US Economics Analyst

Productivity Paradox v2.0: The Price of Free Goods

- A cynic knows "the price of everything but the value of nothing." If confronted, he might say the same thing about our GDP statistics. After all, smartphone consumption in the official statistics still lags the tallies from the smartphone industry itself—even after last summer's GDP benchmark revision. And on the inflation side, while many old sources of mismeasurement have been resolved, software and healthcare quality appear to be even more important.
- Missing growth from "free" digital goods like Google Maps, camera phones, and Snapchat may be an even larger issue. In an experimental setting, Brynjolfsson et al. (2019) induce consumers to choose between foregoing access to social media or paying a monetary penalty. The dollar values assessed by the median participant imply trillions of unmeasured consumer surplus.
- The rise of the internet has blurred the lines between the economic and household spheres, and much of what we do on Facebook—sharing stories with friends, planning and reviewing social events—is a substitute for traditional household activities that are non-market in nature (and hence should be excluded from GDP). This may explain why "willingness to pay" approaches can produce implausibly large estimates of newly created consumer surplus: the utility is not new, it has just migrated online.
- A top-down perspective also indicates huge scope for unmeasured output, as growth of domestically generated profits and incomes (GDI) is outpacing that of GDP, a departure from earlier decades. On top of this, US profits generated in tax havens totaled over $300bn in 2018, some of which represents unmeasured domestic production. Our updated bottom-up estimates ($233bn of missing nominal consumption) are in the same ballpark.
- We conclude by assessing GDP mismeasurement across four dimensions: unmeasured nominal output, free and crowdsourced digital products, consumer inflation (quality change, outlet bias), and business ICT investment. In our central estimate, the pace of annual real GDP growth is understated by around 1.0pp currently, up from 0.5pp in 2005 and 0.3pp in 1995. This is somewhat larger than our previous estimates and would imply that roughly half of the post-crisis productivity slowdown is explained by greater mismeasurement.

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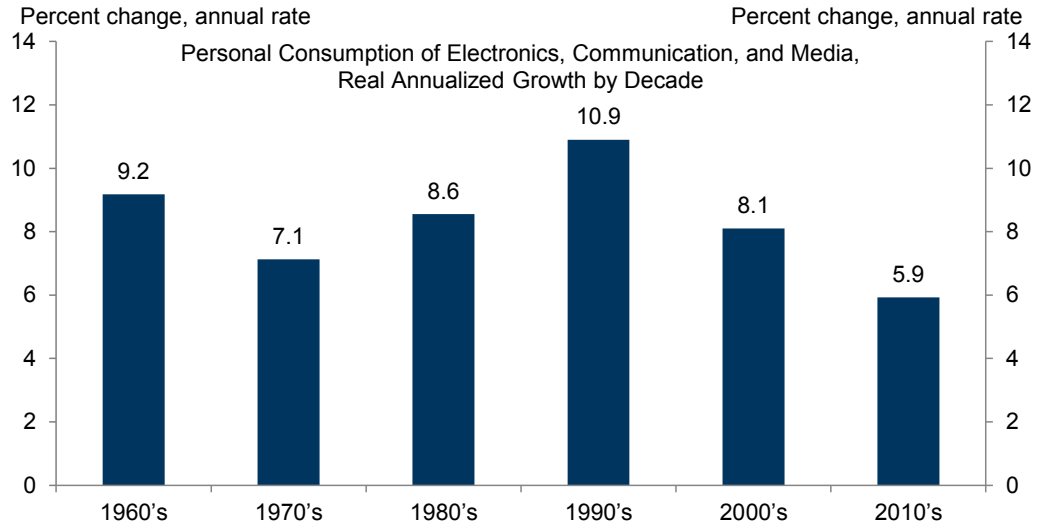
Traveling back in time to witness the collapse of the Soviet Union and the birth of grunge music would be exciting in many ways, but 1991 telecom technology would not be one of them. As illustrated by the below Radio Shack ad from that year, it would require over 10 devices and $3,000 dollars to replicate even the most basic functions of today's smartphones.

Exhibit 1: Most "Radio Shack" Products Are Now Embedded in a Single Smartphone…

Source: Radio Shack

Against that backdrop, we find it striking that the national accounts statistics (GDP) indicate that tech-oriented consumption growth has actually slowed. In fact, in the current decade, it is rising at its slowest pace in the post-war period.

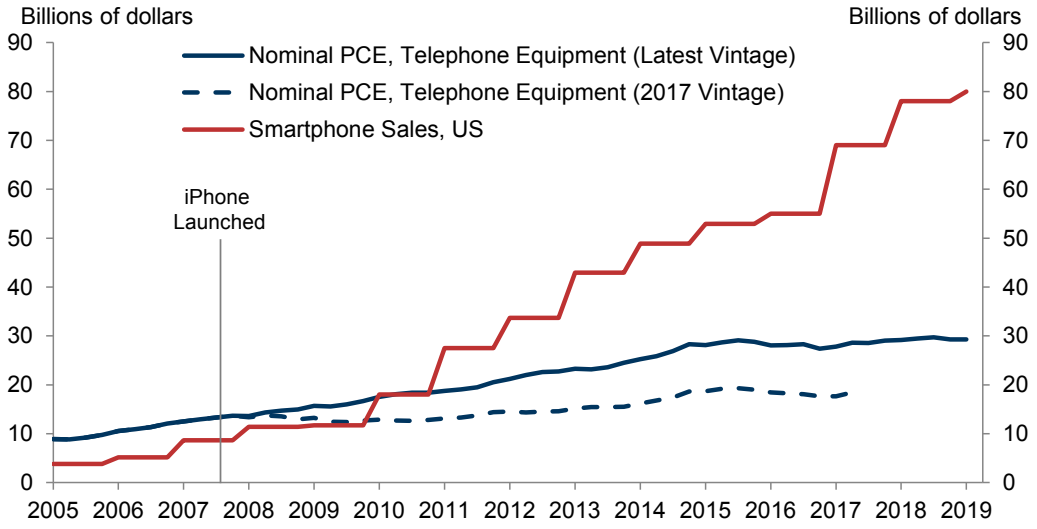
Exhibit 2: ...Yet as Currently Measured, Tech-Intensive Consumption Growth Has Actually Slowed



Source: Department of Commerce, Goldman Sachs Global Investment Research

In our view, the most likely explanation is measurement error, which can be particularly high in industries where the universe of products or the firms that provide them is rapidly evolving. Plotting telephone hardware specifically (Exhibit 3), we see that nominal spending has not kept pace with industry measures of US smartphone shipments.

Exhibit 3: Revisions Moving in Right Direction (but More to Come)



Source: Department of Commerce, Statista, Goldman Sachs Global Investment Research

Updating our previous work, we estimate that even after upward revisions to spending and downward revisions to inflation, smartphones continue to represent between

$100bn and $225bn of missing real consumption (see Appendix).[1] In principle, the BEA adjusts for many of the underlying drivers; however, Exhibit 3 suggests it may require another Economic Census or two for the source data and product classifications to catch up. While one Economic Census every five years may be sufficiently frequent to rebenchmark most mature industries and consumption categories, five years can be an eternity in others.

