JAPAN

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JAPAN

SELECTED ISSUES

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CONTENTS

POST-PANDEMIC FISCAL POLICY: IMPLICATIONS FROM THE BUFFER-STOCK MODEL OF GOVERNMENT[1]

Japan's post-pandemic fiscal policy will face a difficult challenge. Premature fiscal support withdrawal would risk derailing the recovery, while the higher-than-ever public debt and demographic pressures point to a need for fiscal consolidation. To illustrate this trade-off, we tailor a stochastic structural model to the Japanese economy. The model suggests that, in the near term, fiscal policy should be supportive with a view to narrowing the output gap and minimizing hysteresis, while fiscal consolidation at a gradual pace is warranted over the medium-term to rebuild fiscal buffers.

A.   Introduction

1.   Post-pandemic, Japan's fiscal policy will face a difficult trade-off between achieving a strong, durable recovery and ensuring debt sustainability. Japan responded to the pandemic decisively, alleviating its impact on the economy[2]. Amid elevated uncertainty related to the pandemic and the conflict in Ukraine, premature fiscal support withdrawal would risk derailing the recovery. On the other hand, the wider fiscal deficit as a result of these measures, the unprecedented level of public debt, and an expected rise in age-related spending, call for fiscal consolidation after the recovery is firmly in place to ensure debt sustainability. The post-pandemic fiscal policy must strike a fine balance between these two considerations. To illustrate this trade-off and derive policy implications, we tailor a stochastic structural model named Buffer-Stock Model of the Government (Fournier, 2019a) to the Japanese economy.

B.   Set-up of the Model

2.   The model is analogous to the buffer-stock model of the consumer (Deaton, 1991). In that model, a risk-averse forward-looking consumer faces a borrowing limit. He or she saves in good times for a precautionary purpose, and dissaves in bad times. In the Buffer-Stock Model of the Government, the forward-looking benevolent government faces a risk of losing market access beyond a debt limit. The difference between current debt and its limit is equivalent to a buffer.

3.   This simple model is useful to understand the effect of the intertemporal budget constraint on the government's reaction to shocks. The government decides the fiscal stance (defined as a change in the structural primary balance) to maximize household welfare, while being cognizant of debt sustainability concerns. Output is affected by an exogenous shock, which can persist. Recessions reduce potential output, reflecting human and physical capital losses of economic downturns (hysteresis effect). The model incorporates feedback effects between fiscal policy and output, in that the primary balance affects output through the fiscal multiplier, and output affects the primary balance through the automatic stabilizer. The stabilizing role of fiscal

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[1] Prepared by Jean-Marc Fournier (FAD), Anh Dinh Minh Nguyen (FAD), and Takuma Hisanaga (APD).

[2] See Annex III. of IMF (2022) "Fiscal Response to the Pandemic" for details.

policy is constrained by adverse effects of higher debt—a rise in risk premium—and an implementation lag. Based on this set-up, the model recommends an optimal fiscal stance reflecting the following principles (See Appendix for details of the model.):

- **Governments should smooth the cycle.** Counter-cyclical fiscal policy dampens recessions and avoids distortions during overheating, thus improving short-term utility.

- **Highly indebted governments should react less to adverse shocks.** The debt buffer has an insurance value—it is the "reserve" of debt that the government can issue to smooth shocks. When the buffer is small, the probability of market stress is high and the marginal value of an extra unit of buffer is large. This provides an incentive to preserve buffers to guard against future shocks. As a result, when debt is higher, the optimal policy response to offset a negative shock is smaller than when debt is lower.

4.   **The model is calibrated to the Japanese economy.** Key parameters in the model reflect Japan-specific estimates:

- **Sensitivity of interest rate to debt level.** This parameter represents the impact of debt increasing by one percent of GDP on the risk premium measured in basis points (bps). A simple regression analysis is conducted following Tokuoka (2010) which studied the sensitivity of Japanese Government Bond (JGB) yields to public debt. The estimated equation is:

$$nominal\ 10\ year\ bond\ yield\ =\ \beta_0\ +\ \beta_1\ gross\ debt\ +\ control\ variables$$

- Selection of control variables broadly follows Tokuoka (2010), except for the U.S. long-term interest rate that is added as a control variable to capture global financial conditions. An increase in the gross-debt-to-GDP ratio by one percentage point is associated with a rise in JGB yields by one basis point (Right-hand side table). This sensitivity of one is close to the estimate of 0.7 in Mochida (2019), and stands in the middle of the model calibration used in recent Article IV consultations for France (1.5)–a country in a monetary union–(Fournier, 2019b) and for the US (0.5)–the country with the largest reserve currency (Box 7 of IMF, 2020).

Japan: Regression Results

Dependent variable: nominal 10 year bond yield

Explanatory variables	Coefficients
Gross debt	0.01 **
BOJ's holdings of JGBs	-0.01 ***
Private sector financial assets	-0.01
Share of foreign JGB holdings	-0.05 **

(Notes)
1. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
2. R square: 0.93, Observations: 80 (quarterly data from Q4 2000 to Q3 2020)
3. Data sources:
- 10-Year Benchmark Government Bond Yield (EOP, % p.a.): MOF
- General Government Gross Debt in percent of GDP (excluding the bonds issued to finance the Fiscal Investment and Loan Program): Flow of Funds (FoF)
- Central government debt held by the BoJ in percent of GDP: FoF
- Share of foreign holdings of JGBs: FoF
- Private net financial assets held by the household and corporate sectors in percent of GDP: FoF
4. Other control variables: short-term interest rate, inflation, real GDP growth rate, and the US long-term interest rate.

- **The fiscal multiplier.** The fiscal multiplier calibration reflects the country's economic structure such as trade openness, labor market rigidity, business cycle, and monetary policy stance. These elements are combined with

the bucket approach proposed by Batini et al. (2014). Following this approach, we first categorize Japan among the "Medium-multiplier" group (multiplier of 0.4~0.6). Next, both the lower and upper bounds are increased by 30 percent to reflect that the Bank of Japan's (BoJ's) policy rate has been close to the effective lower bound for a long time. As a result, we arrive at 0.5~0.8 as a range of multiplier for Japan and use the mid-point value of 0.65 as the baseline multiplier. Alternative values of multiplier are also considered in sensitivity analysis.

- **Growth-adjusted interest rate.** A text chart on the right shows Japan's interest rate-growth differentials (r-g) between 1995 and 2020. The differential was negative in many years in the 2010s, which contributed to the stable debt-to GDP ratio during the second Abe administration. However, it was positive during 1995 and 2009. This turnover in the sign of the differential illustrates a high uncertainty around its future value. Mindful of this uncertainty, we assume zero as the long-run value of r-minus-g in the baseline of the model, and run the model additionally under both positive (+0.3) or negative (-0.3) r-minus-g scenarios to study sensitivity of the results.

Japan: r-g
(real effective interest rate - real GDP growth rate: 1995-2020)

Sources: Cabinet Office, IMF staff calculations.
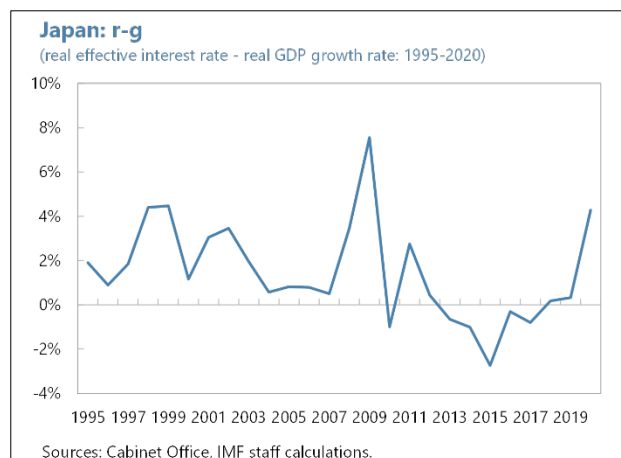
- **Automatic stabilizer** is set at 0.4, which is the semi elasticity of the primary balance to the output gap estimated for Japan by Price et al. (2015).

5.   Data are based on the latest projections. The projections up to 2027 for the current policy scenario are taken from the 2022 Article IV Consultation Staff Report for Japan. Beyond 2027, key variables are assumed to gradually converge over 2028~2030 to long-run values. As for the long-run values, the potential growth rate is assumed to be 0.3 percent, inflation is 1 percent, and the 10-year JGB yield is 1.3 percent. These are consistent with the assumptions in the Debt Sustainability Analysis in 2022 Article IV Consultation Staff Report, except for the 10-year JGB yield which deviated from the assumption in DSA (2.0 percent) in order to match the baseline r-minus-g assumption discussed above.

C.   Fiscal Stance Recommended by the Model

Baseline Advice

6.   The model suggests that the latest economic package should be rolled out decisively to minimize hysteresis. In comparison to the current policy plans, the model suggests a wider deficit in the near-term, driven by a stronger focus on narrowing output gap and minimizing hysteresis. This model result could be interpreted as a policy recommendation to disburse the contingent measures included

in the November 2021 economic package[3] decisively in response to the Omicron wave in early 2022, and the Russia-Ukraine conflict. It is noteworthy that, while the primary consideration underlying the model suggestion is to close the output gap through multiplier effect, a desirable size of fiscal support depends also on other considerations such as the need to provide lifeline assistance to households and firms who are adversely affected by the pandemic or spillovers from the conflict in Ukraine.

7.   The model recommends a medium-term fiscal consolidation. After 2024, the model advice deviates from the current policy scenario, calling for a gradual fiscal adjustment over the medium-term. In contrast to the upward path of public debt in the medium- to long-term in the current policy scenario, the model discerns a need to anchor public debt on a downward path and rebuild fiscal buffers to create room for policy support in case further shocks arise.

Figure 1. Structural Primary Balance and Debt Under the Baseline

Structural Primary Balance
(General Government, percent of potential GDP)

General Government Gross Debt
(Percent of GDP)

Sources: IMF staff calculations.

