

DIGITALIZING THE JAPANESE ECONOMY¹

The COVID-19 pandemic has put a spotlight on Japan's uneven state of digitalization. While Japan is a leader in various technology frontiers including use of industrial robots, it lags behind its peers in digital adoption by businesses (ICT investment and e-commerce), government services, and financial services. Cross-country empirical analysis suggests that an expansion of digital services and innovation in Japan, through an increase in ICT investment, could improve labor productivity. Japan also has scope for a sizeable expansion of e-commerce and digital payments, which would help the country further reap the benefits of the digital economy. While the government's digital transformation strategy would help accelerate digital adoption, strengthening policies to ensure data privacy, digital literacy, consumer protection, and cybersecurity are also important.

A. Introduction

1. Although Japan remains a leader in various technology frontiers, its adoption of digitalization significantly lags behind other countries (Figure 1). According to the OECD Digital Economy Outlook 2020, Japan's digital infrastructure availability (internet usage rate, mobile broadband penetration rate, internet speed) is considered to be at a high level. At the same time, the country has made significant strides in automation and is one of the top users of industrial robots in the world. However, it is sharply lagging in the digitalization of businesses, government services, and financial services. For instance, uptake of online government services was below ten percent in Japan, the lowest level among OECD countries. Public sector and business transactions in Japan still rely on paper documents and personal seals. Japan is ranked below eight other Asia Pacific countries in the 2020 IMD World Digital Competitiveness Ranking,² which shows that Japan faces a lack of capital and human resources in the digital field, insufficient flexibility in business transformation, and obstacles to regulatory frameworks in comparison to other countries.

2. This chapter focuses on the opportunities associated with the expansion of digitalization in Japan. The following areas of Japan's digital economy are analyzed—investment in information and communication technology (ICT), the digitalization of consumption (e-commerce), and the digitalization of finance (digital financial services). The sections are organized as following: Section B provides an overview of the recent trends and gaps in Japan's digital economy, including related regulatory developments; Section C estimates the economic impact of digitalization; and finally Section D concludes with a discussion of priority policies towards reaping the economic benefits of Japan's digital transformation.

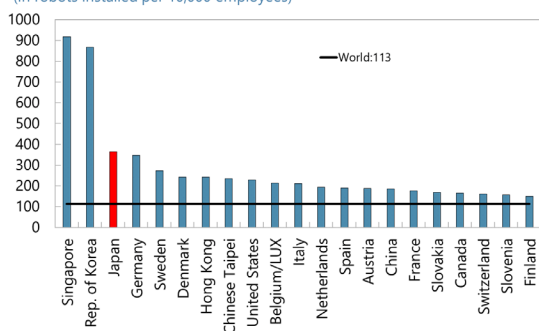
¹ Prepared by Purva Khera and Rui Xu (both APD).

² The full ranking can be found at [IMD World Competitiveness Centre](https://www.imd.com/world-digital-competitiveness-ranking).

Figure 1. Japan's Digital Competitiveness

Robot Density in the Manufacturing Industry 2019

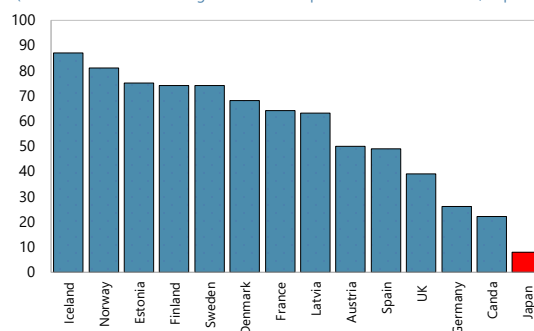
(In robots installed per 10,000 employees)



Source: International Federation of Robotics.

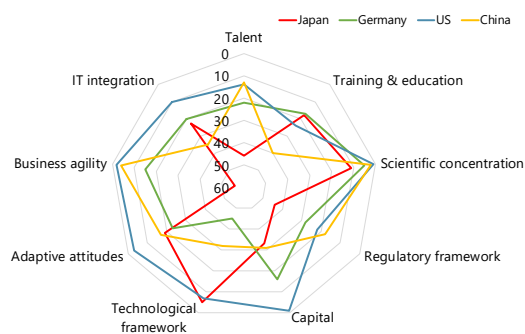
Uptake of Digital Government Services, 2020

(share of individuals sending filled forms via public authorities website; in percent)



Source: OECD Going Digital Toolkit.