Are We There Yet?

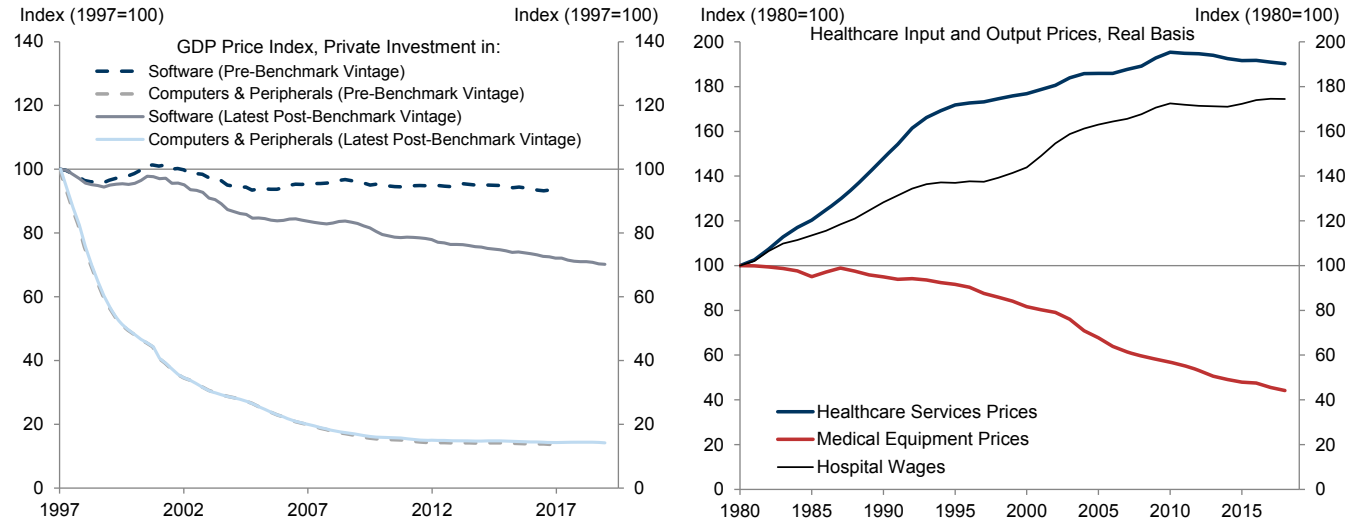
Revisions at the aggregate level have also boosted measured GDP growth, a trend we expect to continue in the upcoming decade. Most recently, the 2018 comprehensive GDP update added 0.05pp to measured growth since 2007. The previous two benchmark revisions also increased trailing-ten-year growth (by +0.2pp and +0.1pp, in 2013 and 2009, respectively). These upward revisions to real growth reflect the impact of both higher nominal growth indicated by the Economic Census[2] and of lower inflation related to methodological changes—most recently quality adjustments to business software and telecom hardware.

Price measurement issues go well beyond smartphones, in our view, with healthcare and business ICT (information and communication technology) among the more problematic categories. As shown in the left panel of Exhibit 4, last summer's benchmark GDP revision represented a positive step in resolving the quality-improvement disconnect between hardware and software.

[1] Why might such a gap persist? First, last summer's comprehensive update incorporated the Economic Census of 2012, not the 2017 version currently being analyzed (preliminary data released in September; benchmark revision in 2022). In addition to potentially stale readings of nominal spending levels, sample-based methods can sometimes cause misclassification issues. In Smartphones for example, the vast majority are purchased using financing or are heavily discounted by wireless carriers, who implicitly finance these purchases through a cell phone contract. As a result, smartphone consumption in some cases may be misclassified as telecom services revenues and are then measured by the more stable price index—understating real consumption growth. Similarly, if some iPhones are instead classified as intermediate inputs used by wireless carriers in their production process, they would be omitted in the GDP and PCE calculations entirely. Even if they are classified as business investment (and is measured in GDP), the non-work related smartphone services provided to the employees who use them would not, with the monthly payments instead classified as a business-to-business input cost.

[2] For example, the level of nominal internet spending was revised up by 28% with the 2013 benchmark revision.

Exhibit 4: Despite Methodological Improvements, Price Mismeasurement Remains an Important Issue



Source: Department of Commerce, Department of Labor, Goldman Sachs Global Investment Research

In contrast, quality adjustment in the healthcare sector remains in its infancy, as new and improved medical procedures are not incorporated into price and productivity statistics. As shown in the right panel, the measured real price of healthcare has nearly doubled since 1980, despite a dramatic decline in the (much easier to measure) cost of technology and equipment that delivers it—as well as a more modest rise in labor costs. While hardly conclusive, it stands to reason that the new technology embedded in healthcare equipment and R&D capital should tend to increase the real output provided by doctor visits, prescription refills, and surgical procedures. Yet, these quality changes are not currently measured in the national accounts.

In Exhibit 5, we summarize the changes to price measurement in the national accounts, leaning heavily on the detailed work of former BEA economist Brent Moulton. Despite major improvements—most of which have now been backcasted in the GDP statistics through the 1990s or earlier—we estimate that consumer-level price inflation likely remains overstated by 0.4pp—or by twice that if "free" digital goods are included.[3]

[3] For the healthcare sector, non-economic factors such as reduced smoking and healthier diets play a role in improved health outcomes. Accordingly, we base our healthcare assumption on the promising results of Dauda, Dunn, and Hall (2019), who control these factors and adjust for healthcare outcomes (improvement in life expectancy vs. the prevailing standard of care). Specifically, we apply their "conservative" estimate of annual quality change (+3.1%, which itself assumes an additional year of life is valued at $50k) to the hospital subset of US healthcare spending—excluding doctor's office visits and nursing home spending that is not skewed toward major/life-saving procedures. Note that we exclude both business IT and unpaid digital consumer content in the 0.4pp point estimate.

Exhibit 5: Inflation Measurement: What's Changed, and What Hasn't?

Major Price Measurement Issues in the National Accounts and Approximate Impacts*			
Status	**Issue**	**Approximate Bias***	**New Methodology Adopted**
Resolved and Restated**	Smartphone hardware quality ^	0.01	2019
	Business own-account software † ^	0.05	2018
	Lower-level substitution ^^	0.20	PCE in 1995
	Quality adjust PCs and TVs ^^	0.03	1998-99
Resolved but Not Restated**	Consumer internet speed ^^^	0.001	2019
	Cell phone plans ^^^^	0.10	2017
	Audio-video quality ^^	-0.004	2000
Unresolved	Business IT hardware quality † ^^^^	0.17	-
	Business IT software quality † ^^^^	0.16	-
	Healthcare ^^^^^	0.24	-
	Smartphone "unquantifiables" ^^^^	0.05	-
	Retailer outlet bias ^^^^	0.10	-
	*Ad-financed digital content †† ^^^^^^*	*0.08*	-
	*Other "free" digital goods †† ^^^^^^*	*0.34*	-

* In periods affected. Positive values signify inflation overstated and real growth understated. And estimated impact on annual real GDP growth.

