

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

“...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!

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

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



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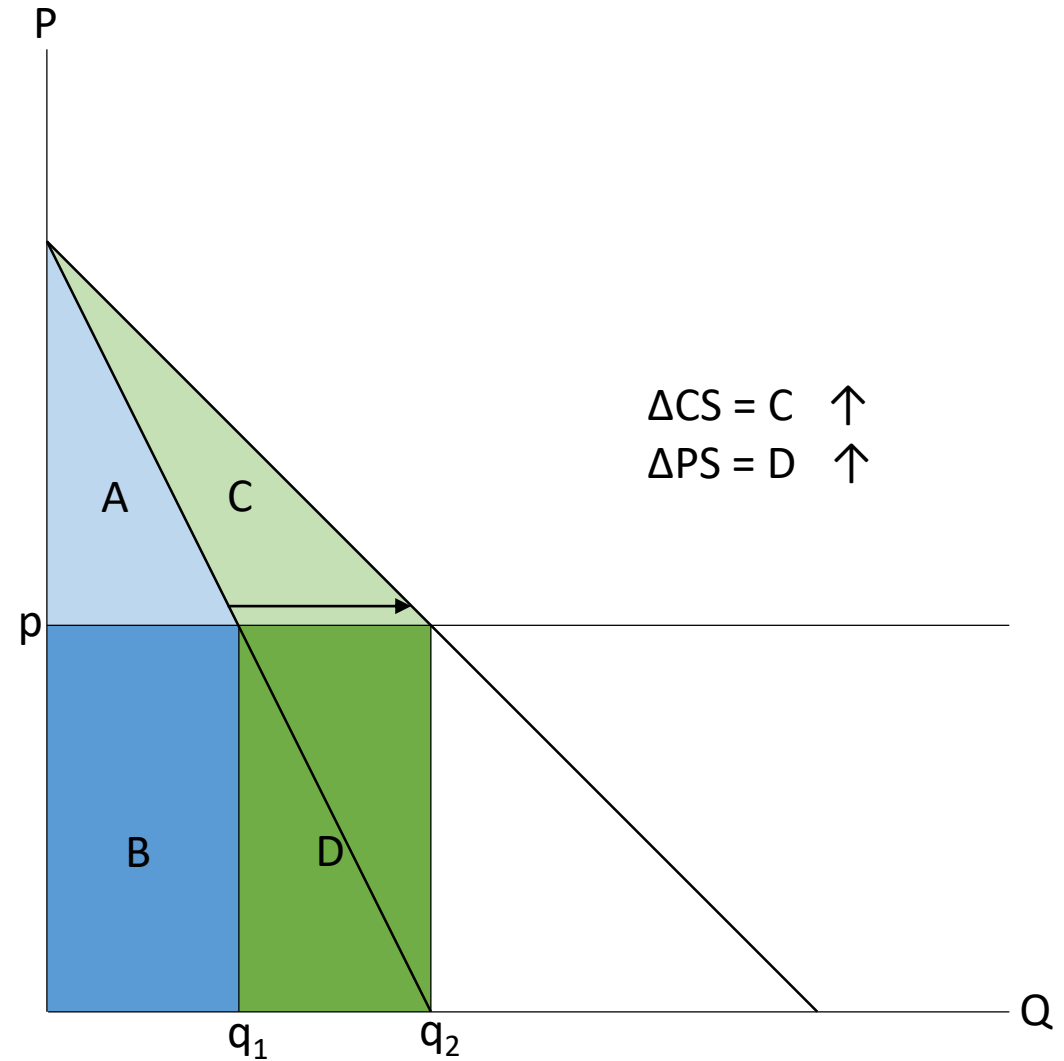
GDP vs. Consumer Welfare

