

## **Risks from Waiting under Digital Uncertainty**

**A REPORT OF THE  
G7 CENTRAL BANK DIGITALIZATION WORKING GROUP**

**July 2019**

NOTE: This report was circulated to G7 Central Bank Governors to stimulate discussion. The analysis and recommendations set forth in this report are those of the authors and do not represent the views of the respective Central Bank Governors or their institutions.

The G7 Central Bank Digitalization Working Group consists of representatives of the G7 central banks and the IMF, established by the Bank of Canada during Canada's 2018 G7 Presidency. The Bank of Canada chairs the group. Member names are listed at the end of the report.

## Risks from Waiting under Digital Uncertainty

### Issue

There is a growing risk that the key economic and financial relationships that are relevant for monetary policy are changing in ways that are not fully understood. Advances in several areas, including artificial intelligence (AI) and machine learning (ML), have the potential to change how economic activity is structured and significantly boost productivity. They also have the potential to alter the distribution of income and market power. Changes to the transmission of monetary policy—and the risks associated with the effective lower bound on interest rates—could follow. Some of these technologies are just beginning to be diffused, so discussions around their potential impact are in many ways speculative. But two things are clear. First, digitalization necessitates advances in the measurement of inflation, output and productivity to help guard against the risk of monetary policy errors. Second, government policy also needs to keep pace to ensure that we collectively realize the full benefits of digitalization and address potential downside risks.

### *Signs of digital diffusion from existing statistics*

There is already evidence that economic activity has become increasingly digital and this is expected to accelerate.<sup>1</sup> Satellite accounts that extract the value of digital activity from national accounts statistics (US, Canada) show that it rivals or exceeds the size of traditional sectors. They also show that digital-intensive occupations are leading job growth. While total investment growth in advanced economies started to slow in the second half of 2018 as uncertainty from trade and geopolitical tensions took its toll, investment in digital processes like software continued to rise.<sup>2</sup> Cloud computing services are increasingly being adopted by firms and spending on these services has been comparable in size to the telecom investment wave in the late 1990s (**Figure 1**). Innovations in consumer content delivery have accelerated since the mid-2000s in tandem with rising consumer digital capital use (**Figure 2**). E-commerce is rising in importance. For firms that participate in online markets, prices appear to vary more strongly and more often than assumed in typical monetary policy models.

### *The key missing pieces from a central bank perspective*

Monetary policy requires reliable estimates of inflation and the variables used to estimate productive capacity and labour market tightness in the economy. Digitalization will increasingly call this reliability into question in the absence of further advances in measurement.

The rapid development of new goods and services, increased product and price customization and quality changes associated with digitalization make the measurement of inflation more challenging than it has been historically. Some of the problems might be addressed by more frequent updates of the basket of goods and services that underpins official measures of inflation. Other innovations are more difficult to capture (e.g., time spent consuming high-quality content via networked devices) as they do

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<sup>1</sup> Digitalization refers to the shift in the way we record and process information from analogue to digital systems. For example, when setting prices, some businesses increasingly rely on AI systems instead of the judgment of sales representatives. As digital technology evolves and diffuses, and the cost of using it for prediction continues to fall, it can result in more significant changes.

<sup>2</sup> It is plausible that more traditional investments are postponed during periods of heightened uncertainty, while investments in digital capital, which take less time to build and involve fewer sunk cost elements, are pursued anyway.

not involve a market transaction at the time of consumption, which is where price collectors look to pick up new goods as they appear.

Estimates of the productive capacity of the economy and labour demand and supply are also being affected. Intangible investment—spending on software, data, and business processes, especially AI/ML—is expected to be a driver of productivity growth. But measurement is challenging. Likewise, welfare effects and cross-border activities of platforms and cross-border data flows enabled by digitalization are either unmeasured or measured poorly.

Digitalization will increasingly call the reliability of economic data used for monetary policy into question in the absence of further advances in measurement

Platforms facilitate matching and may thereby create new capacity out of otherwise unused (or underused) assets. Firms also increasingly consume shared services on an on-demand basis instead of more traditional investment that takes time to build or implement. Platforms are also facilitating new forms of self-

employment (including “gig” jobs), which may be leading to mismeasurement of employment, unemployment and wages. Taking these shifts together, unobservable variables like potential output and capacity pressures, which are key inputs into monetary policy decisions, are becoming more uncertain.

