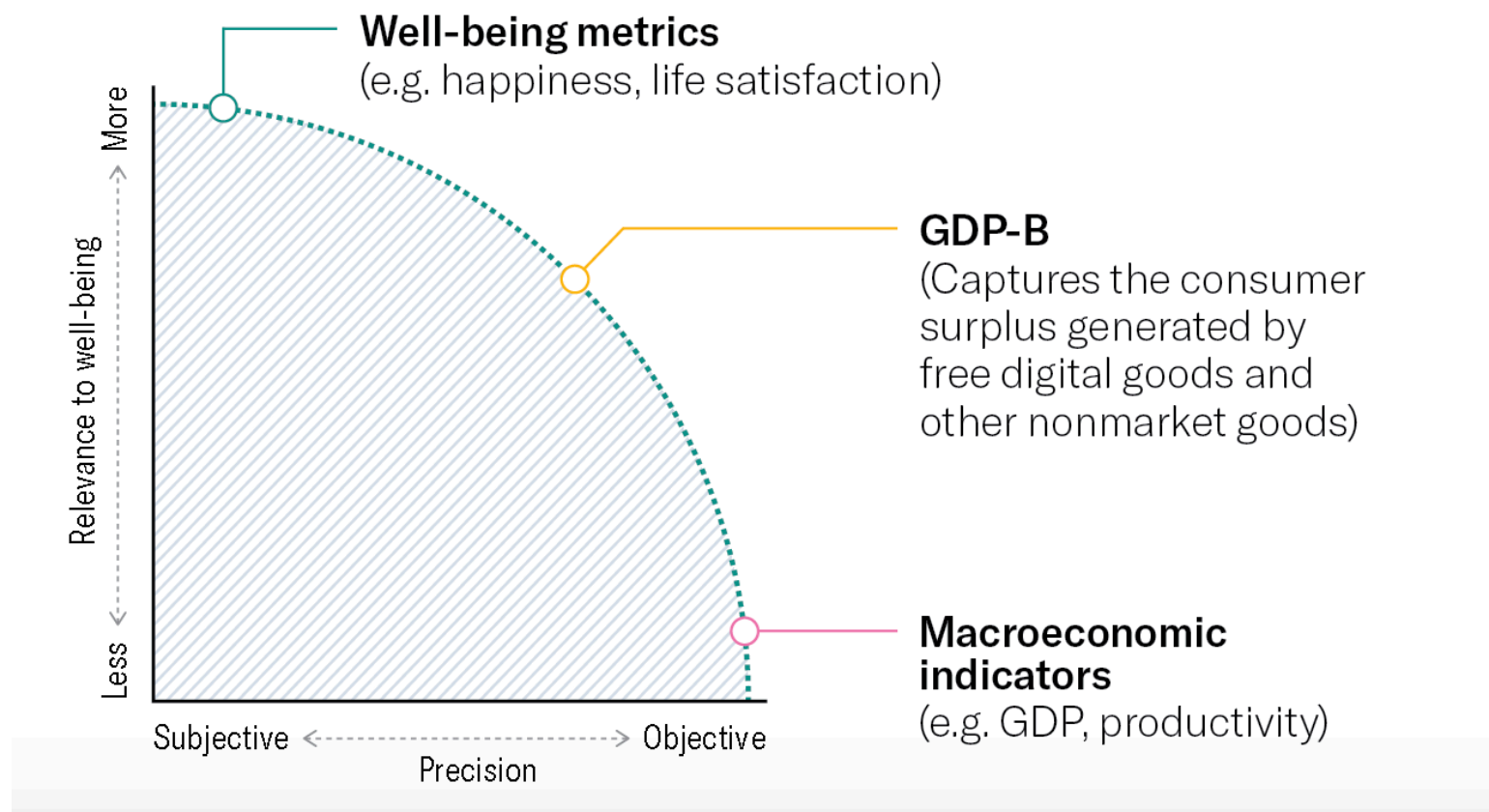
Service	Median WTA/ month
WhatsApp	€535.73
Facebook	€96.80
Maps	€59.16
Instagram	€6.79
Snapchat	€2.17
LinkedIn	€1.52
Skype	€0.18
Twitter	€0.00

## Interviews:

*“Whatapp is the only communication tool I use to contact my friends here. Without it, I can do nothing.”*

*“WhatsApp is crucial. I use the app every hour of the day to keep in touch with friends and family but also to discuss group projects or things about my work. I really need to keep access to this app. There is also not a very suitable alternative.”*

# A dashboard of metrics instead of 1 single number



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Ref. How should we measure the digital economy?, Avinash Collis & Erik Brynjolfsson, *Harvard Business Review*, Nov-Dec 2019

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# Next Steps

- Expanding the data collection to include a bigger basket of goods (digital goods, representative goods from the CPI basket, other non market goods)
- Partnerships with major online platforms to conduct large scale choice experiments
- Partnerships with Statistical Agencies to scale up data collection



# Conclusion

1. GDP, developed in 1930s, remains the de facto metric of economic growth.
2. Conceptually, consumer surplus is a better metric of economic well-being.
3. Massive online choice experiments have the potential to reinvent and significantly supplement the measurement of economic welfare.
4. GDP-B captures the economic welfare gains from new and free digital goods
5. We need a dashboard of metrics (subjective well-being, GDP-B, GDP) to inform decision making by policymakers and managers

# THANK YOU!



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