IMD World Digital Competitiveness 2020

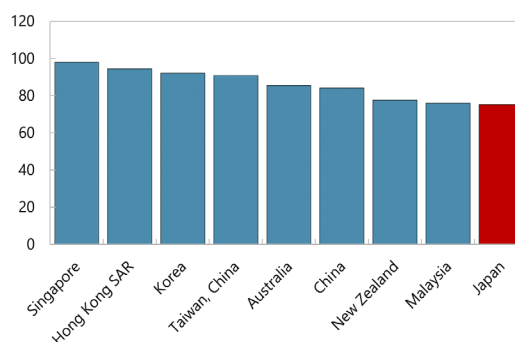


Source: IMD.

Note: The numbers in the graph are the rankings in the surveyed countries.

Digital Competitiveness in Select Asia Pacific Countries (2020)

(Max score is 100)

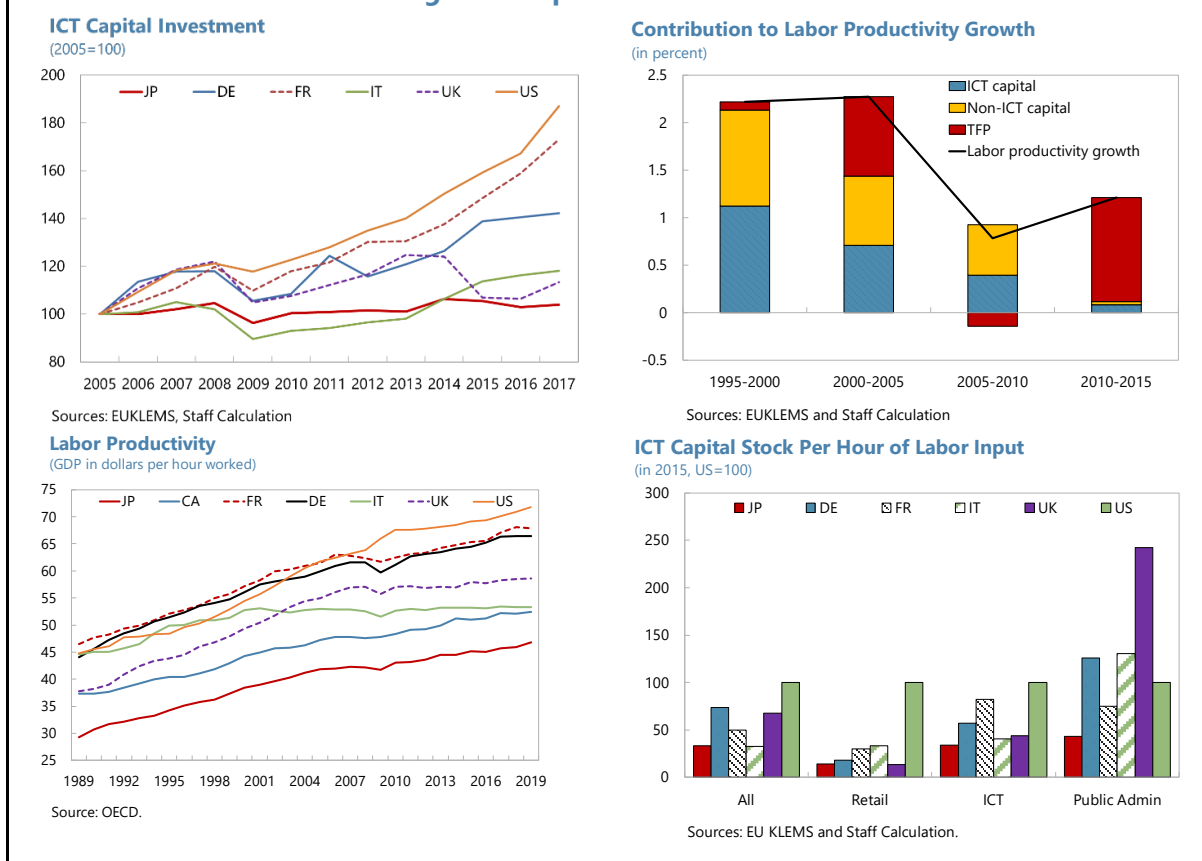


Sources: IMD World Digital Competitiveness Ranking 2020

B. Japan's Digital Drag: An Overview of the Digital Economy

3. ICT investment in Japan has been stagnant since 2005, falling behind other advanced economies (Figure 2). More than 80 percent of Japanese companies have legacy IT systems that are both inefficient and expensive to maintain. This is because most Japanese firms view IT investment as a cost instead of profit-generating (see McKinsey & Company 2020). Insufficient ICT investment has reduced the contribution of ICT capital to labor productivity growth in recent years, preventing Japan from catching up with the other G7 countries.