** Substantially resolved, though quality change may still be incompletely captured across difficult-to-quantify dimensions.

† Bias quoted in GDP terms (instead of consumption terms).

†† It is open to debate whether free digital goods represent a measurement problem for nominal GDP or for prices (or some combination).

^ Based on BEA report accompanying revisions

^^ Moulton (2018)

^^^ BLS estimate

^^^^ GS estimate

^^^^^ Daude, Dunn (2019)

^^^^^^ Brynnjolffson (2019), Byrne & Corrado (2019), Nakamura (2018)

Note: "Resolved and Restated" categories pertain to GDP and PCE statistics that were revised at least back to 1995. CPI data is not revised by construction. CPI adopted lower-level substitution in 1999.

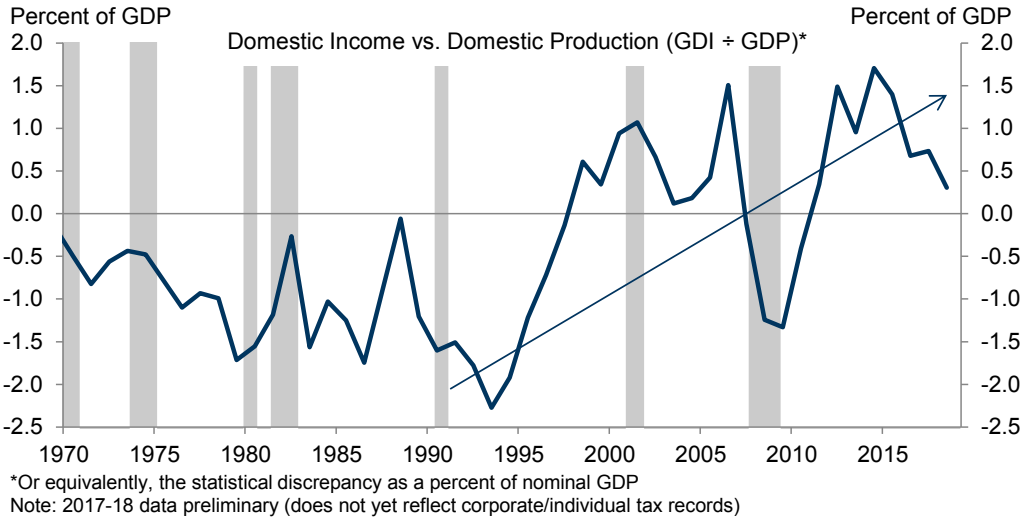
Source: Goldman Sachs Global Investment Research

Encouragingly, many old sources of mismeasurement have been resolved or mitigated—notably by hedonic adjustments (for products with well-defined characteristics), by calculation formulas that assume consumers shift away from more expensive goods, and by the decline of domestic production of computers and other high-tech hardware. However, we note that new sources of price mismeasurement may be as or even more important on net: Software quality is more difficult to measure than that of hardware, healthcare and other tech-centric categories are growing as a share of the economy, and new business models offer several categories of traditional market consumption for free (or in exchange for viewing advertising).

Statistical Discrepancy

If we are correct that technological change is not fully reflected in the real output statistics, we might expect easier-to-measure profits and incomes to be regularly above those justified by the pace of production and expenditure. As shown in Exhibit 6, economy-wide income (GDI) has indeed risen faster than GDP in recent years, a departure from earlier decades.

Exhibit 6: Domestically Produced Income Has Grown More Quickly than GDP Since the Mid-1990s



Shading denotes NBER recessions

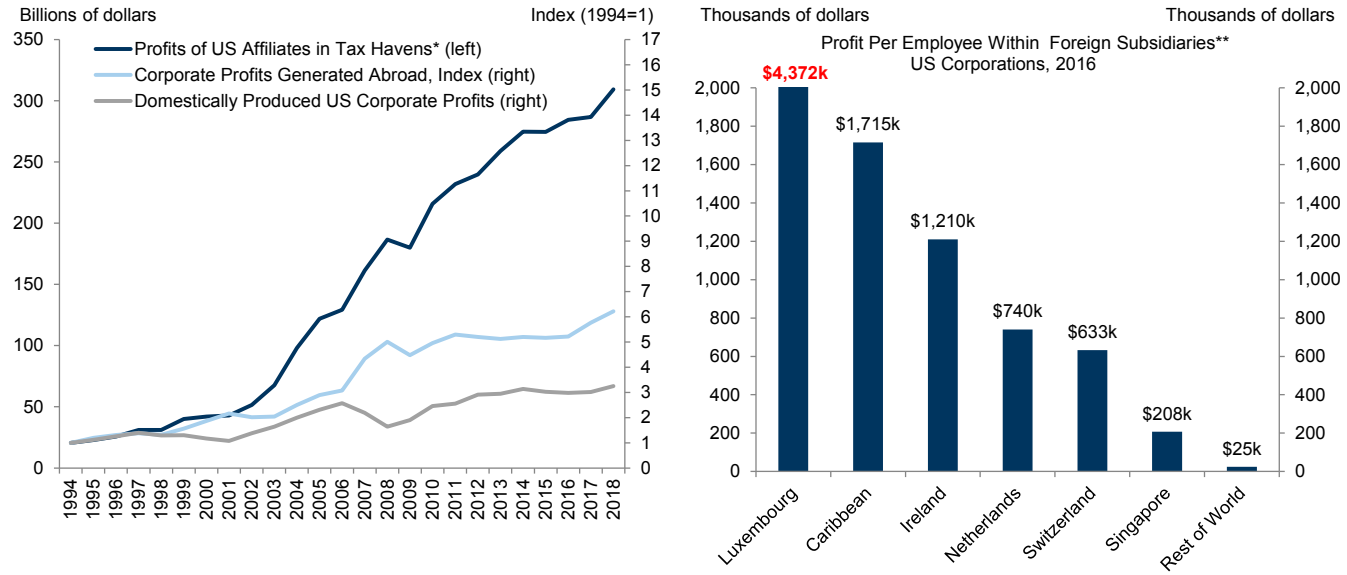
Source: Department of Commerce, Goldman Sachs Global Investment Research

Motivated by this finding, we produce top-down estimates of nominal GDP mismeasurement. In addition to the gap between Gross Domestic Income and GDP, we include two additional outlets for unmeasured production:

Nominal GDP Bias = (GDI - GDP) + Misclassified Foreign Profits + Free "New Economy" Products

The second term reflects the relocation of domestically generated profits to tax-haven countries. As shown in Exhibit 7 and discussed in previous research, profits of US subsidiaries located in these countries have grown dramatically faster than those of US firms and establishments residing domestically or in other geographies. Specifically, US corporate profits generated in tax havens have risen dramatically over the last 25 years, with the excess growth vs. the proportionate change in rest-of world profits at $200bn. We view this as a reasonable baseline estimate for the magnitude of profit-shifting, particularly because US employees in tax-haven countries are implausibly productive—in the aggregate generating profit per employee between 8x and 175x those in other US international subsidiaries (35x on average, dollar-weighted).