Δ Production vs. Δ Consumer Surplus

Case 1: Classic Goods

E.g. Automobiles, haircuts, food

GDP \uparrow , Consumer Surplus \uparrow

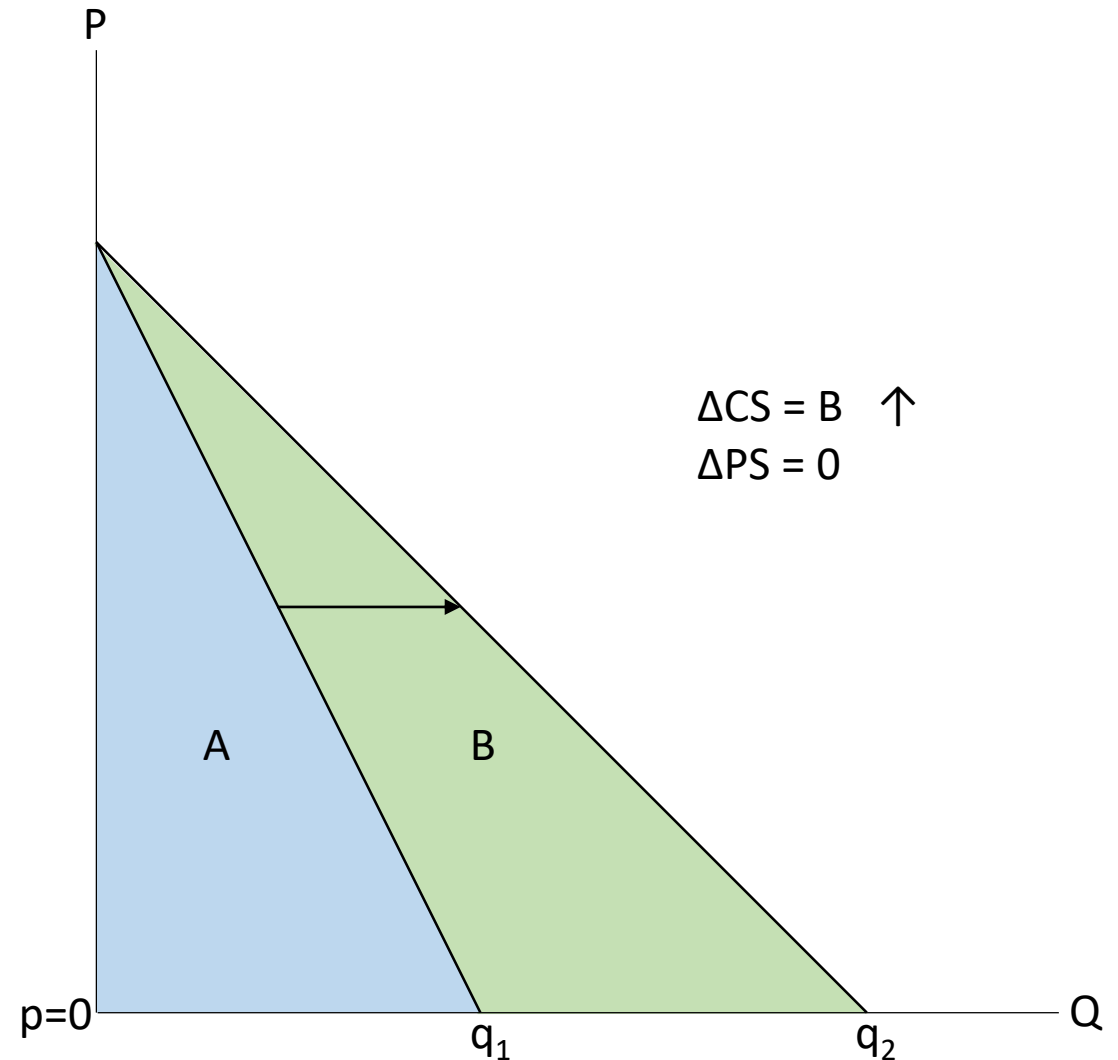


Δ Production vs. Δ Consumer Surplus

Case 2: Digital Goods

E.g. Increased use of free maps on smart phones or more digital photos;
Special case: Free digital apps that never existed before