Source: IMF staff calculations.
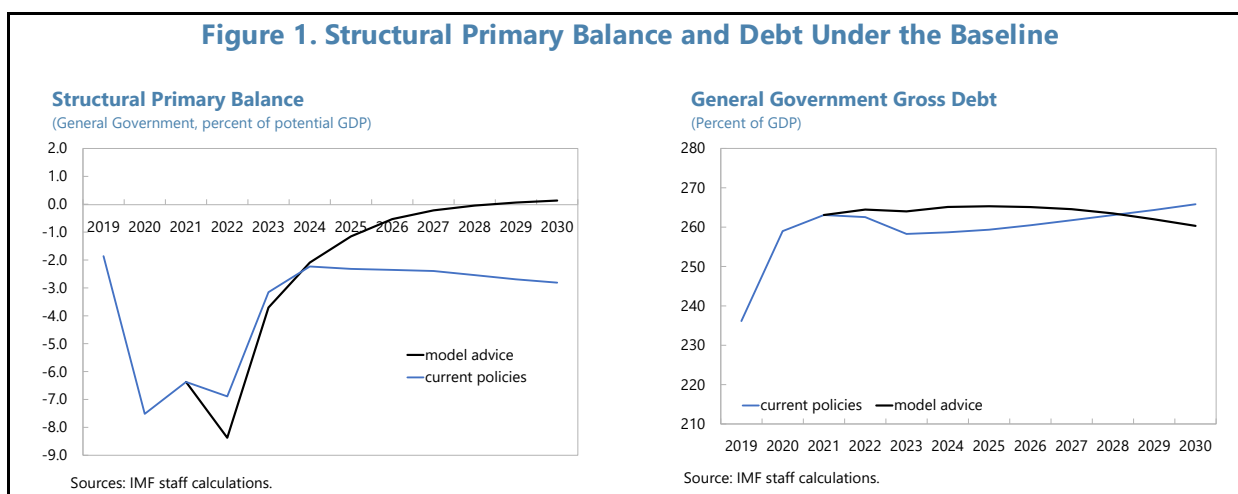
8.   These results are robust to sensitivity checks. To check the sensitivity of the advice to assumptions, we change the parameters one by one. The text chart on the right reports the recommended structural primary balance in 2022, with the baseline scenario in red. The argument for a wider near-term fiscal deficit broadly holds under most of the alternative parameters. That said, a few observations are noted. First, the model does not recommend more stimulus in an alternative scenario without scarring, illustrating that the main motivation for additional stimulus is to avoid hysteresis. Second, if the fiscal multiplier is lower, a wider fiscal deficit is called for, highlighting the importance of targeted support to households and firms which tends to have a higher multiplier than untargeted one. Third, the elimination of fiscal

Recommended Structural Primary Balance in 2022
(percent of potential GDP)

2022 forecast

Sources: IMF staff calculations.
Note: In the lower (higher) multiplier scenario, the multiplier (m1) is 0.5 (0.8). In the lower adjustment cost scenario, the adjustment cost is set at 1.5. In the larger hysteresis scenario, hysteresis is 100% larger than in the baseline. In the higher elasticity of interest to debt scenario, alpha is set at 1.5.

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[3] The economic package announced in November 2021 included measures that are deemed contingent on future health and economic developments, and these measures are not fully incorporated in the current policy scenario. See Annex III. of IMF (2022) for details.

multiplier sensitivity to shocks does not change the recommended fiscal stance. Lastly, sensitivities to the elasticity of interest rate to debt and to the adjustment cost are small.

Scenario Analyses for Near-Term Fiscal Policy

9.   Given large uncertainty surrounding the pandemic, the scale of additional fiscal support should be attuned to epidemiological, economic and geopolitical developments. Two alternative scenarios about the pace of the recovery illustrate this point. The upside scenario envisages a quicker and stronger recovery underpinned by the pent-up demand from households with large savings. In this scenario, temporary support would be smaller and phased out sooner while private demand takes over, leading to frontloaded fiscal consolidation. In the downside scenario, where recovery is hindered further by the Omicron variant and/or the conflict in Ukraine, more stimulus is advisable even if it increases public debt, followed by a larger fiscal adjustment in order to reduce debt afterwards. Automatic stabilizers, which react quickly and accurately to economic developments, can help in this respect.

Figure 2. Structural Primary Balance and Debt Under Different Recovery Scenarios

Structural Primary Balance
(General Government, percent of potential GDP)

General Government Gross Debt
(Percent of GDP)

Sources: IMF staff calculations.

Source: IMF staff calculations.
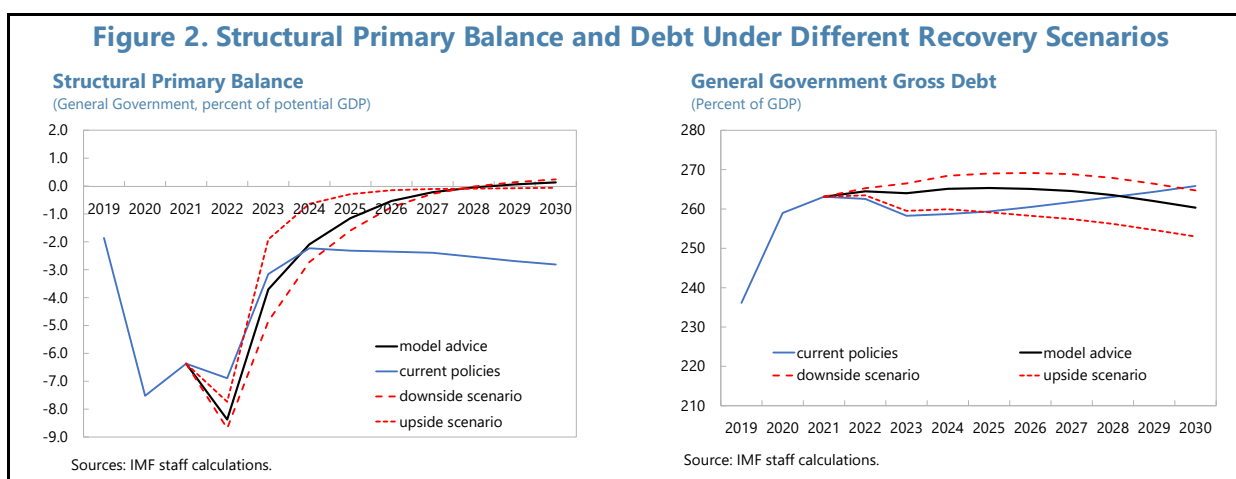
Pace of Medium-Term Fiscal Consolidation

10.   The optimal path of fiscal adjustment depends on how economic growth rates and interest rates unfold in the long run. While the model recommends fiscal consolidation after the pandemic, its pace depends largely on the assumptions on the interest rate-growth differential. For instance, with a small downward change to the interest rate-growth differential (r-g=-0.3), the model suggests a more gradual fiscal consolidation. Public debt can be reduced even with a negative structural primary balance. On the other hand, with a positive interest rate-growth differential (r-g=0.3), the structural primary balance should be higher than in the baseline. This is driven by two considerations. First, a higher balance is required to achieve the same debt level target under this scenario. Second, since debt is costlier, the model suggests the need to reduce the debt-to-GDP ratio faster in the medium run.

Figure 3. Structural Primary Balance and Debt under Alternative r-g Scenarios

Structural Primary Balance
(General Government, percent of potential GDP)

General Government Gross Debt
(Percent of GDP)

Sources: IMF staff calculations.

Source: IMF staff calculations.
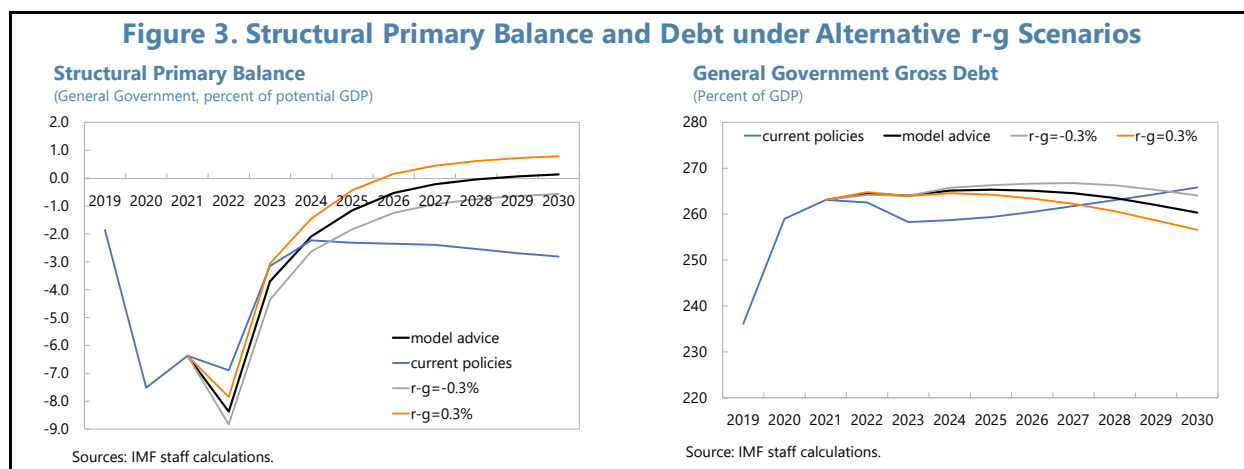
D.   Conclusion and Policy Implications

11.   The model advises supportive fiscal stance in the short run followed by a medium-term gradual fiscal consolidation. In the near term, the model gives priority to narrowing the output gap to minimize hysteresis through roll-out of the latest economic package. Near-term fiscal support should be state-contingent, reflecting health, economic and geopolitical developments. The model's recommendation for medium-term fiscal adjustment is driven by a need to stabilize debt and rebuild fiscal buffers gradually in the face of the intensifying demographic pressures. The recommended pace of adjustment is sensitive to the r-minus-g assumptions, reaffirming the critical role the interest rate-growth differential plays in debt dynamics for highly indebted countries like Japan.

12.   The importance of the interest rate-growth differential strengthens the case for a credible medium-term fiscal framework. Presence of such a framework could affect the interest rate-growth differential favorably through pre-empting a rise in risk premium by retaining investors' confidence in debt sustainability, or propping up corporate investment and growth through reduced uncertainty. Considering susceptibility of the optimal fiscal policy path to changes in macro-financial prospects, the framework could include a contingency plan that is readily implementable when, for example, there is a sustained decline in economic growth and/or a rise in interest rates.