Figure 2. Japan's ICT Investment



4. While the pandemic has accelerated the change in consumption behavior towards increased online shopping and e-commerce, there remains a sizeable scope for expansion (Figure 3).³ In 2020, e-sales grew by close to 20 percent in Japan. The percentage of households that engage in online spending has also risen since 2017 and peaked at close to 51 percent (June 2020) in the midst of the pandemic, including amongst the older population. However, despite recent growth, Japan's e-commerce accounts for only close to 3 percent of GDP, much lower than peers in Asia and other advanced economies. There remains significant scope to expand e-commerce adoption among Japanese firms and consumers.

5. Growth in e-commerce has been supported by the increased use of digital payments, but Japan's transition to cashless payments has been relatively slow (Figure 4). Cashless payments grew at the fastest rate in the wake of the COVID-19 outbreak and increased to 30 percent of Japan's consumer spending in 2020.⁴ Nonbanks play a significantly larger role – the monthly active users of the top five non-bank digital payment applications is roughly three times that of the top five bank applications (Bank of Japan Review, 2021). However, use of digital payments in Japan remains far below that of comparators – the ratio of cashless transactions in

³ E-commerce refers to business-to-consumer commerce, and does not include business-to-business sales.

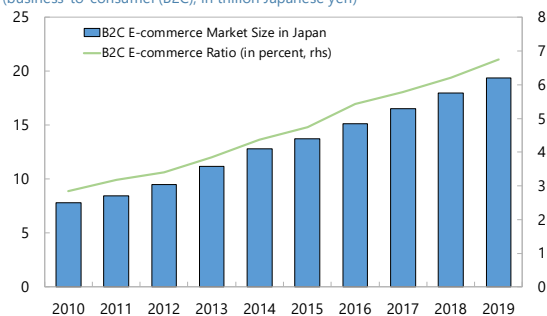
⁴ The cashless ratio, compiled by the Ministry of Economy, Trade and Industry, is the share of private final consumption expenditure paid using credit and debit cards, electronic money, and QR code payments.

South Korea was close to 95 percent, the UK was more than 55 percent, and the US more than 45 percent. Only Germany among the major economies has a lower ratio of cashless transactions at close to 20 percent.

Figure 3. E-commerce Adoption in Japan

E-commerce Market Size in Japan

(business-to-consumer (B2C), in trillion Japanese yen)

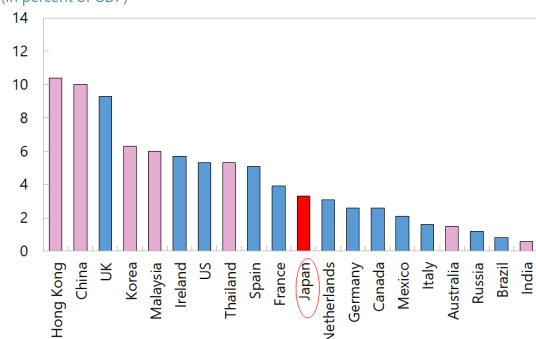


Source: Ministry of Economy, Trade and Industry.

Note: E-commerce ratio refers to the e-commerce market scale to the total amount of overall commercial transactions

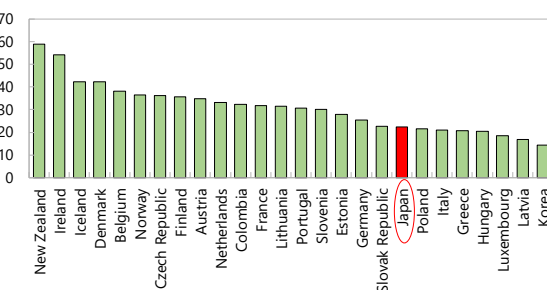
E-commerce Sales Across Countries, 2018

(in percent of GDP)



Source: United Nations Conference on Trade & Development, 2018.

Businesses Receiving Orders Over the Internet, 2019



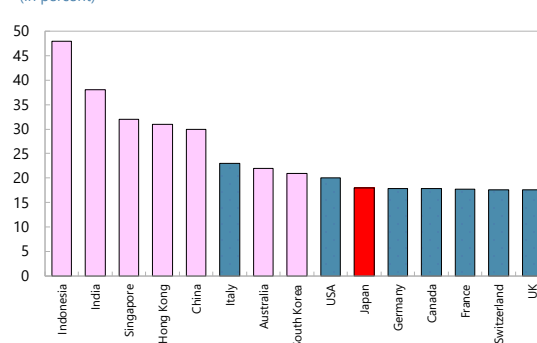
Source: OECD, ICT Access and Usage by Businesses.

Note: Data for SMEs (50-249) employees.

2018 data is used for New Zealand, Iceland, Colombia, Portugal, Japan, and Korea.