Exhibit 7: Windfall Profits in Tax-Haven Countries Likely Represent Another $200bn of Missing US GDP

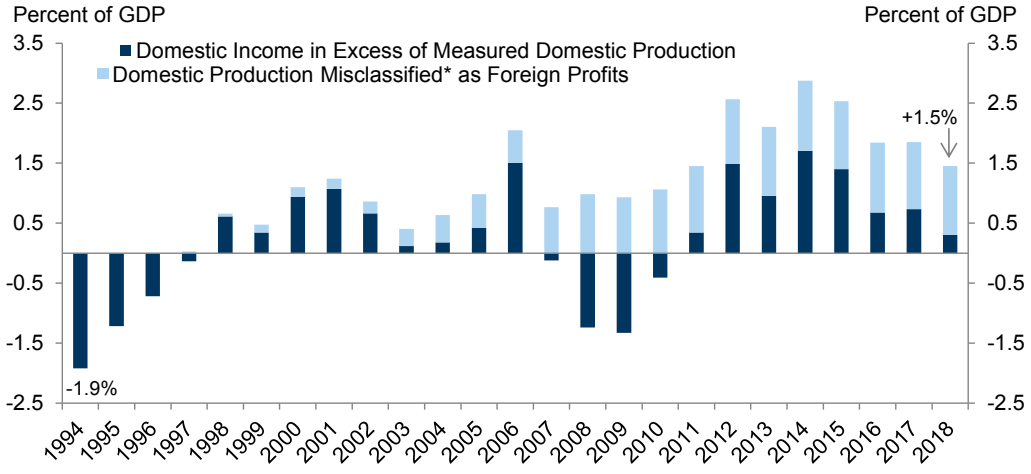


*Netherlands, Ireland, Luxembourg, Bermuda and other Caribbean Islands, Switzerland, and Singapore
**US subsidiaries' net income per employee in the country

Source: Department of Commerce, Goldman Sachs Global Investment Research

Combined, the GDI-GDP gap and the foreign profit shifting suggest nominal GDP growth has been understated by between 0.10-0.15pp/year since 1994, as shown in Exhibit 8.

Exhibit 8: GDP-Accounting Approach Alone Suggests Nominal Growth Understated by 0.10-0.15pp/year



*GS Estimate. Assumes true tax-haven profits rise at same pace as worldwide profits (of US corporations), on average.
Note: 2017-18 data preliminary (does not yet reflect corporate/individual tax records)

Source: Department of Commerce, Goldman Sachs Global Investment Research

At first pass, it seems far-fetched to imagine such a substantial amount of unmeasured nominal output—after all we have a Census of the economy every five years. However, our updated bottom-up estimates of missing nominal consumption among rapid-growth industries produce results in the same ballpark (we estimate $233bn of unmeasured nominal consumption using this bottom-up approach, see Appendix).

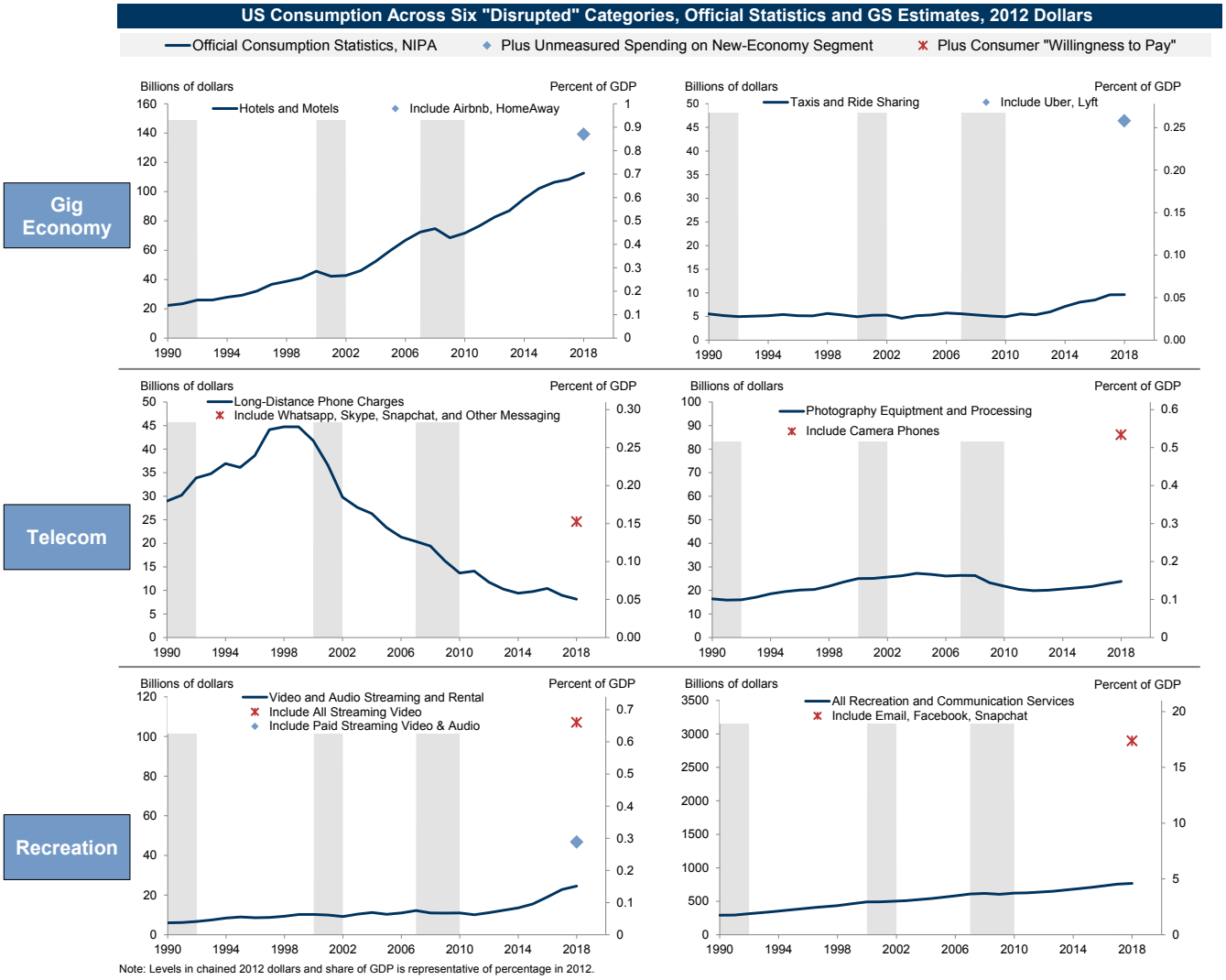
Accounting for Taste: Free Digital Goods and their Analog Analogs

What about the third term in our equation: Free "New Economy" Products? Since the 2017 publication of Bartering for 'Free' Information[4] that suggested just under 0.1pp of missing annual growth–a result which at the time we viewed as conservative—several much larger estimates have been proposed. Byrne and Corrado (2019) for example estimate a GDP-growth boost from consumer telecom worth 0.5pp per year. They construct models of consumer utility using granular telecom price data, household time use, and an assumption of complementarity between hardware and network use. Separately, the "willingness to accept" approach of Brynjolfsson et al. (2019) (how much would you need to be compensated to give up Facebook for a month?) suggests a much larger impact. Smartphone cameras *alone* are found to generate 0.6pp of annual growth in broadly measured consumer welfare (known as "GDP-B", where the "B" stands for "Benefits").