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Appendix I. Model Details

1.   The government maximizes household utility by choosing a change in the structural primary balance pb$^{st}_t$ to stabilize output fluctuations intertemporally under constraints:

$$V_t(d_{t-1}, gap_{t-1}, pb^{st}_{t-1}) = \max_{\Delta pb^{st}_t} E_t\left[u(c_t, L_t) + \beta V_{t+1}(d_t, gap_t, pb^{st}_t)\right]$$

where t is the year, d_t is the gross-government-debt-to-potential-GDP ratio, gap_t is the output gap, c_t is aggregate consumption,[1] L_t is labor, u(.,.) is the instantaneous utility function, and β is the discount factor. The optimization is subject to the structure of the economy and the government budget constraint that takes the form of a risk to losing market access rising with debt (see below).

2.   The value function consists of the per-period utility function u(.) and the expected continuation value discounted by β. The per-period utility function is:

$$u(c_t, L_t) = \frac{c_t^{1-\sigma}}{1-\sigma} - \xi y_t^{*\,1-\sigma}\frac{L_t^{1+\eta}}{1+\eta}$$

which is a standard constant relative risk aversion utility function in consumption c_t and labor L_t where σ is the parameter of risk aversion and η is the inverse of the Frisch labor supply elasticity. Households enjoy consumption, but also face labor disutility. ξ is calibrated so that utility peaks when output y_t is equal to its potential y_t^*. Utility thus declines if output increases above potential, reflecting distortions associated with overheating.

3.   The model features rising market pressure when debt is rising. First, the interest rate increases in public debt, with a calibration in line with empirical evidence (as discussed in Fournier (2019)). This sensitivity of the interest rate to debt reflects a risk premium, which can be regarded as the consequence of an excess of supply of government bonds. Furthermore, the risk premium increases in the change in debt. Symmetrically, even at a high debt level, the risk premium may be moderate if the government shows its capacity to reduce debt. Second, a risk to lose market access rules out unbounded debt paths. The probability to lose market access also depends on the level and the change of government debt:

$$P(lma) = [1 + exp(d_1(1 - d_t/\bar{d} - d_2(d_t - d_{t-1})))]^{-1}$$

where d_1 governs the debt limit uncertainty, d_2 governs the effect of a debt change on the risk to lose market access, and $\bar{d}$ is the debt level at which the probability to lose market access is 50 percent (given no change in the debt level). If the government loses market access, the government

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[1] Public and private consumption are not distinguished, and hence assumed to provide the same utility.

has to keep debt constant under an adverse scenario of a shock of $d_3\sigma$, where σ is the standard deviation of economic shocks.

4. **Output is driven by long-term exogenous potential growth and long-run hysteresis costs.** Output is produced by a linear production function in labor. Productivity is affected by a permanent hysteresis effect of crisis. If production is below its perceived potential, unemployed workers face a decay in their skills, their network, and their morale (Blanchard and Summers, 1987; DeLong and Summers, 2012). Output deviates from its potential because of a process of shocks v_t and because of the primary balance. The derivative of the output gap with respect to the primary balance is set equal to a usual fiscal multiplier m_1 when the economy is at output equilibrium. The fiscal multiplier depends on the output gap itself, reflecting recent empirical literature on larger multipliers in downturns (Baum et al., 2012; Auerbach and Gorodnichenko, 2013), corroborated by modeling with financial frictions (Canzoneri et al., 2016). An additional term governed by coefficient m_2 thus magnifies the multiplier in downturns:

$$\frac{\partial gap(pb_t, v_t)}{\partial pb_t} = -m_1(1 - m_2 gap(pb_t, v_t))$$

5. **The primary balance is the sum of a cyclical component and of a structural component**:

$$pb_t = pb_t^{st} + a.gap_t$$

6. **Finally, the aggregate resource constraint is:**

$$c_t = y_t(1 - \chi(\Delta pb_t^{st})^2)$$

where c_t denotes aggregate consumption, and the last term represents fiscal adjustment costs, reflecting the implementation costs of changes, or the costs associated with tax uncertainty (e.g., Skinner, 1988). This can also reflect the difficulty in reversing fiscal decisions (IMF, 2017). This adjustment cost is relative to output.

7. **The calibration used for Japan is reported in the right-hand Table (See Section B above for details).**

Japan: Baseline Calibration	
Welfare function	
Discount factor β	0.99
Risk aversion σ	2
Labor elasticity η	1/0.3
Weight of labor ξ	1
Fiscal parameters	
Fiscal multiplier when the gap is null m_1	0.65
Fiscal multiplier sensitivity to shocks m_2	5
Automatic stabilizers (primary balance semi-elasticity to the gap) a	0.41
Adjustment cost χ	3
Interest rate and debt parameters	
Growth-adjusted interest rate at current debt level	0%
Effect of debt level on the risk premium α	1.0%
Effect of debt change on the risk premium α_2	0.5%
Debt level at which the risk to lose market access is 50% $\bar{d}$	300%
Debt limit accuracy d_1	3
Effect of debt change on the risk to lose market access is d_2	1
Adverse scenario coefficient in case of loss of market access d_3	-1%
Economy parameters	
Potential GDP per capita growth	0.9%
Shock persistence ρ	0.60
Shock size σ	3.8%
Hysteresis	10%
Hysteresis threshold	-1%

OPTIONS FOR REVENUE MOBILIZATION[1]

This chapter explores options for revenue mobilization that will be an indispensable part of Japan's medium-term fiscal consolidation. Consumption taxes and property taxes—both known for growth-friendliness—are promising tax handles for further mobilization. Options for other taxes are also explored, considering their effects on income and wealth distribution, externalities, and growth. Implementation of all the options could yield about 4 percent of GDP over the medium-term.

A.   Introduction

1.   Revenue mobilization will be indispensable for Japan's medium-term fiscal adjustment. On the expenditure side, social security spending will grow as population ages while the size of non-social security spending is already low among the G7 countries. On the revenue side, Japan's tax revenues in percent of GDP were penultimate of G7 countries in 2019 (a text chart). These facts highlight a critical role revenue-enhancing measures could play in Japan's medium-term fiscal consolidation. In this chapter, we will delve into Japan's tax system and lay out specific options for revenue mobilization for each major tax handle.

G7: Revenues and Expenditures 2019
(In percent of GDP)

Source: OECD.
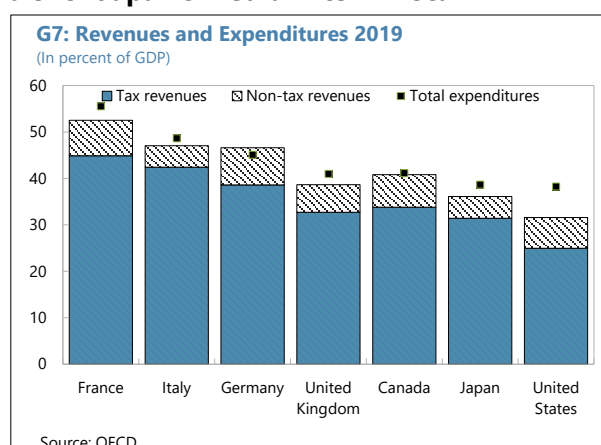
2.   Japan relies heavily on income taxes. Japan's tax revenues (including social security contributions) were 31 percent of GDP in 2019. Consumption tax and social security contributions contributed to a steady increase in the tax revenue-to-GDP ratio over the last decade (left chart in Figure 1). Compared to the other G7 countries, Japan collects more revenues from corporate income tax and social security contributions (a right chart in Figure 1). It is notable that social security contributions now account for 41 percent of Japan's tax revenues. On the other hand, the share of goods and services taxes is 20 percent in Japan, lower than the other G7 countries except the U.S. There could also be a potential scope for revenue mobilization in property taxes, as they are expected to yield stable revenues even amid the demographic transition. Against this backdrop, we start our discussion with the consumption tax and property taxes, followed by income taxes (personal income taxes and corporate income taxes) and environmental taxes.

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[1] Prepared by Pablo Lopez Murphy and Takuma Hisanaga (both APD).

Figure 1. Japan's Tax Revenues and Composition

Japan: Tax Revenue Composition
(In percent of GDP)

G7: Tax Revenue Composition
(In percent of total tax revenues-2019)

Sources: OECD, IMF staff calculations.
Note: Taxes on goods and services include general goods and services taxes (Consumption Tax in Japan) and excises.

Sources: OECD, IMF staff calculations.
Note: Taxes on goods and services include general goods and services taxes (Consumption Tax in Japan) and excises.

B. Consumption Tax

3.   Japan has room to raise the consumption tax rate further. Japan's consumption tax (value-added tax) was introduced in 1989 with a tax rate of 3 percent. Its rate was increased to 5 percent in April 1997, 8 percent in April 2014, and 10 percent in October 2019. Still, Japan's consumption tax revenues are in the lower range among G7 countries (a left chart in Figure 2). The consumption tax is an appealing source of revenues for Japan because (i) it serves as a stable source of revenue, (ii) its distortionary effects on labor, saving, and investment are small compared to income taxes, and (iii) it distributes the tax burden equitably across generations (Keen et al., 2011). A model-based study by IMF staff demonstrated that the consumption tax rate needs to reach 15 percent by 2030 if a rising cost of aging is to be financed by the consumption tax (McGrattan et al., 2018). Expected yield from the rate increase to 15 percent would be up to 2½ percent of GDP.

4.   The reduced rate is inefficient in protecting low-income households. A reduced rate of 8 percent—applicable to consumption of food, non-alcoholic beverages, and newspapers—was introduced in October 2019 to alleviate the regressive effect of the rate increase. Analysis of household survey data reveals that, while a share of amounts spent on the goods subject to the reduced rate in total expenditures is the highest for the lowest income quintile, the top income quintile spent twice as much on those goods as the lowest income quintile did (a right chart in Figure 2). This illustrates large revenue foregone due to the reduced rate[2,3]. Looking ahead, the government could consider replacing the reduced rate with a more targeted support to vulnerable households (discussed in the next paragraph) (Morinobu, 2014). Merging the reduced rate with the standard rate could also improve efficiency through alleviating administration costs and distortion in firms' input choice and consumers' spending decisions (Mirrlees et al., 2011; Acosta-Ormaechea and Morozumi, 2019).