Growth in E-sales During the Pandemic, 2020

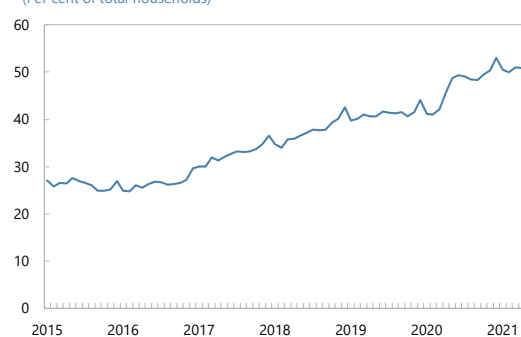
(in percent)



Source: Statista.

Households Using Online Shopping

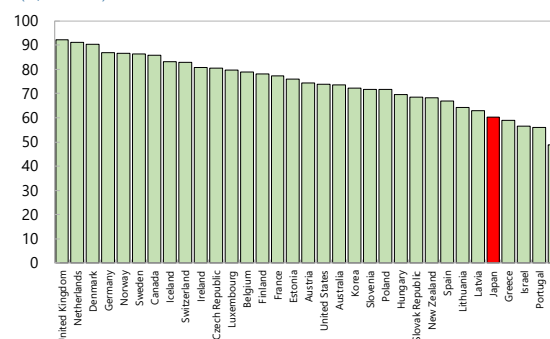
(Per cent of total households)



Source: Ministry of Internal Affairs and Communications.

Share of Internet Users who have Purchased Online

(%, 2019-20)



Source: OECD, Going Digital Toolkit.

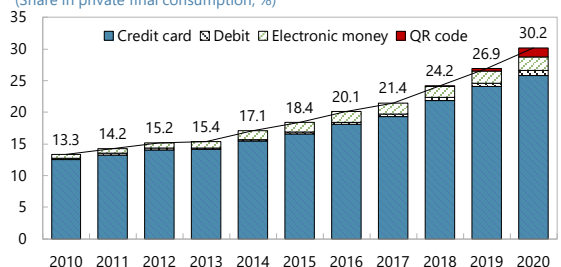
6. Cash use remains entrenched in Japan (Figure 4). Currency in circulation (a proxy for cash use) is by far the highest amongst peers in Japan, at [20] percent of GDP, and has been increasing over time. Japanese households held over 55 percent of their total financial assets in cash at end-2020, versus the United States and Euro Area where cash accounted for 22 and 34 percent of total financial assets, respectively. Structural factors explain Japan's high preference for cash. On the

demand side, an ageing population, the low interest rate environment, availability of high denomination notes, privacy and anonymity issues, concerns about overspending, and low crime rate play important roles (Bech et al., 2018). On the cash supply side, Japan has one of the highest concentrations of bank branches and ATMs which represents a convenient and inexpensive cash supply chain (Payments and Settlements Systems Report, 2019).

Figure 4. Digital Payments in Japan

Cashless Payments in Japan

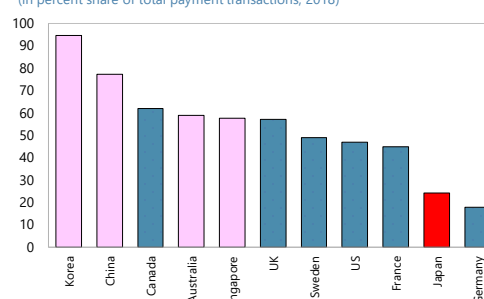
(Share in private final consumption, %)



Sources: Cabinet Office, Bank of Japan, Japan Consumer Credit Association, Payments Japan.

Cashless Payments Across Countries

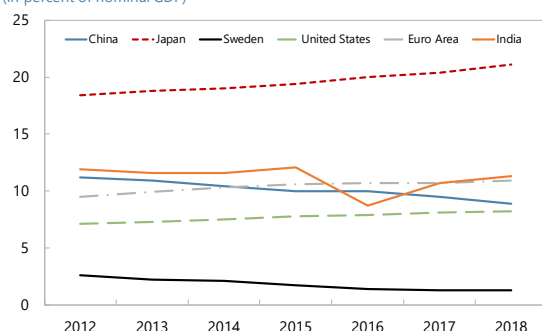
(in percent share of total payment transactions, 2018)



Sources: Payments Japan, BIS, Euromonitor International.