GDP no change,
Consumer Surplus \uparrow

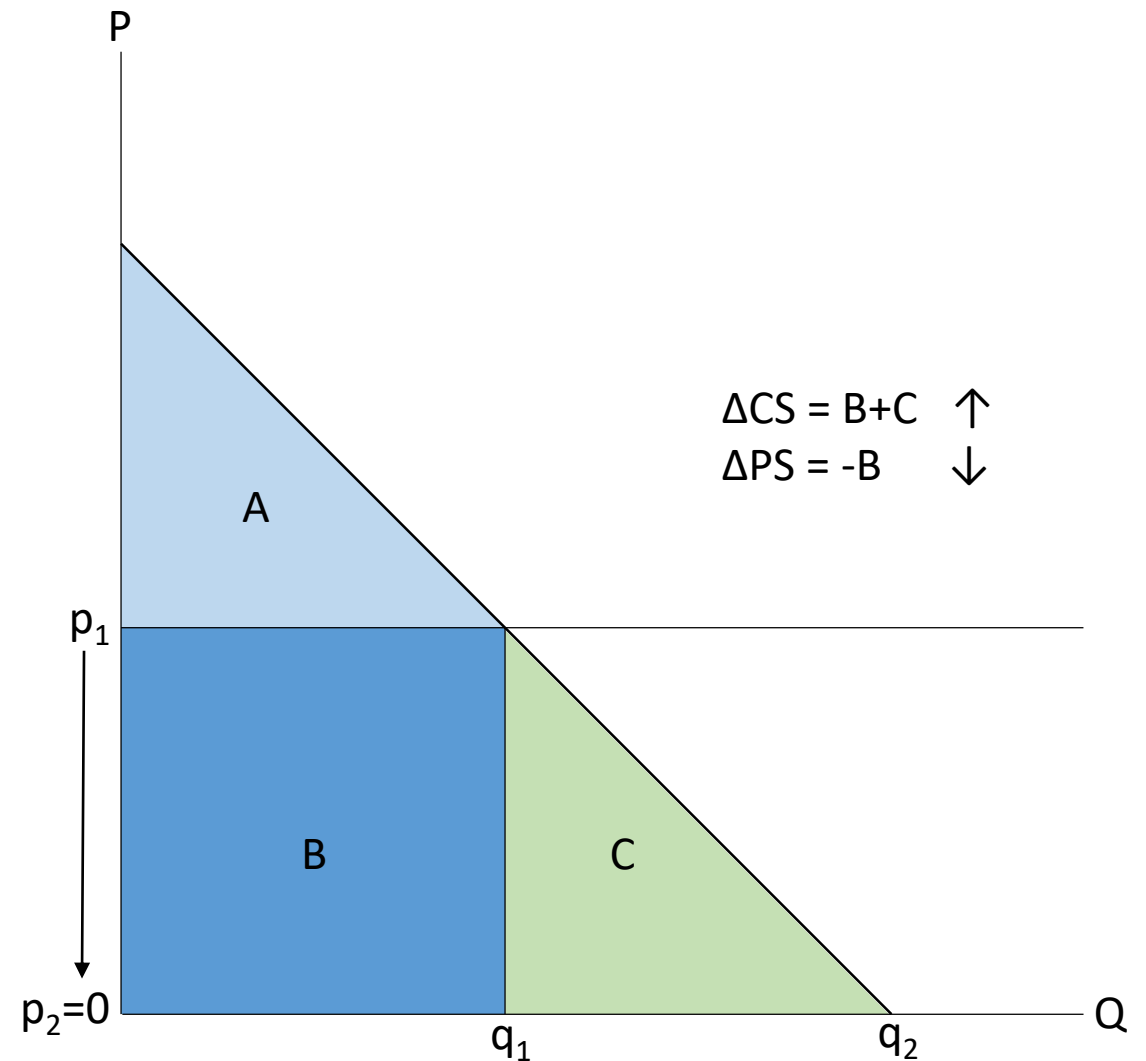


Δ Production vs. Δ Consumer Surplus

Case 3: Transition Goods

E.g. Encyclopedia
(Wikipedia vs. Britannica)
Chemical photography to digital
photography

