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Can U.S. Productivity Measures Keep Pace With Innovation?

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GLOBAL ALTERNATIVE ASSET MANAGEMENT

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By Jason M. Thomas

Over the past 18 months, the U.S. labor market has improved markedly, with no corresponding acceleration in the growth of businesses' sales or output. Since December 2013, the U.S. economy has added 4.5 million net jobs and the unemployment rate declined from 7% to 5.3%. At the same time, real final sales of U.S. businesses have continued to grow at the same 2% to 2.5% annual rate that has prevailed since the end of the Great Recession. Since "productivity" measures the difference between inputs (payrolls or labor hours) and outputs (sales or GDP), current trends have led the U.S. government's official measure of annual productivity growth to decline to just 0.6% over the past four quarters, or one-fourth of the average of the past 25 years.

Stagnant productivity could be a temporary phenomenon, attributable to the costs of training the large number of workers newly added to payrolls over the past year. Alternatively, slow productivity growth could reflect the low rate of business investment since the Great Recession. Capital-per-worker is often used as a proxy for productivity and the decline in investment has caused this ratio to fall relative to its prior trend.¹ Finally, stagnant productivity could be a sign that businesses are overstaffed. While unlikely, official measures of productivity do tend to stagnate in periods prior to the onset of recession, as sales drop relative to payrolls. To be sustained, the improvement in the labor market over the past 18 months must translate to faster demand growth. Otherwise, the growth in payrolls is bound to slow, or even reverse.

Undercounting Innovation?

To many observers in Silicon Valley, the U.S. productivity slowdown looks more like a problem of mismeasurement than a genuine cause for concern.² Critics argue that official statistics fail to capture the recent boom in U.S. productivity because GDP excludes the "free" output from digital services and social media. Real GDP may also be understated because price indexes used to deflate nominal GDP do not account adequately for improvements in the quality of next generation high-tech products like computers, mobile phones, and software. According to this view, proper accounting for digital goods and tech deflation would result in a substantial upward revision to real GDP and productivity, easing concerns about the sustainability of current trends.

Since GDP represents the market value of all goods and services produced in an economy, a product or service must have a market value, or identifiable price, to be included in the GDP estimate. As a result, a large swath of the digital economy, including Google, Wikipedia, Facebook, Twitter,

and YouTube, does not contribute directly to GDP because consumers pay nothing to use these services.³ The failure to account for "free" services creates some obvious dilemmas. When a consumer downloads a free Google Maps app on her mobile phone instead of purchasing a road atlas at a bookstore, GDP declines. Since the app provides a flow of services – interactive location tracking, directions, traffic warnings, road closure updates, etc. – that make it far superior to the old atlas, it is counterintuitive that a measure of economic value would *decline* as a result of this product substitution. Real productivity is supposed to *increase* when innovation reduces marginal production costs, as occurs when digital map downloads replace the printing, binding, and physical distribution of hard copies.

Digital content and services are not entirely free, of course. The basic premise of the "information economy" is that consumers "pay" for online content through their attention, and that attention can be monetized through advertising revenues. These ad revenues do count towards GDP as the "cost of goods sold" of the businesses that advertise.⁴ For example, if Ford advertises a new car on Facebook, that portion of Facebook's revenue is treated in the GDP accounts as an expense of Ford, similar to the purchase of intermediate goods like steel and auto parts used to manufacture the car. But there is no independent accounting for the value consumers derive from the social networking service itself.

Increased consumption of online content has led to exponential growth in digital advertising since 2000, but most of the increase has come at the expense of traditional media.⁵ Print newspapers have been especially hard hit, with real advertising revenues falling to levels last seen in 1950.⁶ When adjusted for inflation, total advertising spending in the U.S. has been roughly flat since 2008, suggesting that the social media boom has contributed little to measured GDP, on net.⁷

A Better Measure of GDP?

The absence of meaningful real growth in aggregate ad spending suggests that if there is a GDP accounting problem, it does not involve the undercounting of revenues, but rather the difficulty associated with calculating the value of services for which revenues do not exist.⁸ Even if one agrees that real GDP should increase when a consumer switches from a printed road atlas to a Google

3 Brynjolfsson, B. and Oh, J. (2012), "The Attention Economy: Measuring the Value of Free Digital Services on the Internet," Thirty Third International Conference on Information Systems, Orlando 2012.