Banknotes and Coins in Circulation in Major Countries

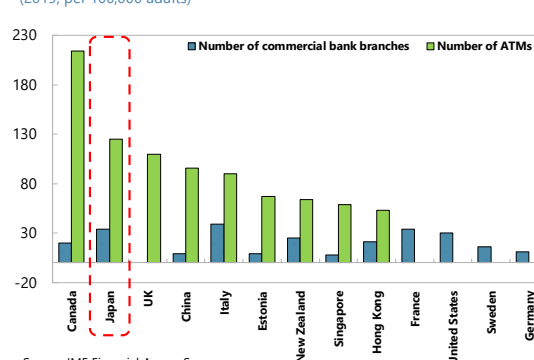
(In percent of nominal GDP)



Source: BIS.

Access to Bank Branches and ATMs

(2019, per 100,000 adults)



Source: IMF Financial Access Survey.

7. Japan has introduced a range of initiatives to support digitalization, a top priority of the current government's reform agenda. In September 2021, a new Digital Agency was set up to control the government's entire IT system budget and to expedite a digital overhaul of administrative procedures as well as of key sectors such as healthcare and education. Priority areas include: (i) improving online administrative procedures and reducing reliance on hand-stamping paperwork; (ii) promoting the use of 'My Number' digital ID cards and linking it to bank accounts; and (iii) advancing deregulation to allow online medical services and education. New tax incentives were also introduced to promote ICT investment by the private sector. Measures have also been adopted to promote cashless payments towards the government's target of a 40 percent cashless ratio by 2025 — the government offered reward points for using cashless payment instruments and also subsidized retail stores to install cashless payment equipment (up to March 2020) following the consumption tax hike in October 2019.⁵ More recently, in May 2021, the Payment Services Act was

⁵ This is called the [Point Reward Project for Consumers using Cashless Payment](#).

revised to remove the upper limit on fund transfer services by nonbanks,⁶ while also reducing inter-bank fund transfer fees,⁷ which would help ensure a competitive environment.

C. Potential Gains from Digital Transformation in Japan

8. Digitalization can boost labor productivity through ICT capital investment and total factor productivity gains. Reviving ICT capital investment can directly enhance labor productivity by increasing capital input. In addition, ICT investment can improve total factor productivity through IT-induced externalities and IT-leveraged innovations (Chou et al., 2014).

9. We quantify the impact of two specific policies included in the government's digitalization strategy:

- **First, the planned increase of public ICT investment.** As envisaged in the third supplementary budget of FY2020, the government plans to increase public ICT investment by 10 percent in 2021-2023. Although a small increase by itself, the effect of public ICT investment can be amplified through its spillover to private-sector ICT investment. The spillover effect is estimated using the following regression model:

$$\log(ICT\ Inv_{c,t}^{private}) = \alpha_c + \beta_i \cdot ICT\ Inv_{c,t-i}^{public} + \delta_t + \epsilon_{c,t}$$

where c denotes country, i captures the lagged effect, and δ_t is year fixed effects. The model is estimated using data from 20 countries in the EU KLEMS database from 1995 to 2017.⁸ The results suggest that a 10 percent increase in public ICT investment is associated with a 2 percent increase in private-sector ICT investment in four years (Figure 5).

- **Second, the new tax credit.** As specified in the "Business Adaptation Plan" included in the third supplementary FY2020 budget, firms that satisfy the Digital requirements and Business transformation requirements can receive a tax credit of 3-5 percent of their ICT capital investment or apply a 30 percent accelerated depreciation. The tax measures are effective for two years and can incentivize private ICT investment by reducing the relative price of ICT capital. The quantitative effects can be calculated by calibrating a Ramsey-Cass-Koopmans model with ICT capital (Box 1). Assuming a 50 percent uptake of the tax measures, ICT investment could increase by about 3 percent over the medium term.