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[2] This finding of a large leakage to high-income households is in line with experiences in other countries (OECD and KIPF, 2014).

[3] In addition to the reduced rate, several countermeasures, in particular free childcare for low-income households, were introduced in 2019, which helped offset the impact of the consumption tax rate increase on low-income households.

Figure 2. Consumption Tax

G7: VAT Revenue and Rates
(In percent of GDP (LHS), in percent (RHS), 2020)

Source: OECD.
Note: The rate for Canada is the combined federal/provincial rates in Ontario. Most provinces in Canada additionally impose a value-added tax or a retail sales tax. Data for the U.S. is not shown as it does not have VAT.

Japan: Expenditures on Goods Subject to the Reduced Rate
(by Income quintile, total households, 2019Q4)

Sources: Family Income and Expenditure Survey, IMF staff calculations.
Note: Goods subject to the reduced rate are food, non-alcoholic beverages and newspapers. Total expenditures are consumption expenditures except remittances.

5.   Japan could draw on its peers' experiences of targeted transfer schemes. For example, Canada introduced the GST (Goods and Services Tax)/HST (Harmonized Sales Tax) Credit in 1991. It is a quarterly cash transfer targeted at low- and modest-income households, which is intended to offset all or a part of the GST/HST they pay. The transfer amount is flat until households' income reaches the income threshold of about 38 thousand CAD, except for single households for whom the amount increases in order to strengthen work incentives (a text chart on the right[4]). This scheme is known for limited cases of fraud/misreporting because its design is simple, and its eligibility is assessed and screened by tax officers. Introduction of such a scheme in Japan would entail two administrative challenges. First, while Canada's GST Credit system builds on taxpayers' income information submitted through their annual tax returns, most

Canada: GST/HST Credit
(Canada Dollar- base year 2019)

Source: Canada Revenue Agency.
Note: Household income on X-axis.

employees in Japan do not file annual tax returns. This is because labor income taxes are withheld at source and adjusted annually by their employers, and investment income is withheld at source in many cases. Though Japan's National Tax Agency collects employees' income information from employers, its coverage is partial. Local governments gather data of residents' incomes, but such data are not aggregated by a central agency. One option to address this challenge is to make tax return filing mandatory while providing individuals with pre-filled tax returns. The second challenge is delivery of payments. Reflecting that transfers between bank accounts are widely-accepted means of payments in Japan, the municipal offices had to solicit eligible residents' bank account information in the past cash transfer programs, which led to implementation lags. This administrative burden will be saved if a bank account of each taxpayer is linked to a unique identification number (My Number) of its holder. As a positive development, a recent legislative

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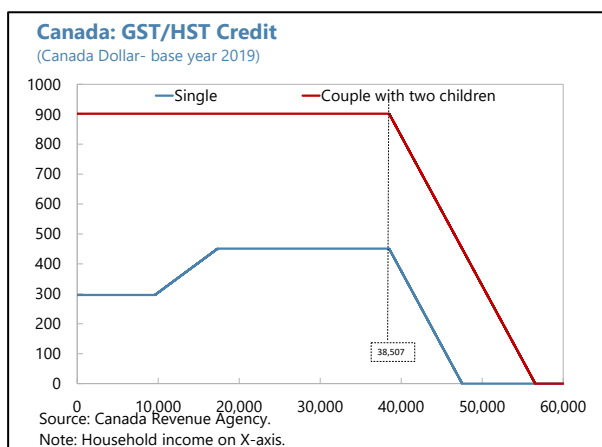
[4] As the text chart shows, an amount of GST/HST Credit each household receives does not depend on an amount of GST/HST it pays (Fenochietto and Benítez, 2021).

change enabled citizens to register information of their bank accounts and My Number, which the government can access solely for the purpose of delivering benefits.

C. Property Taxes

6.   In most G7 countries, property tax revenues are mainly comprised of recurrent taxes on immovable property. In Japan, municipal governments levy a recurrent tax at a standard rate of 1.4 percent on immovable properties—land, buildings, and depreciable assets (Fixed Asset Tax). Additionally, the City Planning Tax is imposed on buildings and land in urban areas. Revenues from these two taxes are 2.0 percent of GDP in 2020, a relatively low level among G7 countries (a left chart in Figure 3).

7.   The effective tax rate of Japan's Fixed Asset Tax is low. Taxable values for residential land—especially land smaller than 200m^2—are heavily discounted from assessed values (a text chart on the right). As a result, the effective tax rate for small residential land is about 0.2 percent (a right chart in Figure 3), against the standard statutory rate of 1.4 percent (Sato, 2013).

Illustration of Valuation of Residential Land

Land Market Value	A reference value of land released annually by the Ministry of Land, Infrastructure, Transport and Tourism.
Assessed value	Municipalities who impose the Fixed Asset Tax assess values of land at about 70 percent of the Land Market Value.
Taxable value (Tax base)	Taxable value is discounted from the assessed value. Discount factors are 1/6 for land up to 200m^2 and 1/3 for land exceeding 200m^2.
Revenue	Tax rate in most municipalities is a standard rate of 1.4 percent. Additional 0.3 percent is levied in urban areas (City Planning Tax).

Sources: Ministry of Internal Affairs and Communications, IMF staff.

Figure 3. Recurrent Tax on Immovable Property

G7: Property Taxes 2020
(In percent of GDP)

Source: OECD.

Japan: Recurrent Tax on Land
(Trillion JPY- FY2020)

Sources: Ministry of Internal Affairs and Communications, IMF staff calculations.
Note: Land plots below the threshold are excluded. "Commercial" refers to "Real estate for non-residential use."
Effective tax rate = Taxable value*1.4%/Assessed value

8.   The preferential treatment for small residential land could be gradually eliminated. A tax on immovable property is growth-friendly because its immovable nature limits its distortionary effect on decisions to invest (Arnold, 2008). The current low effective tax rate on residential land could be contributing to a rise in unoccupied houses in urban areas, because houseowners do not want to relinquish the preferential status even if they do not live there.[5] Raising the holding cost of

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[5] A legislative change effective 2016 partially addressed this issue by disallowing the discount from assessed values when unoccupied houses meet certain criteria (a risk of collapse, etc.).

properties could incentivize property owners to put their properties to a productive use (Norregaard, 2013). Lastly, the current size-based approach is not well-targeted at households with modest incomes and wealth, because most of the urban high-value residential plots fall within the threshold of 200m² (Honda, 2016). If the preferential treatment of residential land is eliminated, additional revenue yields from the Fixed Asset Tax and the City Planning Tax are estimated to be up to 0.5 percent of GDP.

9.   **A cross-country comparison points to a limited scope for additional revenues from inheritance and gift taxes.** Wealth acquired through inheritance are subject to the inheritance tax with a progressive rate schedule. In an effort to increase its tax base and strengthen redistribution, the basic deduction applicable to every inheritance was narrowed and the tax rate for the top bracket was raised from 50 to 55 percent in 2015. If assets are acquired as a gift, the gift tax is imposed, also with progressive tax rates. Japan's tax revenues from these taxes are about 0.4 percent of GDP in 2020, larger than other G7 countries except France (a left chart in Figure 3).

10.   **A net wealth tax would entail several implementation challenges.** Recurrent net wealth taxes entail high administrative costs and difficulties in capturing and assessing asset values. Also, it could discourage savings and lead to tax evasion and avoidance (Scheuer and Slemrod, 2021). Japan introduced the net worth tax in 1950, but repealed in 1953 because of these issues. Among the OECD countries, many have moved away from recurrent net wealth taxes, making Switzerland the only country which raises meaningful revenues from a recurrent net wealth tax (a text chart on the right) (OECD, 2018a). In light of these challenges, it would be more realistic and feasible to focus on improving

Revenues from Recurrent Taxes on Net Wealth of Individuals (percent of GDP - 2020)

Sources: OECD

the existing property tax system or reinforcing taxation on capital incomes (IMF, 2021a).
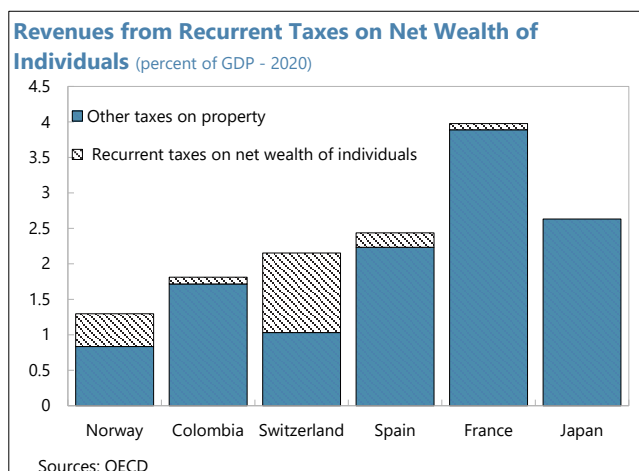
D.   Personal Income Taxes

11.   **Japan's personal income taxes yield low revenues due to the generous deductions.** The top statutory rate of Japan's personal income tax is about 55 percent,[6] the highest among G7 countries. However, revenues from Japan's personal income taxes is the lowest among G7 countries, due to generous deductions that erode the tax base (a right chart in Figure 4)[7]. As base-broadening

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[6] On top of a 45 percent rate imposed by the central government (excluding the special tax for reconstruction from the 2011 Great Eastern Japan Earthquake), local governments impose an additional 10 percent as Resident Tax. The central government's top rate was raised from 40 to 45 percent in 2015.

[7] Compared to a tax credit scheme which Canada and Italy have in place, deductions are in principle less progressive (or could be regressive), as deductions tend to benefit high-income earners because of the high marginal tax rate applied to their taxable incomes (Abdel-Kader and De Mooij, 2020).

measures. the authorities could streamline two deductions—the Employment Income Deduction and the Public Pension Income Deduction. Another avenue for reforms in personal income tax, which is a tax on capital incomes, will be discussed in the last paragraph of this section.