GDP \downarrow , Consumer Surplus \uparrow

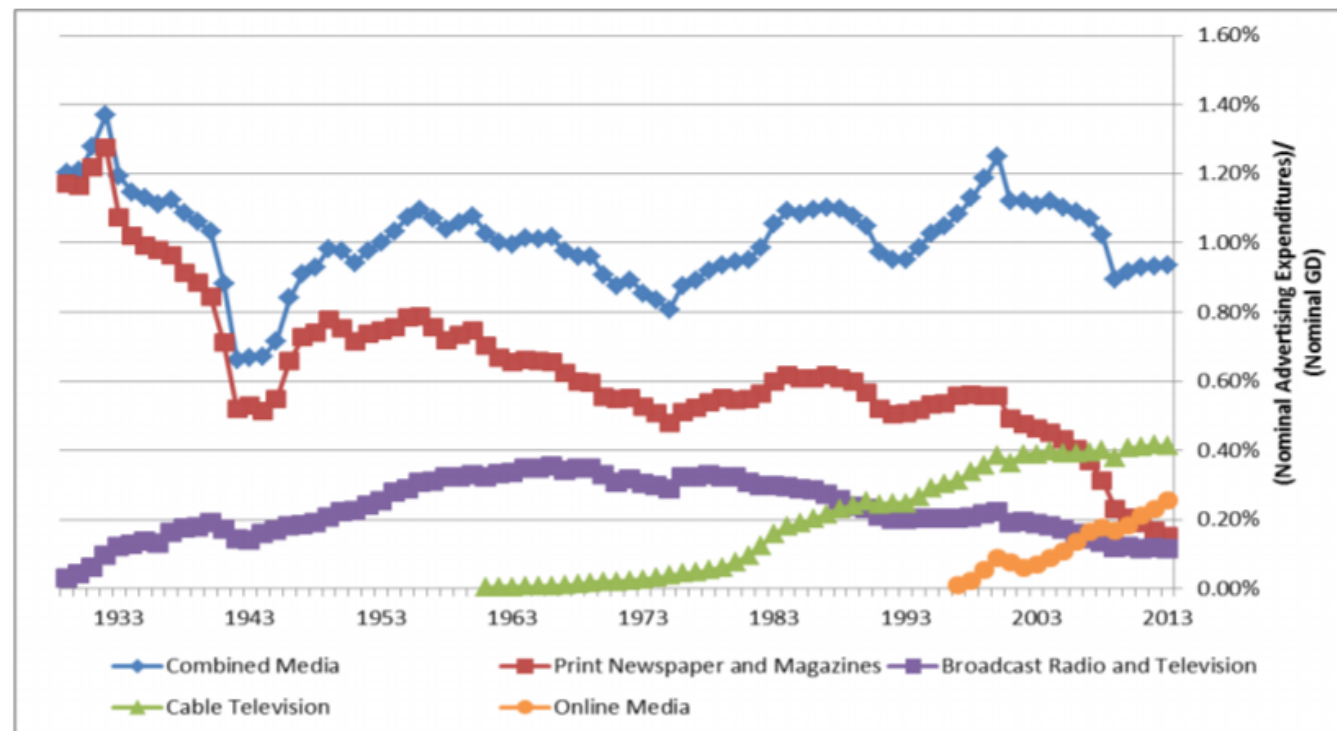


Some of these goods have ads

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
- At Massive scale

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

Estimating welfare gains from Facebook

- SBDC experiments on a representative sample of US internet population (n= 13,321)
- 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
 3. This can be done remotely: Facebook reports when user was last online
 - Random application to 1 in 200 users suffices for Incentive compatibility