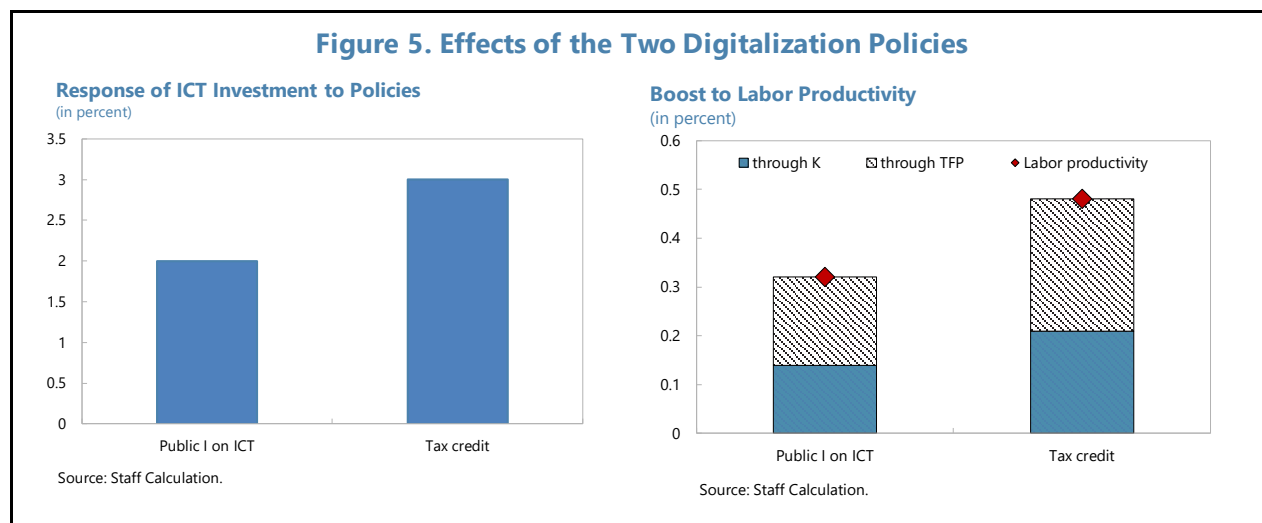
10. The combined impact of these two policies could increase Japan's ICT investment by about 5 percent, raising labor productivity by about 0.8 percent. There are two channels through which ICT capital contributes to labor productivity. First, ICT capital enters production

⁶ Prior to this amendment, funds transfer service providers could only send money up to one million yen.

⁷ The current fee stands at ¥117 for a transfer of less than ¥30,000 and at ¥162 for ¥30,000 or more. The interbank money transfer fees will be lowered to ¥62 per transaction, on average, effective from October 1.

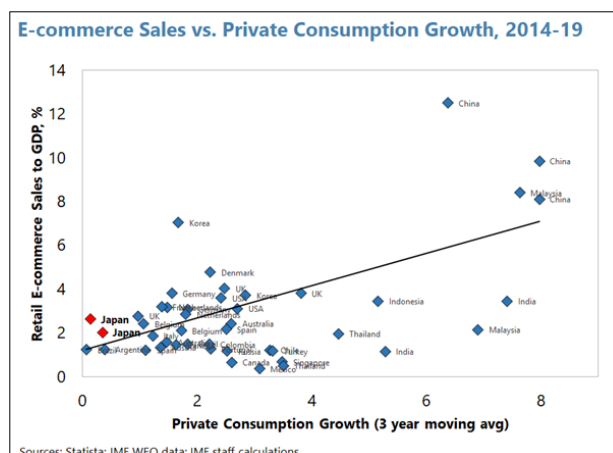
⁸ The sample includes the following 20 countries: Austria, the Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Italy, Japan, Lithuania, Latvia, Luxemburg, the Netherlands, Romania, Sweden, Slovenia, Slovakia, the United Kingdom, and the United States.

directly and boosts the marginal product of labor. The elasticity of labor productivity with respect to ICT investment is estimated at 7 percent. Applying this elasticity, labor productivity could increase by about 0.35 percent through the investment channel. Second, ICT capital can improve total factor productivity (TFP) through IT-induced externalities and IT-leveraged innovations. Applying the elasticity of TFP with respect to ICT investment estimated at 9 percent, the boost to labor productivity through the TFP channel is about 0.45 percent (see details of the estimation in Box 1).



11. Expansion of e-commerce could help Japan further reap the benefits of the digital economy and support medium-term growth. There is increasing evidence that e-commerce can

improve labor and capital productivity. Using firm-level data for 14 European economies covering 2002-10, Falk and Hagsten (2015) show that an increase in e-sales by 1 percentage point raises labor productivity growth by 0.3 percentage points, with a larger effect for small firms and services sector firms. Kinda (2019) shows that Asian firms engaged in e-commerce have on average 30 percent higher total factor productivity than other firms. At the same time, further expansion of e-commerce could create new demand beyond substitution from offline to online, thus boosting the consumption level over the medium-term (Dolfen et al., 2019). In Japan, there is already evidence of these positive impacts. According to a business survey conducted by Japan Fair Trade Commission in 2018, 94 of percent businesses confirmed that they benefitted from online sales through expansion into new business areas and customer bases, and 77 percent indicated that competition intensified in terms of lower prices and higher product diversity, thus also benefitting consumers.