Changes in market power have important implications for gauging inflationary pressures and the transmission of monetary policy. Proxies of market power and competition can be subject to misreporting and mismeasurement biases or considerable time lags.

### ***Recent evidence on the potential size of the mismeasurement***

Better accounting of digital activity could have meaningful effects on the data on which monetary policy decisions are based. Recent experimental estimates suggest that the unmeasured value of investment expenditures and capital stock in data, databases and data science is significant and growing rapidly.<sup>3</sup> Federal Reserve staff research suggests that declines in official prices indexes are increasingly being understated because the quality change in prices for digital goods and services is unaccounted for (**Figure 3**).<sup>4</sup> This work suggests that the slowdown in US GDP and productivity growth since 2007 would be less pronounced if the value of consumer digital goods and services (both free and market-based) were more carefully measured (**Figure 4**). The US GDP growth and productivity slowdown is mirrored by other G7 countries (**Figure 5**), but it will be difficult to assess whether the decline is similarly overstated without greater cross-country consistency in price indexes. Recent research shows a wide variation in official price trends across G7 and other countries even among information and communication technology product classes that share a common global supply chain. While differences in market concentration and consumer tastes may play a role, differences in measurement methods appear to be

<sup>3</sup> Statistics Canada. [The value of data in Canada: Experimental estimates](#), 2019.

<sup>4</sup> Byrne, David, and Carol Corrado. Accounting for Innovation in Consumer Digital Services: IT Still Matters. No. w26010. National Bureau of Economic Research, 2019.

overstating the degree of variation.<sup>5</sup> Comparability of statistics across member countries is essential for ascertaining differences in the impact of policy.

### Implications for monetary policy

Each of the many facets of digitalization may have important implications for monetary policy. The economics literature is still working through the anticipated impacts.

As digitalization enables firms to better predict future costs and change prices more easily, inflation may become more sensitive to changes in real activity. Digitalization could also decrease costs, due to its direct effects on productivity and by facilitating more flexible labour markets and global competition. Lower costs, especially when combined with a greater responsiveness to economic activity, would put downward pressure on inflation. Improvements in productivity may also increase businesses' demand for capital, which should raise trend growth and lead to a higher neutral rate of interest ( $R^*$ ).<sup>6</sup> Higher trend growth means there is more wealth to share broadly, all else equal. A higher  $R^*$  means that monetary policy has more room to manoeuvre to respond to economic shocks before hitting the effective lower bound on interest rates.

There are alternative paths. If digitalization excessively increases the market power of large firms, it could put upward pressure on prices (**Box 1**). This could reduce the sensitivity of inflation to changes in economic activity, and hence monetary policy.<sup>7</sup> Risks that falling competition could put meaningful upward pressure on inflation may be considered small in a world of low inflation. There is also the concern that firms with greater market power tend to innovate and invest less than

### Box 1: A FOCUS ON COMPETITION

An important channel through which digitalization affects the economy is its impact on market power. There is considerable uncertainty around the direction of the impact, however. Borderless technologies can reduce barriers to entry and therefore increase competition. At the same time, features of the digital economy can also enable the rise of “superstar” firms. Data from a large network can create a formidable barrier to entry. Firms could use their position as gatekeepers to crucial online services to impede competition.

There is evidence that mark-ups have been rising, particularly in digitally-intensive industries (**Figure 6**). This could reflect declining competition but may also reflect the nature of the technology. If the fixed costs of developing the technology or launching a platform are very high and operating costs if successful are very low, high markups may result from needing to cover the fixed cost given the riskiness of the investment.

**Whether digitalization increases or decreases competition is an empirical question that has yet to be answered.** The impact on prices is also unclear. The same network effects that can create winner-takes-most markets may equally give the firm an incentive to price competitively to prevent a competitor from capturing their entire customer base.

<sup>5</sup> Byrne, David. The Mysterious Cross-Country Dispersion in Mobile Phone Price Trends. Board of Governors of the Federal Reserve System (US), 2019.

<sup>6</sup> There is some evidence to suggest that the extent of the increase in firms' demand for capital may be more limited than in the past due to the nature of some digital technologies. Incomplete measurement of intangible capital may be playing a role.