12.   Japan's deduction for work-related expenses stands out in size among G7 countries. The Employment Income Deduction (EID) in Japan is intended to provide a work-related expenses tax allowance on an estimation (not actual) basis.[8] The EID amount starts at 0.55 million JPY (about 5 thousand USD), and increases along with an employment income until the amount reaches the ceiling of 1.95 million JPY.[9] A similar scheme exists in France and Germany among G7 countries, but in a modest scale compared to Japan's (red bars in a right chart in Figure 4).[10] The EID ceiling could be lowered, which would not affect low-income households. According to staff estimates, revenues could increase by about 0.2 percent of GDP if the cap is set at 1.5 million JPY, about three-quarters of the current level.

Figure 4. Personal Income Taxes

G7: Personal Income Tax Revenue and Rates
(In percent of GDP (LHS), in percent (RHS), 2020)

Source: OECD.

G7: Taxable income as a share of gross income (2019, One-earner married couple with average earnings, 2 children)

- Central government taxable income
- Other standard tax allowances
- Work-related expenses tax allowance
- Deduction for social security contributions and income taxes
- Dependent children tax allowances
- Married or head of family tax allowances
- Basic tax allowance

Sources: OECD 2020 "Taxing Wages," IMF staff calculations

13.   The Public Pension Income Deduction (PID) could be set on par with the EID. The PID provides retired pensioners with more generous deductions than the EID. PID starts at 1.1 million JPY (about 10 thousand USD) and rises along with pension income until it reaches the ceiling of 1.95 million JPY. About three-fourth of pension benefits is estimated to be exempt from taxable income largely thanks to the PID (Kashiwase et al., 2012).[11] The degree of base-erosion caused by the PID will worsen in the coming years as the population ages (Yashio and Hachisuka, 2014). This generous deduction applies even to pensioners with large wealth, which could be exacerbating inter-generational inequality of wealth (Colacelli and Le, 2018). If the PID is set on par with the post-

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[8] Another justification for the generous EID used in the past was that corporate employees had lower capacity to pay taxes relative to the self-employed (Dalsgaard and Kawagoe, 2000). However, this comparison has become less relevant of late, given that employees now account for about 90 percent of the total labor force (excluding the unemployed) (FY2012 Annual Tax Reform Package adopted by the Cabinet on December 10th, 2011).

[9] In 2018, the EID amount was reduced by 0.1 million JPY (while expanding the basic income deduction by the same amount) and the ceiling was lowered from 2.2 to 1.95 million JPY except for households with children.

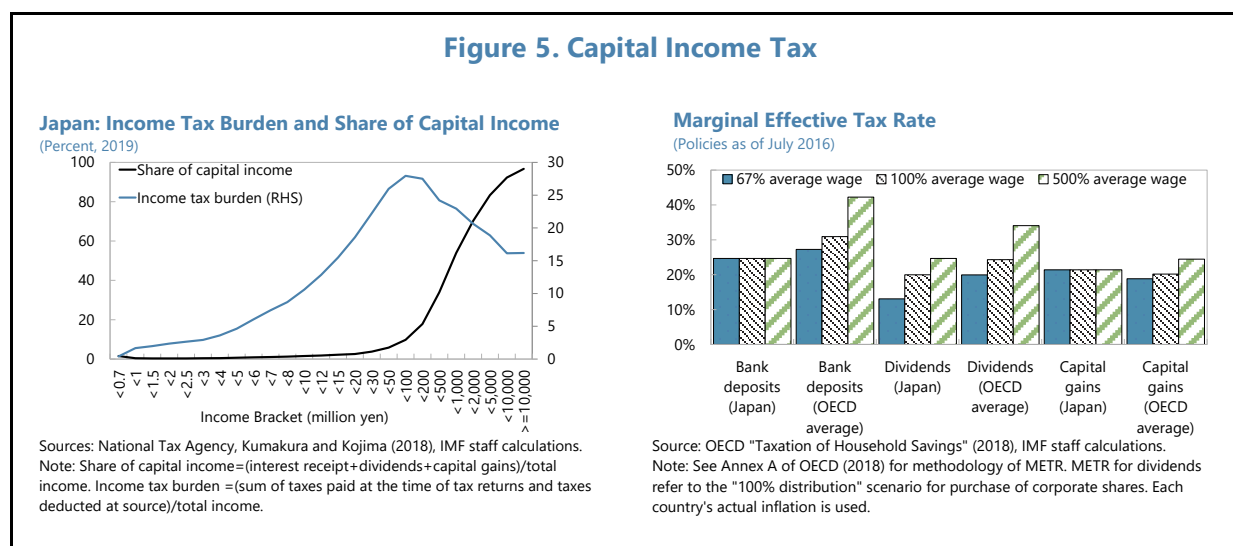[10] In France, 10 percent of employment income is deductible as a work-related expenses tax allowance with a cap of 12.6 thousand euros. A fixed-rate work-related expenses tax allowance of a thousand euros exists in Germany.

[11] Relatedly, Ueda et al. (2010) documents that tax revenues from public pension incomes account for only 2.5 percent of total personal income tax revenues.

reform EID (from 0.55 million JPY with a proposed ceiling of 1.5 million JPY), additional yields are estimated to be about 0.1 percent of GDP. The extra tax burden imposed on low-income pensioners as a result of this reform could be mitigated by a targeted transfer scheme to low-income households (discussed above).

14.   Another option in personal income taxes is to raise the tax rate on capital incomes. Under the principle of dual-income tax, capital gains, dividends of listed firms,[12] and interest are subject to a flat rate of 20 percent in Japan, with a few exemptions intended to promote households' financial investments through NISA (Nippon Individual Savings Account).[13] In general, the share of capital incomes increases as households' incomes rise (a left chart on Figure 5). Because the flat tax rate for capital income is lower than the top tax rate for labor income, the tax burden declines after annual income exceeds about 100 million JPY (about 0.9 million USD) (Kumakura and Kojima, 2018). A cross-country comparison reveals that the marginal effective tax rate in Japan is not high relative to its peers especially for high-income earners (a right chart on Figure 5). Concerns about tax evasion and avoidance could be alleviated by making use of the My Number scheme, the AEOI (Automatic Exchange of Information) with overseas jurisdictions, and a reporting requirement for those who have large wealth abroad. According to staff estimates, a rate increase from 20 to 25 percent could yield additional revenues of 0.1 percent of GDP.[14]

Figure 5. Capital Income Tax

Japan: Income Tax Burden and Share of Capital Income
(Percent, 2019)

Sources: National Tax Agency, Kumakura and Kojima (2018), IMF staff calculations.
Note: Share of capital income=(interest receipt+dividends+capital gains)/total income. Income tax burden =(sum of taxes paid at the time of tax returns and taxes deducted at source)/total income.

Marginal Effective Tax Rate
(Policies as of July 2016)

Source: OECD "Taxation of Household Savings" (2018), IMF staff calculations.
Note: See Annex A of OECD (2018) for methodology of METR. METR for dividends refer to the "100% distribution" scenario for purchase of corporate shares. Each country's actual inflation is used.

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[12] Taxpayers have an option to include dividends from listed firms in their comprehensive incomes instead of paying separately at the rate of 20 percent. Dividends of unlisted firms are subsumed in their comprehensive incomes and subject to the progressive tax schedule.

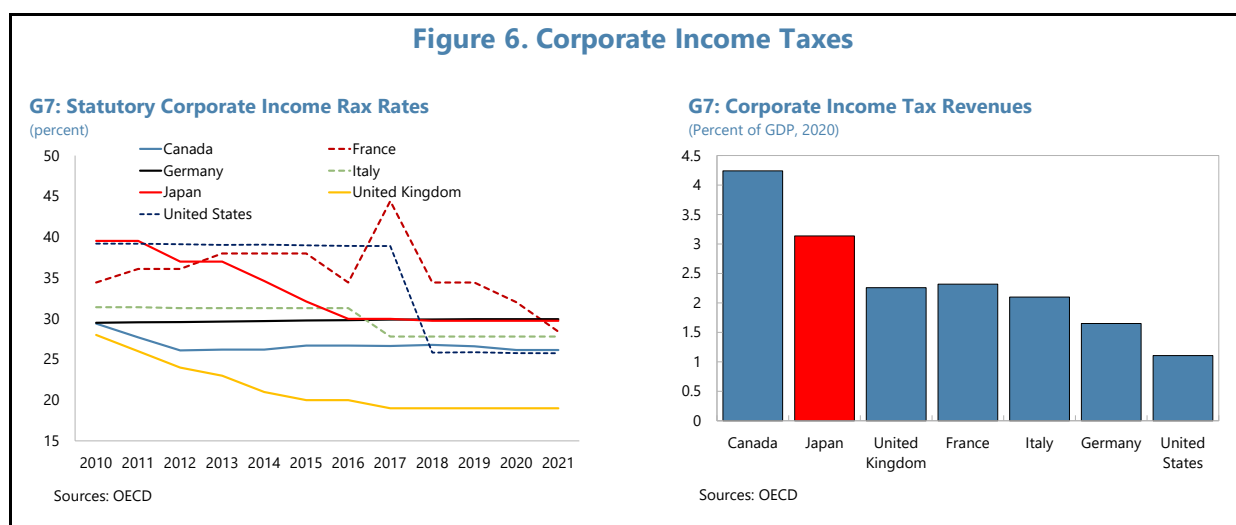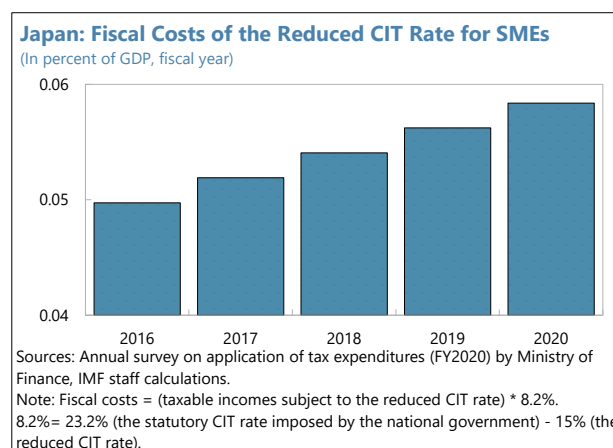[13] The NISA scheme that exempts households' small-scale financial investments from income taxation was introduced in 2014 when the capital income tax rate was raised from 10 to 20 percent.