12. Wider adoption of digital financial services could also enhance productivity and efficiency.

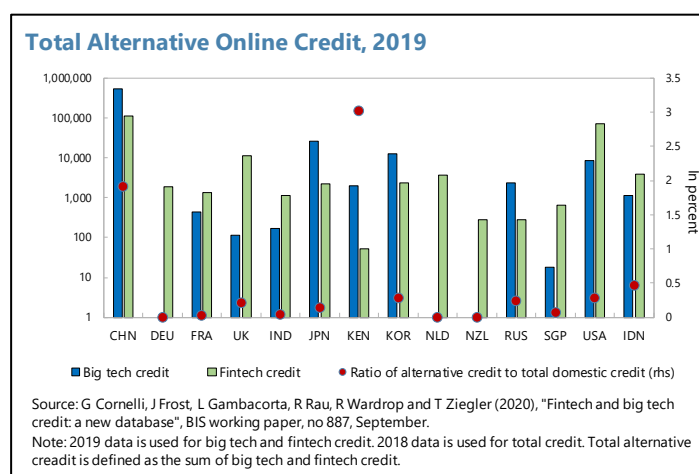
Supplying cash to society is costly, estimated by the Nomura Research Institute to cost around \$15 billion per year (0.3 percent of GDP) in Japan.⁹ As adoption of digital payments becomes widespread, there are opportunities for businesses and financial institutions to enhance productivity by reducing costly labor-intensive cash processing, and harnessing gains from faster payments and data on payment behaviors. Banks across countries have already sharply reduced their networks of ATMs to cut costs (e.g., Sweden, Estonia, Denmark); however, this phenomenon has been relatively slow in Japan despite its structural labor shortages. In Sweden, which is far ahead in the move away from cash – more than half of bank branches are cashless (same as in South Korea) and many retailers do no longer accept cash.¹⁰

13. Moreover, digital data collection could help expand access to finance and help better target government social payments.

A third of Japanese SMEs face financing constraints due to high costs of information, high collateral requirements, and high credit costs ([2017 Financial System Stability Analysis](#)).

This is especially true for start-ups as they do not have a credit history in Japan's credit risk database. Such financial constraints could be alleviated by the "alternative data" generated by the e-commerce and digital payments platforms that allows lenders to identify creditworthy clients and expand more tailored services for borrowers (Sahay et al., 2020). For instance, in Japan, big-tech companies like Rakuten and Amazon have been offering a range of financial products since 2013

including payments, credit cards, mortgages and insurance, making use of the alternative data on their existing user base from their nonfinancial side of business. Digital data collection can also improve the efficiency of public spending by allowing the government to better identify and target social payments assistance. Indeed, the lack of digital adoption may have hindered the Japanese government's response to the COVID-19 shock, as highlighted by the delays in the emergency cash handout program.



D. Policies to Foster Digital Transformation

14. Government-led initiatives are essential in Japan in order to boost digital adoption in the private sector while ensuring inclusion, competition, and innovation. The current government's digital reform agenda identified the public sector as the weak link in digital adoption and is making coordinated efforts to improve public digital services. This top-down approach could

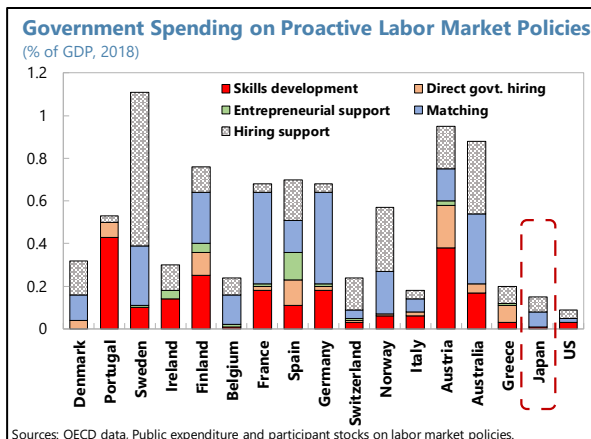
⁹ Maintaining ATMs alone costs about 700 billion yen (\$6.6 billion) annually, and another 100 billion yen is spent handling cash at branch counters.

¹⁰ Sweden has a unique legal framework where a store can refuse to accept cash even though it is a legal tender.

yield promising results through the public sector's influence over the private sector. To be compatible with the new digital systems used by the government, private firms will be compelled to improve their legacy systems.

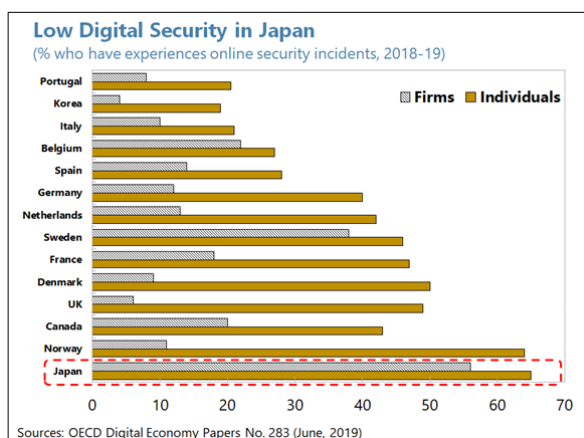
15. To mitigate potential adverse effects on unskilled workers, it is essential to increase labor market mobility and reorient government spending on digital-related education and labor skills, including digital financial literacy.