4 Soloveichik, R. (2014), "Valuing 'Free' Entertainment in GDP: An Experimental Approach," Bureau of Economic Analysis Working Paper.

5 The CMO Survey, American Marketing Association and McKinsey & Co., February 2015.

6 Perry, M. (2013), "Creative destruction: Newspaper ad revenue has gone into a precipitous free fall, and it's probably not over yet," American Enterprise Institute.

7 McKinsey & Co. Global Media Report 2014 and eMarketer, June 2014.

8 Nakamura, L. and Soloveichik, R. (2015), "Valuing 'Free' Media Across Countries in GDP, Federal Reserve Bank of Philadelphia, Working Paper No. 15-25.

1 Yellen, J. (2015), "The Outlook for the Economy," May 22, 2015.

2 C.f. "Silicon Valley Doesn't Believe U.S. Productivity is Down," Wall Street Journal, July 16, 2015.

Maps app, there is no getting around the decline in *actual spending* on maps that results from this product substitution. If accounting techniques were changed so that real GDP increases as a result of this transaction, the gain would have to be “booked” as a drop in the price level, as innovation allows consumers to buy a larger bundle of goods and services at a lower price.

The notion that the price level – the cumulative rate of inflation – is systematically overstated also animates arguments that real business investment since the Great Recession greatly exceeds official estimates. Fed researchers estimate that when properly accounting for improvements in quality, the price of data storage has declined by 28% per year since 2002, which implies that real business investment in data storage has grown 4x faster than indicated by official GDP estimates.⁹ Similar quality adjustments for improvements in computing power suggest that real business investment in high-tech equipment since 2009 has been 17% larger than official estimates.¹⁰

The same phenomenon is evident in the market for consumer devices. The flow of services provided by a mobile phone in 2015 is in some respects superior to those provided by the combination of a digital camera, laptop computer, stereo system, DVD player, and television in 2005. Yet, the average revenue Samsung earns for each smart phone it sells today is virtually the same as the revenue Research in Motion earned on each Blackberry shipped a decade earlier (\$350).¹¹ Realistic adjustment for product quality would suggest that today’s smartphones are worth thousands of “2005” dollars.

Not All Content is Free

Appreciation for the scale of innovation observed over the last 30 years does not necessarily lead one to conclude that GDP is understated. No one can seriously doubt that the tech sector has materially improved living standards and

No one can seriously doubt that the tech sector has materially improved living standards and dramatically increased the ease and speed of communications; the question is whether the changes introduced by this innovation have been adequately captured in national income.

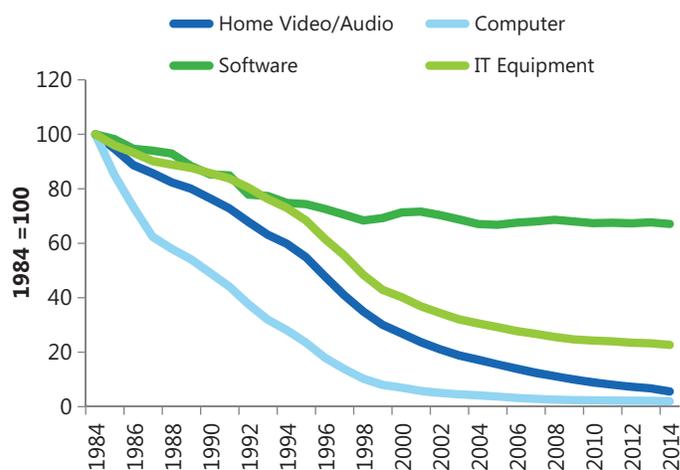
dramatically increased the ease and speed of communications; the question is whether the changes introduced by this innovation have been adequately captured in national income. While there is reason to suspect deflation in high-tech equipment has contributed to the decline in measured business investment, current GDP accounting practices seem appropriate, on the whole, for three reasons.