<sup>7</sup> Some digital platforms have such low short-run marginal costs and such high markups that cost shocks induced by monetary stimulus could be effectively ignored by these firms, thus reducing the effectiveness of monetary policy.

they would under conditions of greater competitive pressure, which could put downward pressure on  $R^*$ . Automation could also depress the labour share and wage growth, particularly for the low and middle-skilled. While technology should ultimately create more jobs than it disrupts, the adjustment period could be prolonged if policy is slow to adjust to smooth the transition. A trend toward a less-even income distribution would affect the transmission of monetary policy and could further depress  $R^*$ .<sup>8</sup>

Empirical evidence suggests that  $R^*$  has trended downward in G7 countries over recent years. If digitalization depresses  $R^*$  further, central banks will be conducting monetary policy closer to the effective lower bound more often, complicating the task of achieving their inflation objectives.

Reliable data are needed to help detect which destination we are heading toward and policy needs to keep pace to ensure we are on the right path. Central bankers are left to take it as a risk to their inflation outlook in the meantime—weighing the possibilities that digitalization is either providing a boost to aggregate supply that is helping to hold inflation pressures at bay, or generating market structure shifts that may lead to much less favourable outcomes. Uncertainty related to mismeasurement adds to the risk of monetary policy errors.

### What can be done

Efforts of statistical agencies and other international initiatives to better measure the digital economy are critical. National statistical agencies are encouraged to continue to identify new data sources, experiment with new techniques of data collection and analysis enabled by digitalization and increase efforts to coordinate measures of digital-based activity across jurisdictions. Efforts to refresh inflation baskets more frequently and build infrastructure to use big data would help ensure reliable inflation statistics. Easing statistical agencies' access to administrative data held by other government agencies (tax authorities and regulators) would be another way to help improve statistics.

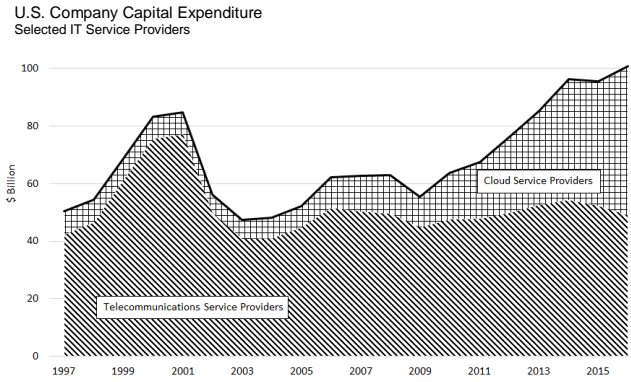
Coordinated action to think creatively about national accounting in light of digitalization, both domestically and internationally, is strongly encouraged. Satellite accounts have been developed to measure digital activity in the US and Canada and to measure investment in data in Canada. These accounts could be readily adopted elsewhere. Finding better ways to measure shifts in market power and their implications would help inform directions for competition policy.

Through mechanisms such as the G7 Central Bank Digitalization Working Group (DWG), G7 central banks and the IMF will continue to work together to advance our understanding of the economic impacts of digitalization as it unfolds and assess the implications for monetary policy and its transmission. This includes sharing experiences and collaborating on ways to better measure digital activity, continuing to study the effects of digitalization on the Phillips curve and the evolution of the labour market, and helping to make progress and encourage international dialogue on the aspects of digitalization relevant to the priorities of Finance Ministers and Central Bank Governors.

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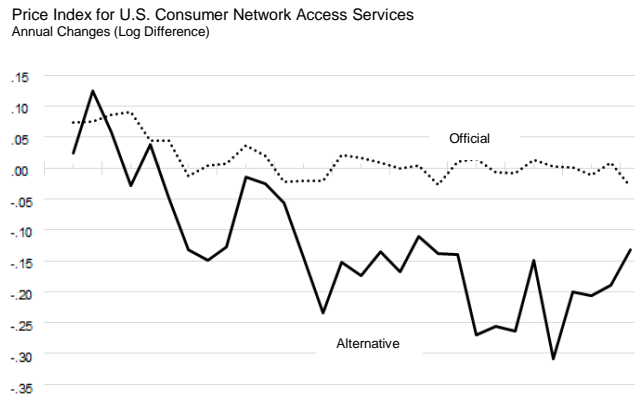
<sup>8</sup> Increases in inequality shift income to those with lower propensities to consume, which may increase the savings rate.