The digital transformation may lead to displacement of unskilled workers in routine occupations. Under the current dual labor market, it is challenging for the displaced workers to find new jobs with comparable pay. Reforms that reduce duality and enhance labor mobility are necessary to secure wage and welfare gains from digitalization. To facilitate the transition, more retraining efforts, especially on IT skills, are called for. Japan's spending on skills development as a percentage of GDP is low (chart) and lack of labor IT skills is one of the most cited barriers to adoption of IT by SMEs. According to a 2016 survey by the Ministry of Economy, Trade and Industry, Japan's shortage of IT engineers was about 170,000 in 2015 and is estimated to increase to 790,000 in 2030. Moreover, improving financial literacy, which remains low in comparison to peers, is also important. For example, Japanese respondents scored an average of 7 percentage points lower on comparable questions in the [2019 financial literacy survey](#) than respondents in the United States, Germany, and the United Kingdom. At the same time, implementing programs to ensure that senior citizens learn basic digital skills (e.g., the "Seniors Go Digital" program in Singapore), including on how to use e-payments solutions, is also important.



16. Data privacy, consumer protection, and cybersecurity regulations need to be strengthened, while more needs to be done to promote interoperability.

Recent cyberattack incidents have exacerbated general mistrust in the digital economy and discouraged its adoption. In a 2019 survey of Japan's financial institutions, more than 70 percent recognized that the threat of cyberattacks is growing. There is also lack of interoperability¹¹ and fragmentation of different payment platforms, undermining network effects and user convenience.



¹¹ Interoperability facilitates the exchange of data between multiple platforms and provides users with network effects that cannot be achieved by a single platform.

Box 1. Quantifying the Effect of Digitalization Policies: A Hybrid Approach

We quantify the effect of the two policies on labor productivity in two steps. This is because direct estimation is challenging given the lack of data on similar policy changes. Instead, we break the analysis into two steps by first evaluating the impact of the two policies on ICT investment, and then establishing the link between ICT investment and labor productivity. The two-step approach gives the flexibility to use different methodologies in each estimation step.

In the first step, we calibrate a neoclassical growth model to quantify the effect of tax subsidies. The structural approach is preferred to empirical estimation because those tax measures are not commonly used across countries. The model sets up the following optimization problem of a representative household:

$$\begin{aligned} & \max_{\{c_t\}} \sum_{t=0}^{\infty} \beta^t u(c_t) \\ & \text{subject to } c_t + (1-\theta)I_t^{ICT} + I_t^{NICT} = f(k_t^{ICT}, k_t^{NICT}) - T(t) \end{aligned}$$

where output per unit of labor is a function of the total factor productivity (A_t), ICT capital per unit of labor (k_t^{ICT}), and non-ICT capital (k_t^{NICT}): $f(k_t^{ICT}, k_t^{NICT}) = A_t \cdot (k_t^{NICT})^\beta \cdot (k_t^{ICT})^\gamma$; θ is the tax credit on ICT capital, and $T(t)$ is a lump sum tax levied to finance the subsidy on ICT investment. By solving the model with and without the tax credit, we can derive the change of ICT capital in response:

$$\frac{k_{ss}^{ICT, new}}{k_{ss}^{ICT, old}} = (1-\theta)^{\frac{1-\beta}{\beta+\gamma-1}}$$

θ is calibrated at 2.5 percent assuming that 50 percent of the firms will utilize the 5 percent tax credit. β and γ are calibrated by estimating the production function $f(k_t^{ICT}, k_t^{NICT}) = A_t \cdot (k_t^{NICT})^\beta \cdot (k_t^{ICT})^\gamma$ using industry-level data in Japan. The regression results suggest that β is roughly 0.37 and γ is 0.07.

In the second step, we separately estimate the two channels through which ICT investment contributes to labor productivity. For the capital accumulation channel, we use the calibrated value of γ to compute the effect of higher ICT capital on labor productivity. For the TFP channel, we estimate the effect directly using the following regression model:

$$\log(TFP_{i,t}) = \alpha_i + \eta \cdot k_{i,t-1}^{NICT} + \delta \cdot k_{i,t-1}^{ICT} + \omega_t + \epsilon_{i,t}$$

The model is empirically estimated using industry-level data in Japan. The elasticity of ICT on TFP, which is δ in the model, is estimated at 9 percent.

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