[14] Another theoretical benefit of strengthening taxation on capital income is to alleviate distortions created by labor income taxes, hence leading to an increase in labor supply (Bastani and Waldenström, 2020; Jacobs, 2013).

E. Corporate Income Taxes

15.   Japan's corporate income taxes yield high revenues amid high statutory rates. In line with global trends, the statutory corporate income tax (CIT) rate in Japan gradually declined from nearly 40 percent to about 30 percent in the past decade, but is still on the upper end among G7 countries (a left chart in Figure 6).[15] Japan's CIT revenues are the highest among G7 countries (a right chart in Figure 6), indicating limited room for additional revenue mobilization from CIT reforms. Here, we present two potential avenues for reforms, focusing on removing distortions.

16.   SMEs' incomes are taxed at a lower rate. A targeted reduced rate is applicable to an annual taxable income below 8 million JPY for small and medium-sized enterprises (SMEs). This rate differentiation leads to an annual revenue loss of about 0.06 percent of GDP, according to staff estimates (a text chart on the right). By taxing small firms at a lower rate, the tax system may discourage firms' growth and discriminate against profitable investments (Benedek et al., 2017). A uniform rate could also be supported on equity grounds, considering

Japan: Fiscal Costs of the Reduced CIT Rate for SMEs
(In percent of GDP, fiscal year)

Sources: Annual survey on application of tax expenditures (FY2020) by Ministry of Finance, IMF staff calculations.
Note: Fiscal costs = (taxable incomes subject to the reduced CIT rate) * 8.2%.
8.2%= 23.2% (the statutory CIT rate imposed by the national government) - 15% (the reduced CIT rate).

that the reduced CIT rate for SMEs could be regressive if it ultimately benefits wealthy SME owners (De Mooij and Saito, 2014). If the targeted statutory rate for SMEs is eliminated, additional revenues could be 0.05 to 0.1 percent of GDP.

Figure 6. Corporate Income Taxes

G7: Statutory Corporate Income Rax Rates
(percent)

Sources: OECD

G7: Corporate Income Tax Revenues
(Percent of GDP, 2020)

Sources: OECD

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[15] An expected rise in CIT rates in the U.K. could bring Japan's rate closer to the G7 average.

17.   Corporate income taxation could play a role in stimulating corporate investments.

Corporate sector's net savings in Japan has been positive for most of the last two decades (a text chart on the right). One option to incentivize corporate investments is to introduce an allowance for corporate equity (ACE) (see Box 2. "Dynamic Effects of Selected Reform Options"). Since the ACE provides a deduction for a notional return on equity, only excess returns to investments are taxed, removing CIT's distortionary effects on investments. Though the ACE has negative revenue implications, revenue losses could be minimized if the ACE is only allowed for incremental equity (De Mooij and Saito, 2014).

Japan: Finanl Surplus/Deficit of Private Nonfinancial Corporations (Percent of GDP, FY)

Sources: Bank of Japan
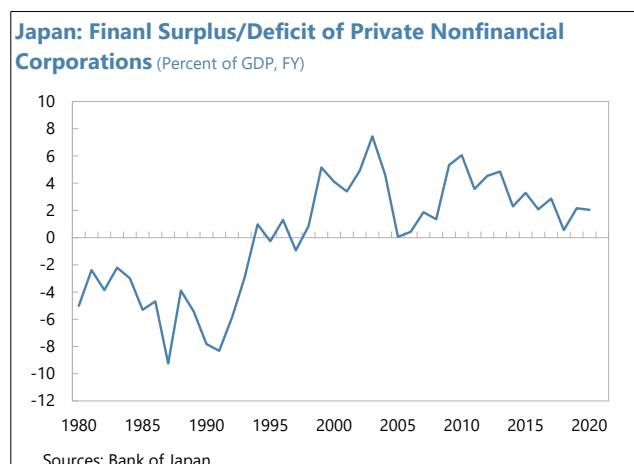
F. Environmental Taxes

18.   Japan's revenues from the environmental taxes are on the lower side among G7 countries (a left chart in Figure 7). Those revenues mainly come from excise taxes on fuels and cars. While the Tax for Climate Change Mitigation (TCCM), a carbon pricing mechanism, has been imposed on fossil fuel consumption since 2012, the current rate of TCCM remains low at approximately 3 USD per ton.[16]

19.   Japan could consider strengthening carbon pricing. Among the other G7 countries, three countries (France, Canada, and the U.K.) had carbon taxes in place as of 2020. While Japan's revenues from TCCM are lower than in Canada and France, TCCM stands out in its broad coverage of greenhouse gas emissions (a right chart in Figure 7). The government of Japan could consider taking advantage of this well-designed existing carbon tax scheme and raising its rate further, while paying attention to potential impacts on vulnerable households and industrial competitiveness (IMF, 2021b). Additional revenues are estimated to be about 0.3 percent of GDP, though an impact on the overall balance would depend on how to use those revenues (see *2022 Selected Issues* paper "Japan: Climate Change Policy Options").

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[16] Revenues from TCCM (about 0.05 percent of GDP) are earmarked for "green" expenditures including measures to expand renewable energy and enhance energy efficiency.

Figure 7. Environmental Taxes

G7: Environment-related Tax Revenues
(Percent of GDP- 2020 unless noted otherwise)

Sources: Policy Instruments for the Environment (PINE) database OECD

Carbon Taxes at the National Level
(2020)

Sources: The World Bank, Carbon Pricing Dashboard, IMF Staff calculations.
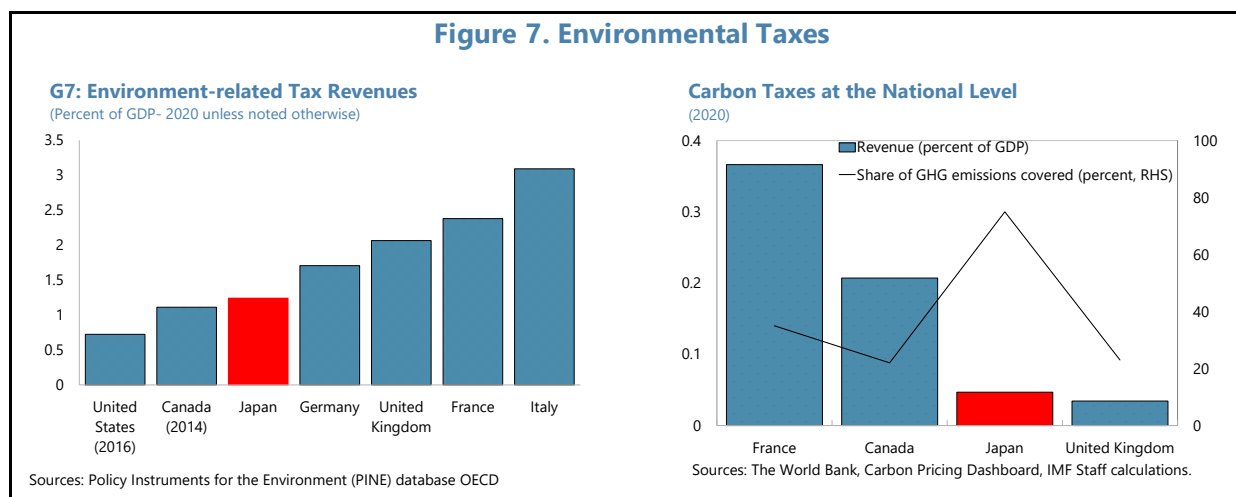
G. Conclusions

20.   Further revenue mobilization efforts are warranted on the back of Japan's low tax revenues relative to its G7 peers. Options discussed in this chapter are summarized in Table 1. For the consumption tax, there is room to raise the rate further. The reduced consumption tax rate could be replaced by a targeted transfer scheme with a view to supporting low-income households more efficiently. On property taxes, the preferential treatment for residential land embedded in Fixed Asset Tax could be gradually eliminated. For personal income taxes, the relatively narrow tax base could be expanded through streamlining the pension and employment income deductions. For corporate income taxes, the government could merge targeted rate for SMEs with the standard rate. It could also consider introducing an allowance for corporate equity. For environmental taxes, a rise in the carbon tax rate could be considered. Among major tax handles, the consumption tax and the property tax could play a pivotal role in Japan's medium-term fiscal consolidation efforts, given their growth-friendliness, and relatively large revenue implications. If every option is put into effect, additional revenues of about 4 percent of GDP could be raised over the medium-term, though a part of those revenue gains (the carbon tax in particular) will be offset by an increase in expenditures. Potentially negative distributional impacts of reforms should be addressed including through a targeted cash transfer scheme (see Box 1 "Distributional Implications of Revenue Mobilization").

Table 1. Japan: Options for Revenue Mobilization

| Tax handle	Reform options	Revenue implications (% of GDP)	Mobilize revenues?	Growth-friendly?	Address distributional concerns?
Consumption tax	Raise the tax rate to 15 percent	2 1/2	✓	✓	
	Replace the reduced rate with a targeted tax credit scheme	Neutral		✓	✓
Property tax	Eliminate the preferential treatment for residential land	0.5	✓	✓	(✓)
Personal income tax	Streamline the pension and employment income deductions	0.3	✓		✓
	Raise the tax rate for capital income to 25 percent	0.1	✓		✓
Corporate income tax	Merge the special rate for SMEs with the standard rate	0.1	✓	✓	
	Introduce an Allowance for Corporate Equity	Depends on its design/impact on output		✓	
Environmental tax	Raise the rate of TCCM (Tax for Climate Change Mitigation)	0.3	✓		

Source: IMF staff estimates.

Box 1. Distributional Implications of Revenue Mobilization[1]

A static micro-simulation is conducted to study distributional effect of the reform options, broadly following the methodology of Kawade (2018). We used 16th wave of the Keio Household Panel Survey (KHPS)[2], conducted in January 2019. The tax codes and the social security policies applied are as of FY2021. Taxes and social security contributions included in this calculation are: Personal Income Tax (PIT) and Resident Tax, consumption tax, Fixed-Asset Tax, and pension, healthcare/long-term care, and employment insurance premiums. We considered following reform options:

- Lower the ceiling (maximum amount) of the Employment Income Deduction of the PIT to 1.5 million JPY. Resident Tax is reformed accordingly.