9 Byrne, D. (2015), “Prices for Data Storage Equipment and the State of IT Innovation,” FEDS Notes.
 10 C.f. Byrne, D. and Pinto, E. (2015), “The recent slowdown in high-tech equipment price declines and some implications for business investment and labor productivity,” FEDS Notes.
 11 2014 Samsung Annual Report and exhibits in Apple v. Samsung Electronics, available [here](#).

First, the notion that content is falling in price or becoming entirely ad-supported is belied by recent developments in live sports programming. Over the past decade, live sports has transitioned from “free” ad-supported television to subscription-based cable networks, with major events like the World Series and college football championship only available to subscribers. Cable networks have found that live sports are one of the few products for which consumers are willing to pay high monthly subscriptions and have bid up the price of sports rights packages.¹² Since 2000, the average cost per sports channel on cable has increased 2.75x.¹³ Increased sports programming costs have led Time Warner Cable, Cablevision and DirecTV to raise prices or institute “sports surcharges.” If content is free, perhaps that says something about the value consumers attach to it.

Second, improvements in product quality must be viewed in the context of consumer substitution in response to changes in relative prices and obsolescence.¹⁴ Some degree of product improvement is required to stimulate new purchases. The industrial economics concept of “planned obsolescence” suggests that businesses innovate to shorten product lifecycles and boost revenue.¹⁵ In cases where consumers do not perceive next generation devices as significant improvements over prior iterations – as in the market for tablets like the iPad – lifecycles lengthen and sales growth slows.¹⁶ The quantity of units sold says a lot about the degree of quality improvement in the next generation of high-tech products and *further* adjustments to price indexes beyond those already included in official data (Figure 1) risks double-counting the real value of such innovation.

FIGURE 1 Cumulative Price Changes by Category, 1984-2014¹⁷



12 TV Sports Rights: Show them the Money, Financial Times, February 13, 2015.
 13 “Bidding war between networks, sports leagues will increase price of cable TV,” Washington Post, January 23, 2015.
 14 McCully, Clinton, P. et al. (2007), “Comparing the Consumer Price Index and the Personal Consumption Expenditures Price Index,” Bureau of Economic Analysis.
 15 Fishman, A. et al. (1993), “Planned Obsolescence as an Engine of Technological Progress,” *Journal of Industrial Economics*.
 16 Gartner Says Tablet Sales Continue to Be Slow in 2015, Gartner, January 2015.
 17 BEA, NIPA Table 2.4.4.

Finally, the complex relationships between complementary products can sometimes obscure the link between payments and value-added. The price consumers pay for broadband internet and smartphones is influenced by the information, content, apps, and social networks available online. Similarly, demand for digital content depends on the speed and quality of the network over which it is delivered. A telecom provider's past decision to invest in fiber optics and mobile broadband transmission technology depended heavily on the assumption that a robust market for online content and apps would develop. The increase in online content represents the "network utilization" required to generate the data subscription revenues that ultimately pay for the initial network buildout.¹⁸

Moreover, current estimation methods already account for any increase in the dollar value of economic activity that occurs thanks to new technology. If Uber increases the frequency with which people contract for transportation services, that increase is counted towards GDP. If Facebook allows a band to keep in better contact with its fans, any additional tickets sold on the upcoming tour will get counted towards GDP. If the ease of shopping on Amazon increases purchases of otherwise hard-to-find toys and electronics, the increase in retail sales will be reflected in GDP. If Google allows information to be gathered at a faster pace, any resulting increase in economy-wide sales will be in GDP, with a corresponding boost in productivity. Serious accounting might reveal the "missing internet GDP" has already been counted elsewhere.

¹⁸ The shift in telecom investment represents a classic "upstream" and "downstream" Goodridge, P. (2013), "The 'C' in ICT: Communications Capital, Spillovers, and U.K. Growth," Imperial College Business School.

Conclusion

To many observers in Silicon Valley, worries about slowing U.S. productivity growth seem misplaced given the pace of technological change and improvements in living standards. While there are reasons to believe GDP misses some consumer substitution towards digital goods, any undercounting is likely to be modest. Most of the gains from technology are already reflected in the output and efficiency gains elsewhere in the economy. Unfortunately, the productivity slowdown cannot be explained away by mismeasurement. If nominal GDP growth does not accelerate, the current pace of payroll growth will likely prove unsustainable and slow markedly in 2016.

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