In Exhibit 9, we illustrate many of these concepts applied at the micro-level and compared against the same (or analogous "old economy") consumption category. For these six "disrupted" segments, NIPA consumption levels are significantly below alternative estimates of consumer spending or consumer surplus, themselves gleaned from three sources: i) company filings and industry sources (row 1 "Gig Economy"), ii) consumer utility-based approaches (row 2 "Telecom"), and iii) the two together (row 3 left panel "Streaming Video"). As shown by the percent of GDP on the right axes, the disconnect relative to the official data is economically meaningful in each case.

[4] By economists Rachel Soloveichik, Jon Samuels, and Leonard Nakamura.

Exhibit 9: Economic Services Once Provided by Phone Companies and Travel Agents Are Now Consumed for Free Online; Gig Economy Also Likely Understated



Shading denotes NBER recessions

Source: Department of Commerce, Goldman Sachs Global Investment Research

The lower right panel compares real spending across the broad recreation and communication categories to the US consumer surplus from email, Facebook, and Snapchat, as implied by Brynjolfsson et al. These three alone imply unmeasured consumption benefits on the order of 10%+ of GDP.

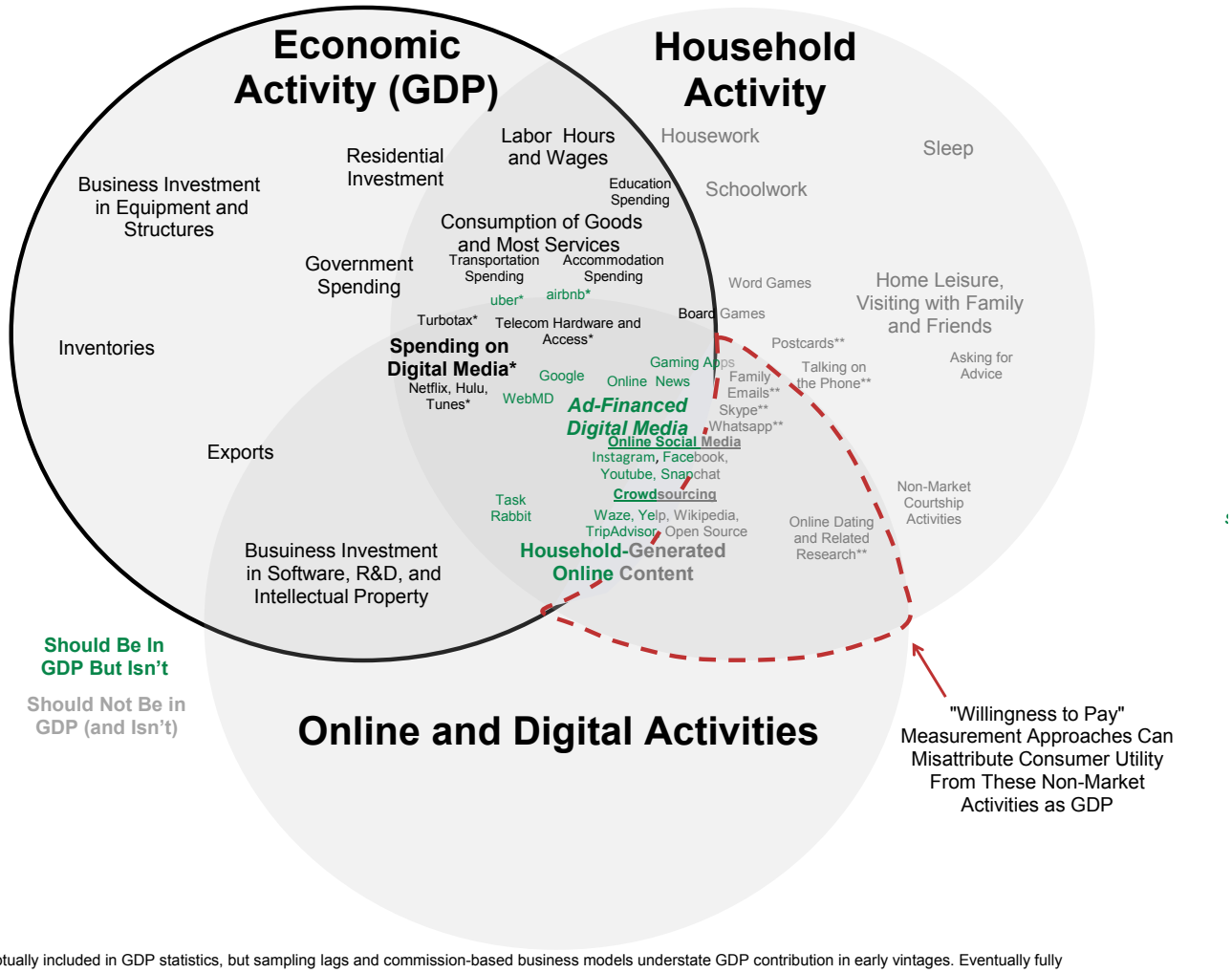
Squaring the Circle

While measures such as GDP-B will be very useful in assessing policy decisions, we are still left with the problem of measuring GDP. What should be counted in today's economy? In Exhibit 10, we offer a visual representation of the "What Counts?" problem facing BEA statistics. Specifically, the advent of digital and online activities has blurred the lines between the economic and household spheres.

As an example, we would argue that much of what we do on Facebook is a substitute for traditional household activities that are not in the economic realm to begin with:

sharing stories with friends, staying in touch with family, planning social events, and researching dating opportunities.

Exhibit 10: Much of This Missing Nominal Growth Occurs in the Nexus of the Economic, Household, and Digital Spheres (Some of Which Is Already Counted in Gross Domestic Income)



*Conceptually included in GDP statistics, but sampling lags and commission-based business models understate GDP contribution in early vintages. Eventually fully reflected (post-Economic Census and methodological reclassifications).
**Access/subscription charges and equipment costs should be (and are) included in GDP. Consumer utility from traditional household (non-market) activities should not.