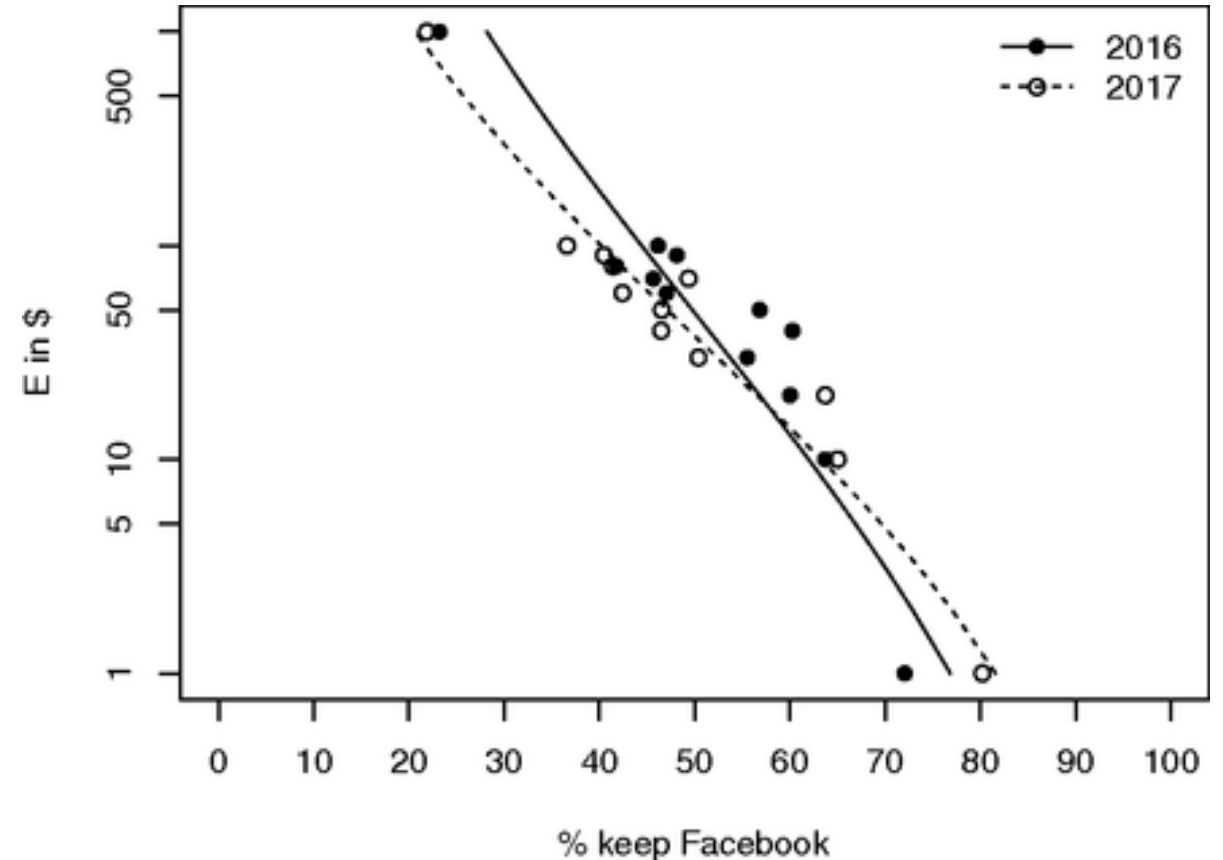
Estimating welfare gains from Facebook

Year	Median WTA/ month [95% CI]
2016	\$48.49 [\$32.20, \$72.93]
2017	\$37.76 [\$27.89, \$51.29]
2018	\$28.32 [\$20.81, \$38.38]
2019	\$19.38 [\$11.08, \$32.96]

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



Similar results in replications by Sunstein (2019) and Allcott et al. (2019)

Other popular digital goods

Facebook, Instagram, Snapchat, Skype, WhatsApp, LinkedIn, Twitter, mobile Maps

- $N \sim 600$ in a European country
 - 1/50 chance to get selected

Other popular digital goods

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

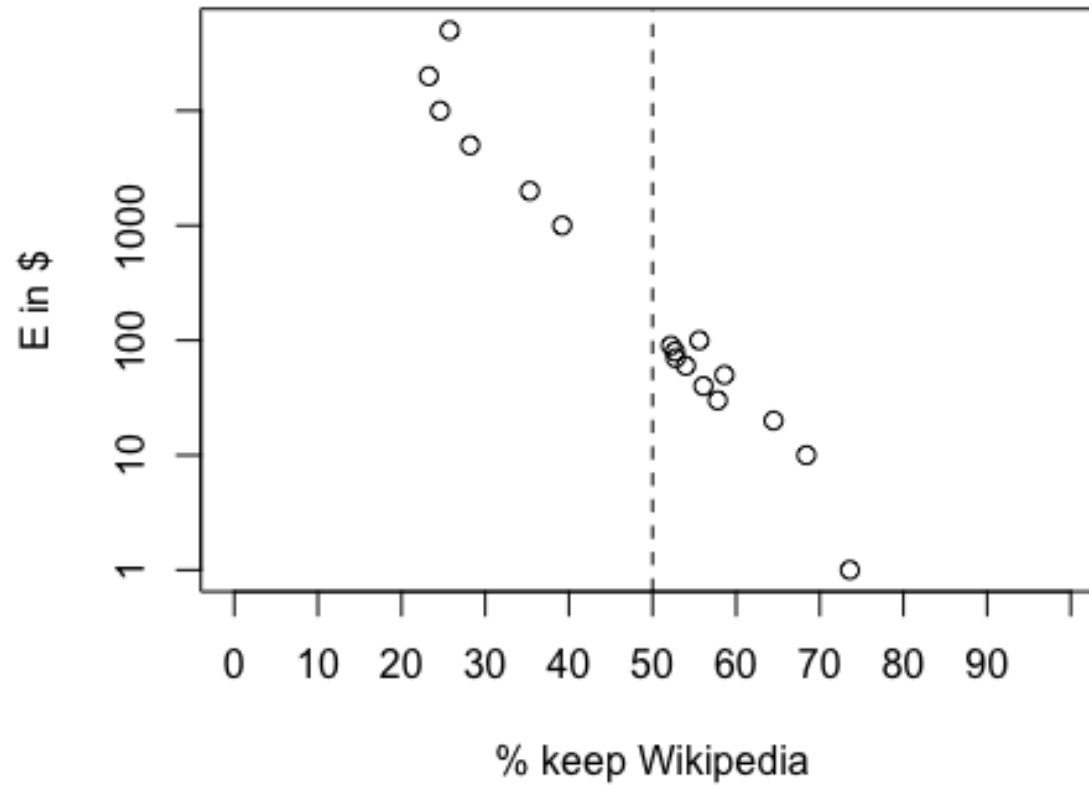
Interviews:

“WhatsApp 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.”

Wikipedia

$WTA_{\text{median}} = \$150/\text{year}$

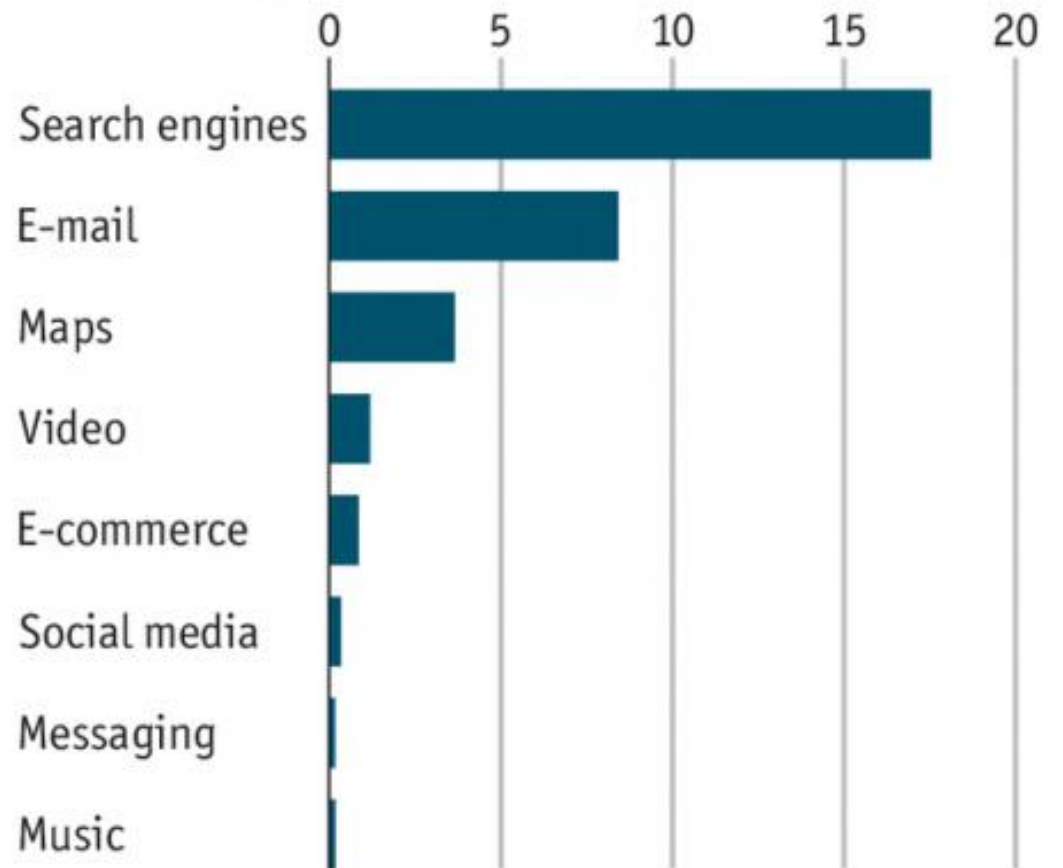


Most popular categories of digital goods

Google surveys (n = 200,000)