**Figure 1:** US IT investment by companies providing consumer and business IT services has reached new highs



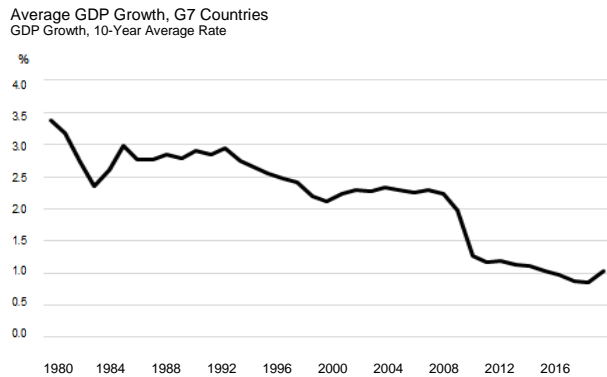
Source: Byrne, Corrado, Sichel (2018). Authors' tabulation of company financial filings.  
Note: Included cloud service providers meet Cisco definition of hyperscale. Included telecommunications service providers are AT&T, Verizon, Sprint, T-Mobile US, Century Link and related companies.

**Figure 3:** Capturing new consumer digital goods and services suggests weaker US inflation than official indexes



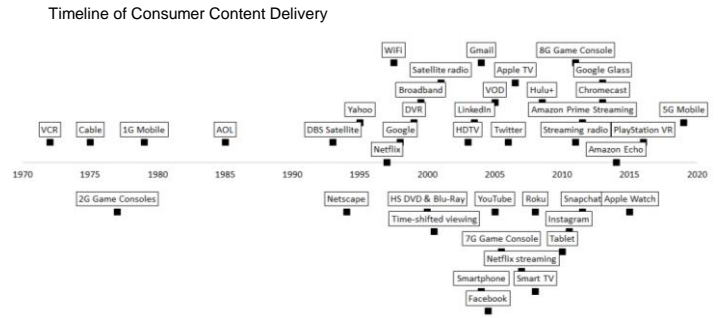
Source: U.S. Bureau of Economic Analysis (official index); Byrne and Corrado (2019).  
Note: Consumer network access services include cable television, internet, mobile phone, and subscription video on demand. These services accounted for 2.6 percent of U.S. personal consumption expenditures in 2018.

**Figure 5:** Measured GDP growth has slowed over time across G7 countries



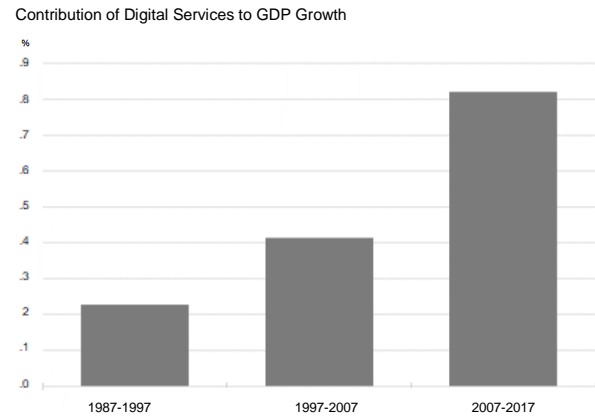
Source: OECD.  
Note: GDP growth at constant prices, expenditure approach, averaged across G7 countries.

**Figure 2:** Innovations in consumer content delivery have accelerated



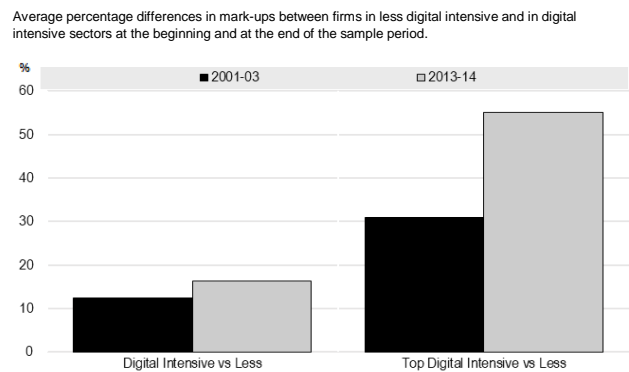
Source: Byrne and Corrado (2019). Authors' elaboration and extension of information on *Total Audience Report*, The Nielsen Company, Dec. 3, 2014.

**Figure 4:** Exclusion of new consumer digital services could explain some of the observed US GDP growth slowdown



Source: Byrne and Corrado (2019).

**Figure 6:** OECD evidence shows that markups have increased, particularly in digitally-intensive sectors



Source: OECD elaborations on Calligaris, Criscuolo, Marcolin (2018), *Mark-ups in the Digital Era* (this version: July 2018).

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