- Lower the floor (minimum amount) and the ceiling of the Pension Income Deduction of the PIT to 0.55 million JPY and 1.5 million JPY, respectively. Resident Tax is reformed accordingly.

- Raise the VAT standard to 15 percent, with no reduced rate.

- Raise the capital income tax rate to 25 percent.

- Eliminate the preferential treatment of residential land in Fixed Asset Tax.

- Introduce a VAT credit (equivalent to the GST Credit in Canada).

After dividing total households into deciles based on households' before-tax incomes adjusted for households' sizes, we calculated average tax burden of each decile. Tax burden is measured as taxes and social security contributions as a share of total income. A chart on the right shows changes in tax burden after all six options are implemented. A tax burden for each decile increases by 2 to 4 percentage points. Without considering a VAT credit, roughly a half of the increase in tax burden in every decile is explained by a rise in the burden of the consumption tax. The result also highlights large redistributive effect of a VAT credit scheme.
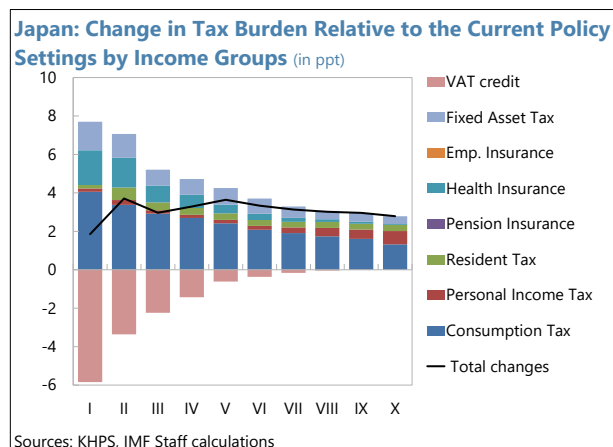
It would also be important to take account of households' assets and inter-generational implications in an aging economy like Japan. Hence, we divided households into deciles based on their assets, split them further by age-groups, and looked at how average tax burden changes. The result in the table on the right shows average tax burden of the older and the wealthier households tends to rise more than the younger households with less assets after reforms.

Japan: Change in Tax Burden Relative to the Current Policy Settings by Income Groups (in ppt)

Legend: VAT credit; Fixed Asset Tax; Emp. Insurance; Health Insurance; Pension Insurance; Resident Tax; Personal Income Tax; Consumption Tax; — Total changes

Sources: KHPS, IMF Staff calculations

Japan: Change in tax burden relative to the current policy settings by asset decile and age groups (in ppt)

	Asset decile									
	I	II	III	IV	V	VI	VII	VIII	IX	X
~34	1.3	2.0	1.5	1.3	2.3	1.7	3.1	2.0	1.6	N/A
35~44	1.9	1.6	0.6	1.0	1.2	2.8	2.4	2.8	1.9	3.4
45~54	2.4	1.9	0.8	1.6	2.0	2.7	2.5	3.4	3.1	4.2
55~64	2.0	1.6	0.1	1.5	2.1	2.0	2.3	3.3	3.4	4.7
65~74	5.2	2.0	1.9	2.3	3.8	4.6	4.1	5.1	6.1	7.0
75~	5.3	4.1	2.7	3.8	4.7	5.0	5.2	6.2	7.0	8.4

(Age-group is the row label on the left side)

Note: Decile is based on households' equivalized net assets (Real assets + financial assets - debt). There is zero sample for household below 35 years old in the tenth decile.
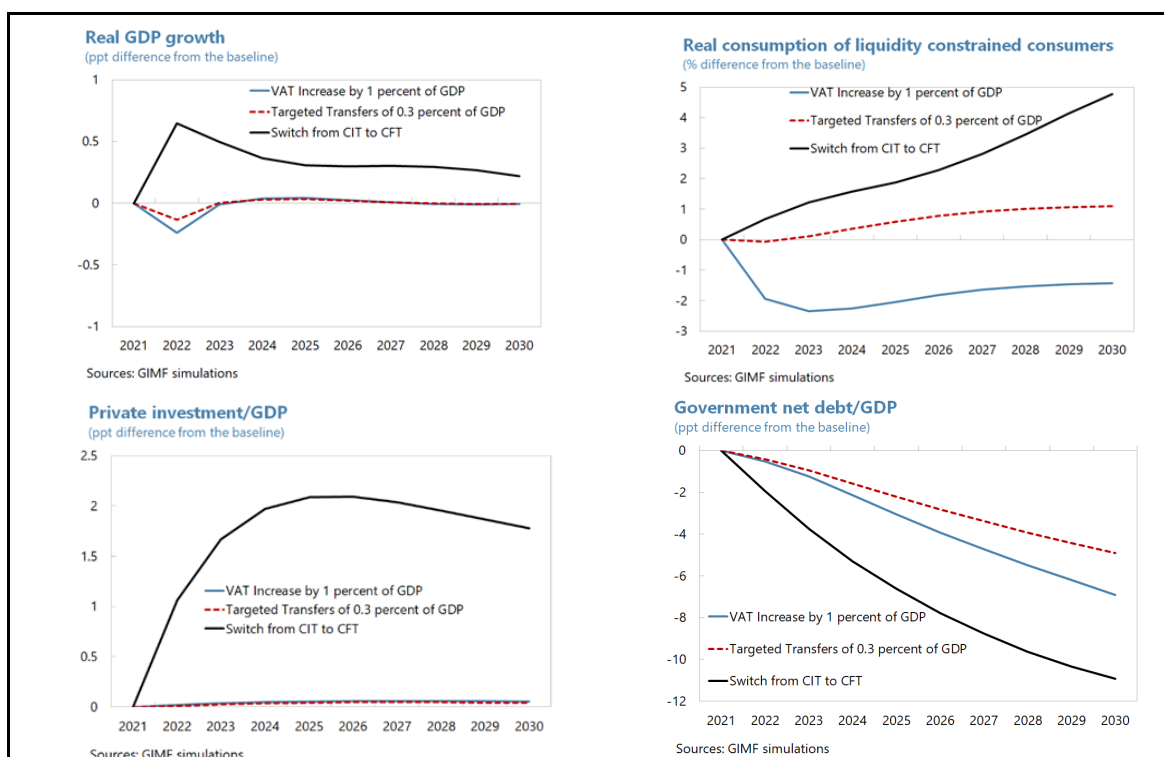Sources: KHPS, IMF Staff calculations

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[1] The data for this analysis, the Keio Household Panel Survey (KHPS), was provided by the Panel Data Research Center at Keio University.

Box 2. Dynamic Effects of Selected Reform Options[1]

The IMF's Global Integrated Monetary and Fiscal Model (GIMF) [2] simulation is conducted to study impacts of selected tax reform options on output and fiscal indicators. Selected reform options are:

1. A permanent increase in consumption tax revenues by 1 percent of GDP, which corresponds to about a two-percentage point increase in the consumption tax rate.

2. An increase in targeted transfer by 0.3 percent of GDP which would offset the impact of the consumption tax hike on liquidity-constrained households.

3. Shift from the current Corporate Income Tax (CIT) to a Cash Flow Tax (CFT) (as a proxy for an Allowance for Corporate Equity) in a revenue-neutral manner.

Simulation results are below. The blue line traces out the impact of Option 1, the red dashed line shows the impact of both Options 1 and 2, and the black line illustrates the impact of all three options. Real GDP growth initially dips because of the consumption tax rate increase but recovers in the following year. Adding targeted transfers allows liquidity-constrained households to maintain the same level of consumption as in the baseline, even after the consumption tax rate increase, and mitigates the impact on real GDP. A shift to a CFT results in output growth above baseline for an extended period, driven by an increase in private investment. This is because the full deductibility of investment expenditures under the CFT is more effective at stimulating investment than the allowance for the depreciation of the capital stock under the current CIT scheme. The net-debt-to-GDP ratio declines by more than 10 percentage points relative to the baseline by 2030 if these options are jointly implemented in 2022.

Real GDP growth
(ppt difference from the baseline)
— VAT Increase by 1 percent of GDP
--- Targeted Transfers of 0.3 percent of GDP
— Switch from CIT to CFT
Sources: GIMF simulations

Real consumption of liquidity constrained consumers
(% difference from the baseline)
— VAT Increase by 1 percent of GDP
--- Targeted Transfers of 0.3 percent of GDP
— Switch from CIT to CFT
Sources: GIMF simulations

Private investment/GDP
(ppt difference from the baseline)
— VAT Increase by 1 percent of GDP
--- Targeted Transfers of 0.3 percent of GDP
— Switch from CIT to CFT
Sources: GIMF simulations

Government net debt/GDP
(ppt difference from the baseline)
— VAT Increase by 1 percent of GDP
--- Targeted Transfers of 0.3 percent of GDP
— Switch from CIT to CFT
Sources: GIMF simulations

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[1] The model simulation is conducted by Keiko Honjo (RES).

[2] GIMF is a multi-country dynamic general equilibrium model applicable to fiscal policy analysis due to the incorporation of non-Ricardian features such as finitely-lived and liquidity-constrained households (Kumhof et al. (2010)).

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LOW-FOR-LONG INTEREST RATES AND BANK PROFITABILITY IN JAPAN[1]

Regional banks, accounting for about 40 percent of commercial bank assets in Japan, face challenges of shrinking profitability and clientele largely due to the demographic transition, while revenue diversification remains limited. This study empirically finds that prolonged monetary accommodation led to significant declines in bank net interest margins, putting pressure on bank profits and leading to greater risk taking in search of yield. Looking ahead, while an accommodative monetary policy stance should be maintained to support growth and reflation, financial sector policies should be strengthened to help make monetary policy more sustainable and mitigate financial vulnerabilities arising from low bank profitability, especially among regional banks.