Category	Median WTA/year 2016	Median WTA/year 2017
All Search Engines	\$14,760	\$17,530
All Email	\$6,139	\$8,414
All Maps	\$2,693	\$3,648
All Video	\$991	\$1,173
All E-Commerce	\$634	\$842
All Social Media	\$205	\$322
All Messaging	\$135	\$155
All Music	\$140	\$168

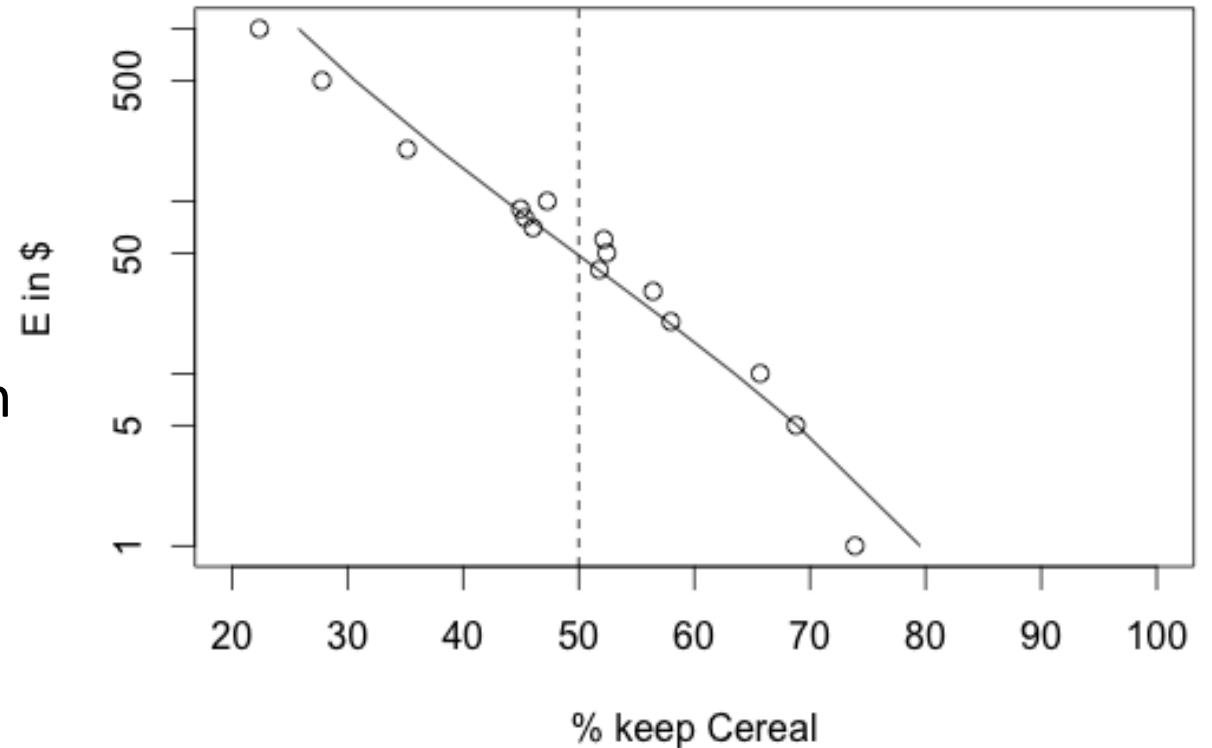
Median payment accepted to forgo use of internet service for a year, \$'000



Non-digital goods: Breakfast Cereal

$WTA_{\text{median}} = \$48.46/\text{year}$
[\$42.01, \$55.60]

Implied Consumer Surplus = \$15 billion
Compare: US Cereal Revenue = \$10 billion



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
 - Using reservation prices
 - Total income method

Ref- GDP-B: Accounting for the Value of New and Free Goods in the Digital Economy
(with Erik Brynjolfsson, Erwin Diewert, Felix Eggers & Kevin Fox), 2019