Source: Goldman Sachs Global Investment Research

This decomposition may also reveal why the "willingness to pay" approaches in some instances seem to produce implausibly large estimates: The migration of household leisure time from the offline realm to the digital sphere does not necessarily mean the economy is growing any faster.[5]

In the area straddling the household and digital spheres, only part of the consumer utility/surplus should be targeted as consumption by the national accounts. Accordingly, we see the results of Brynjolfsson et al. as an upper bound for this particular aspect of the productivity paradox. Given the pronounced shift in household leisure from offline to online activities in recent decades, the Byrne and Corrado approach may also misclassify some time spent on non-market activities as GDP growth.

[5] Relatedly, to the extent "consumer time use" is a significant driver of Byrne and Corrado (2019)'s results, growth estimates may be overstated as consumer time inexorably shifts from the physical to digital world.

Similarly, the corresponding lower bound (for unmeasured growth from "free" goods) may well be the advertising revenues and corporate profits generated from these same activities.[6] With regard to the gray area in between, we would also argue for the inclusion of free digital activities that have supplanted old-economy market transactions—such as Google Flights and TripAdvisor replacing travel agents or Whatsapp and Facebook replacing (narrowly defined) long-distance phone spending.[7]

In Search of Missing Growth

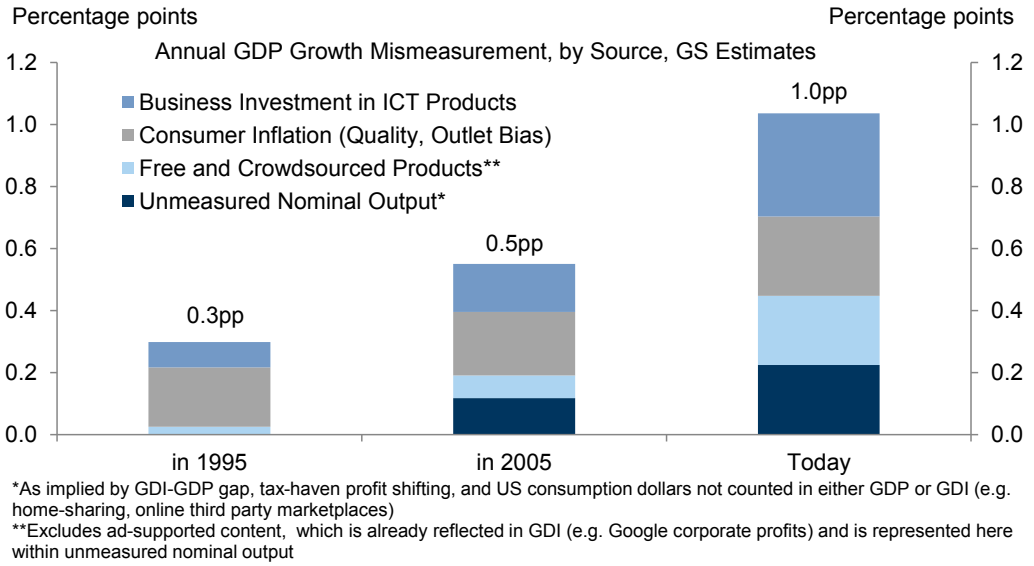
We conclude by revisiting our combined estimates of GDP mismeasurement, combining the above analysis with our previous work on the topic (see Exhibit 11). For free digital goods, we average across the three approaches explored above to form our baseline. Importantly though, in the case of Brynjolffson et al. we exclude *all* consumer surplus generated by search engines and email (to avoid misattribution); we also assume that on average only a third of US consumers derive the associated consumer welfare estimates from these activities, to avoid overstating the impact for the population as a whole.[8] With respect to business capex in information technology, it is worth noting that the broad importance of ICT output in the economy continues to grow, despite the decline in business investment in hardware. Our estimated contribution from business ICT reflects the value-added share of the various high-tech industries, which show a fairly stable share for the computer and electronic products industry but a sharp increase for other technology industries.

[6] Indeed, we note that many of the items in the center-middle section of the diagram are already counted in GDI—and thus should be captured by the top-down approach of Exhibit 8.

[7] Where should we draw the line? Ultimately, if an activity makes money in an arm's-length transaction or represents a direct substitute for other market activities from which it has gained share, it should be incorporated in GDP in one way or another. If it is a non-market activity whose predominant value is developmental or social—it should not—regardless of whether it takes place online or in the physical world.

[8] The volunteer participants in these studies may not be representative of older or lower-income consumers who spend relatively less time on consumer free digital goods.

Exhibit 11: Across Four Sources of Measurement Error, We Estimate GDP Growth Is Understated by 1.0pp Today, Double the Bias in 2005



*As implied by GDI-GDP gap, tax-haven profit shifting, and US consumption dollars not counted in either GDP or GDI (e.g. home-sharing, online third party marketplaces)
**Excludes ad-supported content, which is already reflected in GDI (e.g. Google corporate profits) and is represented here within unmeasured nominal output

Source: Goldman Sachs Global Investment Research

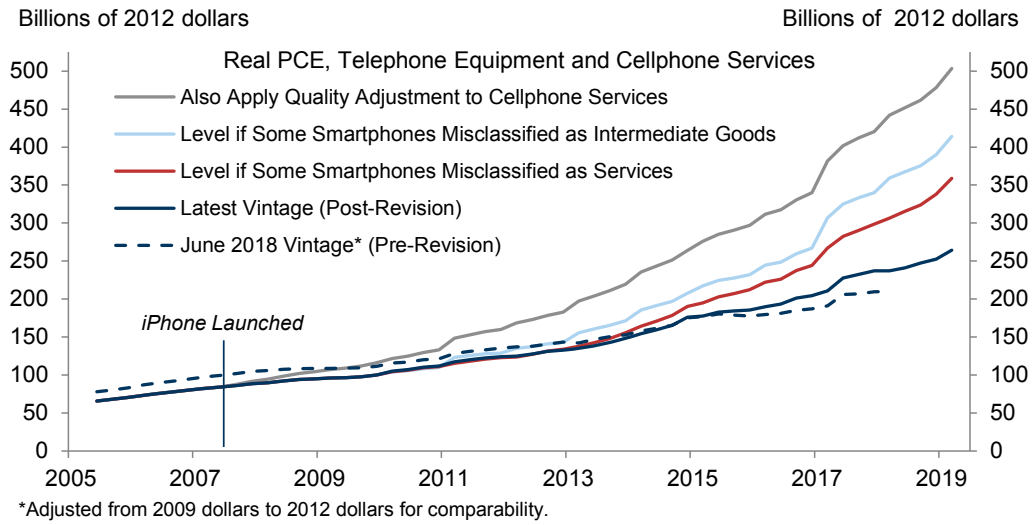
In our central estimate, we estimate that the pace of annual real GDP growth is understated by around 1.0pp of GDP, up from 0.5pp in 2005 and 0.3pp in 1995. While the results contrast with Moulton's finding that mismeasurement has actually declined—to 0.47pp today in PCE terms vs. 0.95pp in 1996)—the results are not directly comparable. Central issues such as healthcare quality, software quality, smartphone services and free digital goods measurement, and profit-shifting are not explicitly addressed in Moulton's analysis.

Our results also suggest that nearly half of the slowdown in measured productivity growth since the financial crisis can be explained by measurement issues. We caution that the uncertainty around our estimates is large, particularly that pertaining to free digital goods and healthcare consumer inflation.

Spencer Hill

Appendix

Smartphones Still Represent $100bn-$225bn of Missing Real Consumption



Source: Department of Commerce, Goldman Sachs Global Investment Research

Bottom-Up Estimates Continue To Suggest Over $200bn of Unmeasured Nominal Consumption, on the Same Order of Magnitude as Top-Down Estimate of Missing GDP

Subindustry	Approximate Consumer Spending, $bn	Estimated Amount Missing From GDP, $bn	Examples	Rationale for Potential Bias
Smartphones and Mobile Apps*	80	50	Apple, Samsung	Misclassification
Online Financial Services	10	10	Venmo, Paypal	Misclassification, Sampling Lags
Streaming Video	20	17	Netflix, AppleTV, Amazon Video, Hulu	Sampling Lags
Digital Music	8	7	iTunes, Pandora	Sampling Lags
Ride-Sharing**	50	40	Uber, Lyft, Via	Sampling Lags, Fee-Based Pricing
Online Third Party Marketplaces**	110	80	Amazon Third Party Sellers	Fee-Based Pricing
Consumer Vacation Rentals**	34	29	Airbnb, Homeaway, Vacationrentals	Fee-Based Pricing, Misclassification
Web-Based Food Service**	19	0	Seamless, Grubhub, Blue Apron	Fee-Based Pricing, Misclassification
Total	**331**	**233**		

Note: Consumption estimates based on financial reports, press coverage, or third-party consumer spending estimates of the subindustry or largest firms in the subindustry, including Netflix, AppleTV, Amazon Video, Hulu, Pandora Internet Radio, Airbnb, Homeaway, Paypal, Uber, Lyft, Seamless, Grubhub, Blue Apron, eBay, and Amazon 3rd Party Sellers

† Based on estimates in Rachel Soloveichik, Jon Samuels, and Leonard Nakamura, " 'Free' Internet Content: Web 1.0, Web 2.0, and the Sources of Economic Growth," FRB Philadelphia working paper 18-17, May 2018

*Appoximate consumer spending represents nominal personal consumption on telephone equipment and wireless services

**Adjusted based on producer revenue shares of consumer spending

Source: Goldman Sachs Global Investment Research

The US Economic and Financial Outlook

Forecast Changes

Our Q2 GDP tracking remained unchanged at +1.4% (qoq ar) over the past week.

THE US ECONOMIC AND FINANCIAL OUTLOOK

(% change on previous period, annualized, except where noted)

	2017	2018	2019 (f)	2020 (f)	2021 (f)	2022 (f)	2019 Q1	2019 Q2	2019 Q3	2019 Q4	2020 Q1	2020 Q2	2020 Q3	2020 Q4
OUTPUT AND SPENDING														
Real GDP	**2.2**	**2.9**	*2.5*	*2.1*	*2.1*	*1.7*	**3.1**	*1.4*	*1.9*	*2.0*	*2.3*	*2.5*	*2.3*	*2.0*
Real GDP (Q4/Q4)	**2.5**	**3.0**	*2.1*	*2.2*	*2.0*	*1.6*	--	--	--	--	--	--	--	--
Consumer Expenditure	**2.5**	**2.6**	*2.5*	*2.5*	*2.3*	*1.9*	**0.9**	*3.7*	*2.3*	*2.0*	*2.5*	*2.8*	*2.6*	*2.3*
Residential Fixed Investment	**3.3**	**-0.3**	*-1.0*	*5.0*	*3.7*	*2.3*	**-2.0**	*0.3*	*4.0*	*6.0*	*6.0*	*6.0*	*4.0*	*4.0*
Business Fixed Investment	**5.3**	**6.9**	*2.9*	*2.5*	*3.4*	*3.2*	**4.4**	*-0.9*	*0.3*	*1.8*	*3.5*	*3.5*	*3.4*	*3.4*
Structures	**4.6**	**5.0**	*-0.5*	*0.7*	*2.0*	*2.0*	**4.4**	*-5.7*	*-1.0*	*0.0*	*2.0*	*2.0*	*2.0*	*2.0*
Equipment	**6.1**	**7.4**	*-0.1*	*1.4*	*4.0*	*3.4*	**-1.0**	*-5.9*	*-5.0*	*0.0*	*4.0*	*4.0*	*4.0*	*4.0*
Intellectual Property Products	**4.6**	**7.5**	*9.3*	*4.9*	*3.5*	*3.8*	**12.0**	*9.0*	*8.0*	*5.0*	*4.0*	*4.0*	*3.5*	*3.5*
Federal Government	**0.7**	**2.6**	*2.6*	*1.2*	*0.0*	*0.0*	**-0.1**	*7.0*	*2.5*	*2.5*	*0.0*	*0.0*	*0.0*	*0.0*
State & Local Government	**-0.5**	**0.8**	*1.9*	*0.5*	*0.0*	*0.0*	**4.6**	*2.6*	*1.0*	*1.0*	*0.0*	*0.0*	*0.0*	*0.0*
Net Exports ($bn, '09)	**-859**	**-912**	*-906*	*-922*	*-957*	*-987*	**-905**	*-914*	*-909*	*-896*	*-909*	*-918*	*-927*	*-936*
Inventory Investment ($bn, '09)	**23**	**45**	*55*	*20*	*20*	*25*	**123**	*43*	*35*	*20*	*20*	*20*	*20*	*20*
Industrial Production, Mfg.	**2.0**	**2.3**	*-0.2*	*0.6*	*1.4*	*1.0*	**-2.2**	*-2.3*	*-0.8*	*0.1*	*1.2*	*1.6*	*1.5*	*1.4*
HOUSING MARKET														
Housing Starts (units, thous)	**1,209**	**1,250**	*1,289*	*1,381*	*1,391*	--	**1,213**	*1,275*	*1,308*	*1,360*	*1,358*	*1,400*	*1,380*	*1,387*
New Home Sales (units, thous)	**617**	**615**	*659*	*707*	*735*	--	**673**	*639*	*649*	*674*	*688*	*708*	*714*	*720*
Existing Home Sales (units, thous)	**5,531**	**5,341**	*5,224*	*5,273*	*5,324*	--	**5,207**	*5,218*	*5,229*	*5,241*	*5,254*	*5,266*	*5,279*	*5,292*
Case-Shiller Home Prices (%yoy)*	**6.2**	**4.1**	*3.2*	*2.8*	*2.7*	*3.0*	**3.0**	*3.1*	*3.1*	*3.2*	*3.3*	*3.1*	*3.0*	*2.8*
INFLATION (% ch, yr/yr)														
Consumer Price Index (CPI)	**2.1**	**2.4**	*1.8*	*2.2*	*2.2*	*2.4*	**1.6**	*1.8*	*1.7*	*2.1*	*2.4*	*2.1*	*2.2*	*2.1*
Core CPI	**1.8**	**2.1**	*2.2*	*2.4*	*2.5*	*2.6*	**2.1**	*2.1*	*2.2*	*2.4*	*2.5*	*2.5*	*2.4*	*2.3*
Core PCE**	**1.6**	**1.9**	*1.8*	*2.2*	*2.2*	*2.3*	**1.7**	*1.6*	*1.8*	*2.1*	*2.3*	*2.2*	*2.2*	*2.1*
LABOR MARKET														
Unemployment Rate (%)	**4.4**	**3.9**	*3.7*	*3.3*	*3.2*	*3.2*	**3.9**	**3.6**	*3.6*	*3.6*	*3.4*	*3.3*	*3.2*	*3.1*
U6 Underemployment Rate (%)	**8.5**	**7.7**	*7.2*	*6.5*	*6.4*	*6.5*	**7.5**	**7.2**	*7.1*	*7.0*	*6.8*	*6.6*	*6.4*	*6.3*
Payrolls (thous, monthly rate)	**180**	**221**	*167*	*144*	*95*	*90*	**206**	**153**	*155*	*155*	*160*	*175*	*140*	*100*
GOVERNMENT FINANCE														
Federal Budget (FY, $bn)	**-666**	**-779**	*-925*	*-1,000*	*-1,100*	*-1,250*	--	--	--	--	--	--	--	--
FINANCIAL INDICATORS														
FF Target Range (Bottom-Top, %)^	**1.25-1.5**	**2.25-2.5**	*1.75-2.0*	*2.0-2.25*	*2.5-2.75*	*2.5-2.75*	**2.25-2.5**	**2.25-2.5**	*1.75-2.0*	*1.75-2.0*	*1.75-2.0*	*1.75-2.0*	*1.75-2.0*	*2.0-2.25*
10-Year Treasury Note^	**2.40**	**2.69**	*1.75*	*2.10*	*2.40*	*2.40*	**2.41**	**2.00**	*1.85*	*1.75*	*1.80*	*1.90*	*2.00*	*2.10*
Euro (€/$)^	**1.20**	**1.15**	*1.16*	*1.25*	*1.30*	*1.35*	**1.12**	**1.14**	*1.15*	*1.16*	*1.17*	*1.19*	*1.22*	*1.25*
Yen ($/¥)^	**113**	**110**	*106*	*103*	*100*	*97*	**111**	**108**	*107*	*106*	*104*	*103*	*103*	*103*