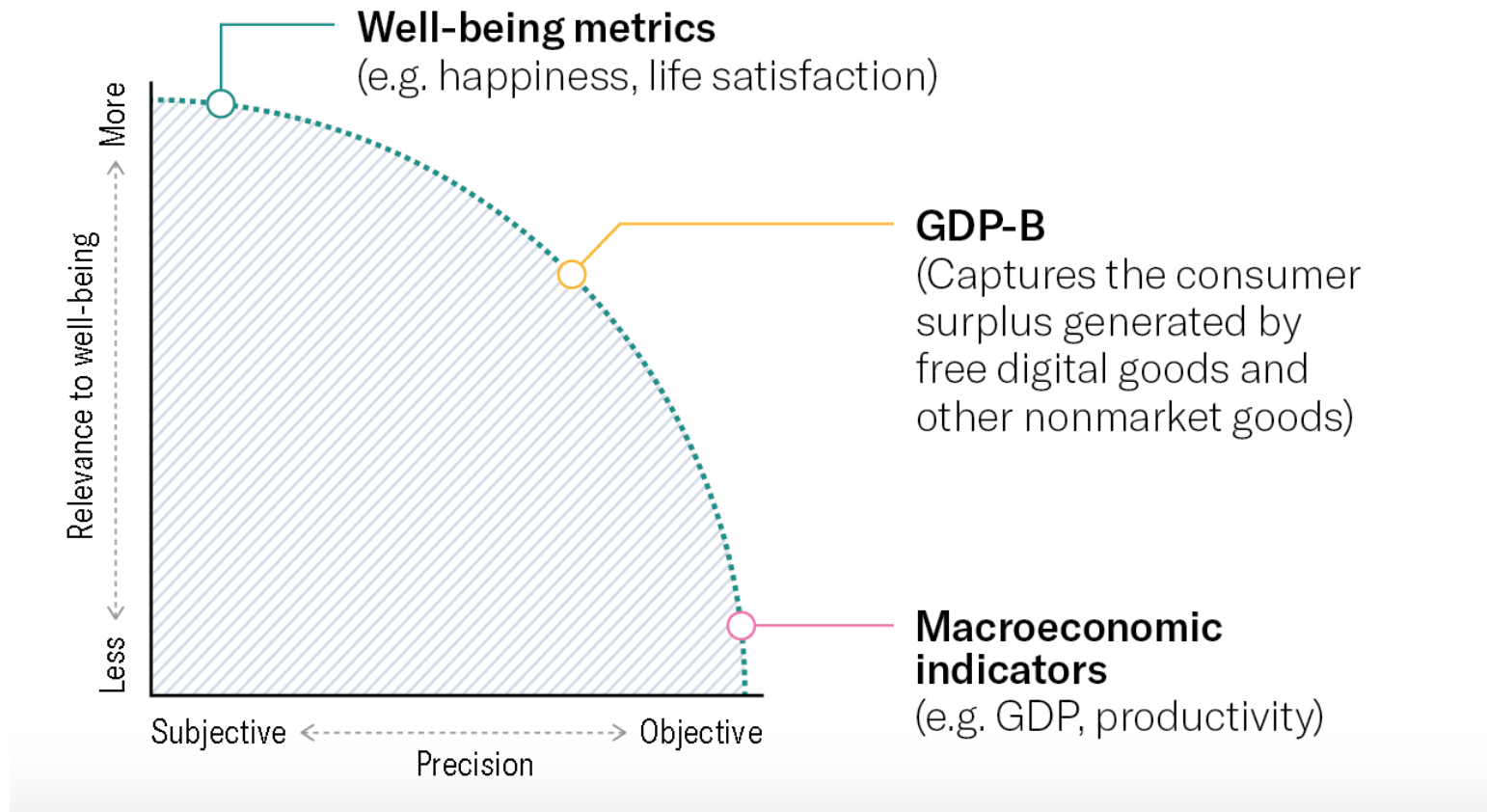
Facebook's contribution to GDP-B

	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

Other popular digital goods (in EU)

Service	Average GDP-B growth/ year (conservative estimate, n = 2 million users)	Average GDP-B growth/ year (generous estimate, n = 10 million users)
WhatsApp	0.82	4.1
Facebook	0.11	0.5
Maps	0.07	0.34
Instagram	0.01	0.07
Snapchat	0.00	0.02
LinkedIn	0.00	0.01
Skype	0.00	0
Twitter	0.00	0

A dashboard of metrics instead of 1 single number



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

MIT Measuring the Economy Project

www.MeasuringTheEconomy.org