* Weighted average of metro-level HPIs for 381 metro cities where the weights are dollar values of housing stock reported in the American Community Survey.
** PCE = Personal consumption expenditures. ^ Denotes end of period.
Note: Published figures in bold.

Source: Goldman Sachs Global Investment Research

GS Probabilistic Fed Call and Economic Releases

GS Modal and Probabilistic Fed Call

Quarter*	GS Modal Path of Target Range^	Hike Probability GS	Cut Probability GS	No Change Probability GS	Expected Value of Funds Rate^ GS**	Expected Value of Funds Rate^ Market
Current value	**2.25%-2.50%**	--	--	--	**2.40**	**2.40**
2019Q3	**1.75%-2.00%**	>5	65 (↑10)	35 (↓10)	**2.08**	**1.91**
2019Q4	**1.75%-2.00%**	5	42	53	**1.88**	**1.71**
2020Q1	**1.75%-2.00%**	10	28	62	**1.76**	**1.60**
2020Q2	**1.75%-2.00%**	10	17	73	**1.70**	**1.52**
2020Q3	**1.75%-2.00%**	20	18	62	**1.66**	**1.46**
2020Q4	**2.00%-2.25%**	55	17	28	**1.71**	**1.42**
2021Q1	**2.00%-2.25%**	35	17	48	**1.72**	**1.41**
2021Q2	**2.25%-2.50%**	55	16	29	**1.77**	**1.43**
2021Q3	**2.25%-2.50%**	40	16	44	**1.80**	**1.44**
2021Q4	**2.50%-2.75%**	55	15	30	**1.86**	**1.44**
	Modal Number of Hikes				**Expected Value of Number of Net Hikes**	
2019	**-2**				**-2.1**	**-2.8**
2020	**1**				**-0.7**	**-1.2**
2021	**2**				**0.6**	**0.1**

^ Denotes end of period.

* Probabilities represent the likelihood of a policy change at either meeting in a given quarter.

** We assume hikes are 25bp per quarter and cuts average 50bp per quarter. The GS expected value of the funds rate is equal to the prior quarter value + 0.25 * the hike probability - 0.5 * the cut probability.

Note: Arrows denote changes since GS update on July 7, 2019.

Date		Time (EST)	Indicator	Estimate GS	Consensus	Last Report
Mon	**Jul 15**	8:30	Empire Manufacturing Survey (Jul)	n.a.	+2.0	-8.6
Tue	**Jul 16**	8:30	Import Price Index (Jun)	n.a.	-0.6%	-0.3%
		8:30	**Retail Sales (Jun)**	**+0.3%**	**+0.2%**	**+0.5%**
			Ex Autos	**+0.1%**	**+0.1%**	**+0.5%**
			Ex Autos, Bldg Materials & Gas	**+0.4%**	**+0.3%**	**+0.4%**
		9:15	**Industrial Production (Jun)**	**+0.1%**	**+0.1%**	**+0.4%**
		9:15	**Manufacturing Production (Jun)**	**+0.5%**	**+0.3%**	**+0.2%**
		9:15	**Capacity Utilization (Jun)**	**78.0%**	**78.1%**	**78.1%**
		10:00	Homebuilders' Survey (Jul)	n.a.	64	64
		10:00	Business Inventories (May)	n.a.	+0.4%	+0.5%
		16:00	Total TIC Data (May)	n.a.	n.a.	-7.8bn
Wed	**Jul 17**	**8:30**	**Housing Starts (Jun)**	**-1.0%**	**-0.7%**	**-0.9%**
		14:00	Fed's Beige Book			
Thu	**Jul 18**	**8:30**	**Philadelphia Fed Survey (Jul)**	**+6.0**	**+5.0**	**+0.3**
		8:30	**Initial Jobless Claims**	**220,000**	**216,000**	**209,000**
		8:30	Continuing Claims	n.a.	1,700,000	1,723,000
		10:00	Leading Indicators (Jun)	n.a.	+0.1%	Flat
Fri	**Jul 19**	**10:00**	**UMich Consumer Sentiment—Prel (Jul)**	**99.0**	**98.6**	**98.2**

Source: Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, Jan Hatzius, Alec Phillips, David Mericle, Spencer Hill, Daan Struyven, David Choi, Blake Taylor and Ronnie Walker, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

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