A. Ultra-Accommodative Monetary Policy in Japan

1.   An accommodative monetary policy helped lift Japan from a decade long deflation.
Since the late 1990s, a domestic banking crisis, the 1997 consumption tax hike, and the Asian financial crisis led to slowing consumer demand, declining consumer prices, and financial instability. In addition, Japan's aging and shrinking population could lower the natural rate of interest (Han, 2019), along with creating additional macroeconomic challenges. With inflation still far from its target after the Global Financial Crisis and the policy rate close to the zero lower bound, under "Abenomics" the Bank of Japan embarked on a series of unconventional monetary policies including Quantitative and Qualitative Easing, the negative interest rate policy, and yield curve control (Westelius, 2020). While sustained monetary accommodation supported lending and lifted Japan out of a decade-long deflation, these unconventional monetary policy measures have pushed down both short-term interest rates and long-term Japanese government bond yields for a prolonged period. This has also been coincided with the global secular decline in the equilibrium real interest rate, to which the major central banks around the world have been adapting.

B. Evolution of Bank Profitability

2.   Prolonged monetary accommodation and structural shifts weigh significantly on bank profitability. Interest rates on new loans have been on a declining path, with decreases accelerating in the 2010s and the median interest rate dropping from over 2 percent in 2000 to around 0.8 percent in 2019. While an increase in loan growth partially offset the impact, its scope to support profitability is diminishing as the median interest margin gets even more compressed and the low interest environment becomes prolonged (Figure 1). Regional banks, which initially had higher net interest margins than city banks, are particularly affected with the median net interest margin halving over the last decade. Faster pace of population aging and shrinking in regional economies, amplified by migration to large urban centers, pose additional headwinds to regional banks (IMF, 2017a and 2017b).

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[1] Prepared by Piyaporn Sodsriwiboon (APD) and Sumiko Ogawa (MCM).

3. **International comparisons suggest that the scope for cost reduction in offsetting the pressures to profitability may be narrowing.** The median overhead cost of Japanese regional banks, defined as total operating cost as a share of total assets, has declined from already low levels over the last decade (Figure 1). On the other hand, their revenue diversification remains limited compared to international peers and city banks, both in terms of the share of total income and as a share of assets.

Figure 1. Regional Bank Financial Performance 1/

Loan Growth and Interest Rates on New Loans by Regional Banks
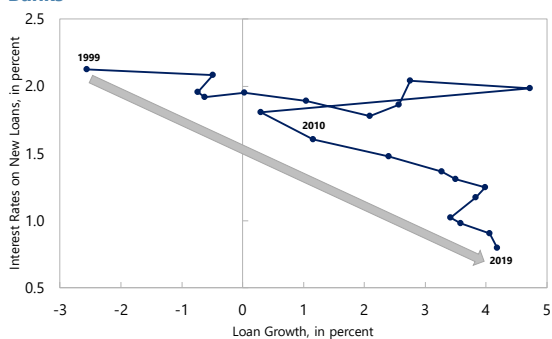
Source: Haver Analytics; Bank of Japan.

Regional Banks I
(In percent)
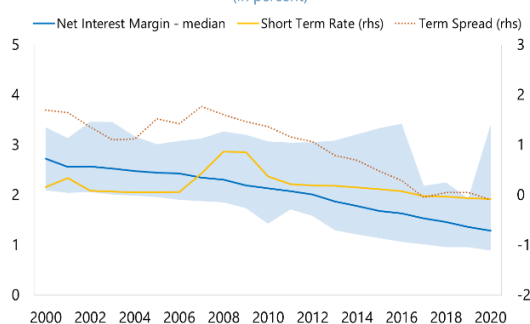
Sources: Japanese Bankers Association; IMF staff calculations.

Regional Banks II
(In percent)
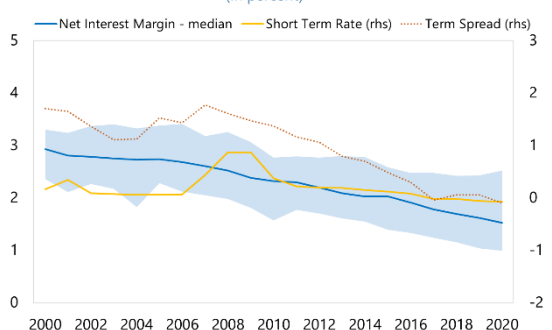
Sources: Japanese Bankers Association; IMF staff calculations.

City Banks
(In percent)
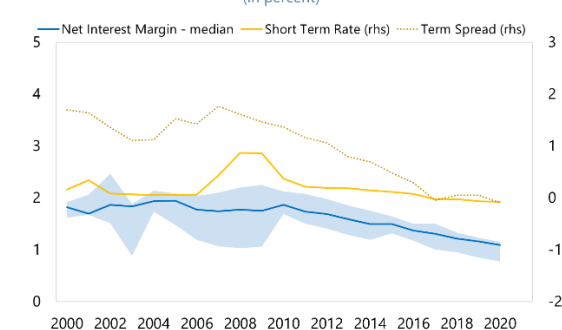
Sources: Japanese Bankers Association; IMF staff calculations.

Overhead cost (total operating cost/total assets)
(percent)
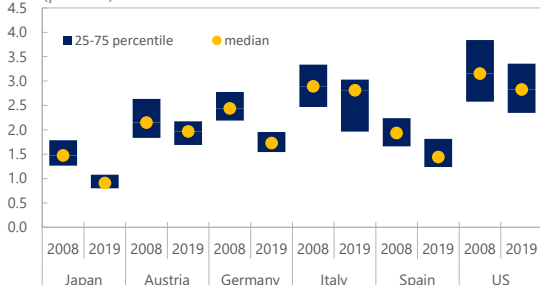
Sources: FitchConnect and staff calculations.
Note: include regional banks for Japan, savings banks for Austria and Germany, consolidated banks and savings banks for Spain, larger cooperative banks (banco popolare) for Italy, and community banks for the US.

Noninterest income/Total assets
(percent)
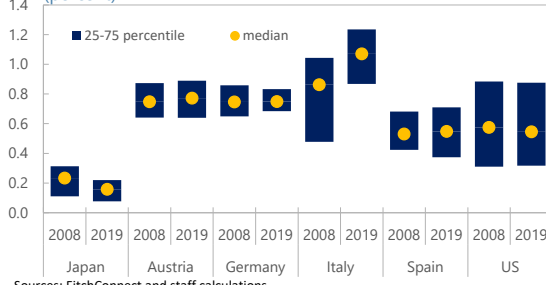
Sources: FitchConnect and staff calculations.
Note: include regional banks for Japan, savings banks for Austria and Germany, consolidated banks and savings banks for Spain, larger cooperative banks (banco popolare) for Italy, and community banks for the US.

1/ For charts on regional banks I, regional banks II, and city banks, the blue-shaded area indicates the range between the maximum and minimum of the banks' net interest margin.

4. **A flattening yield curve has encouraged risk taking**. In search for higher yields, city banks—and larger regional banks to a lesser extent—have been increasing exposures to overseas loans. Both city and regional banks also actively extended real estate-related loans since around 2013, with the focus shifting from large real estate development projects towards small- and medium-sized rental real estate businesses in more recent years. Kawamoto and others (2020) find that the riskiness of credit allocation has increased in Japan's loan market, with loans to low-return SMEs borrowers (defined as firms with low borrowing cost relative to their credit conditions) increasing at a higher pace compared to normal firms. However, these risks appear manageable and do not seem to pose an immediate threat to financial stability, as overseas loan exposures are primarily of high quality[2] and the real estate-related loan growth has been decelerating pre-pandemic.

C. Empirical Analysis

5. **There is a rich literature on low-for-long interest rates and the implications on the transmission of monetary policy and bank profitability.** Altavilla and others (2017) show accommodative monetary conditions in the euro area have a negative impact on net interest income, but a positive impact on loan loss provisions and non-interest income. Demiralp and others (2021) find that euro area banks highly exposed to the negative interest rate policy tend to grant more loans and take more risks in response to negative rates. Klein (2020) finds that the level of the short-term rate and the net interest margin are positively correlated, and the correlation increases substantially at negative market rates. IMF (2020) highlights very low interest rates have been associated with compressed bank net interest margins in several advanced economies over the past decade. Aoki and others (2019) show low interest rates do reduce bank profits, using a theoretical model calibrated to Japan and other developed economies. Nevertheless, most studies are likely to capture only the short-term effects of the policy rates, including the negative interest rate policy, which may evolve over time (IMF, 2021).

6. **This study reinvestigates low-for-long interest rates and bank profits through the lens of the Japanese banks.** It analyzes the key drivers of bank profitability as well as the transmission channels of monetary policy in Japan. The dataset includes the bank-by-bank financial statements of all bank types from the Japanese Bankers Association, covering a sample period of 2000-2020 and on average more than 90 percent of total banking sector assets (see Appendix). Controls for bank-specific as well as macroeconomic and financial variables are included. Panel regressions are estimated as follows:

$$Y_{it} = \beta Y_{t-1\ i} + \delta r_{it} + \gamma X_{it} + \theta Z_{it} + \alpha_i + \epsilon_{it}$$

where Y_{it} is (i) the net interest margin; (ii) provisions-to-total assets; or (iii) loan growth, of an individual bank i at year t. Monetary policy indicators (r_{it}) include the three-month short-term interest rate (3M LIBOR) or term spread calculated as the difference between the 10-year Japanese government bond yield and short-term interest rate. X_i is a vector of bank-specific variables, and

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[2] Around 70 percent of overseas corporate loans are in investment grade (BOJ's Financial System Report, April 2021).

Z_{it} is a vector of macroeconomic and financial variables such as real GDP growth, inflation, and financial volatility.

7.   The empirical results show low-for-long interest rates are associated with positive macroeconomic outcomes from monetary accommodation, though they weigh on bank profits (Table 1). A decline in short-term interest rates or a flattening of the yield curve is associated with improved macroeconomic prospects, cashflows, and creditworthiness of borrowers, thus expanding credit and lowering provisions. The regression results suggest a 100-basis-points decline in the short-term rate leads to about a 10-basis-points increase in loan growth and about 0.7-basis-point reduction in provisions (relative to assets). However, a fall in short-term rates or narrowing term spreads are associated with a decline in bank net interest margins. Specifically, the estimates indicate that a 100-basis-points decline in short-term rates is associated with a decline in net interest margins for the average bank in the sample of about 1 basis point. Similarly, as term spreads are compressed, net interest margins would likely fall by about 0.3 basis point in response to a 100-basis-points fall in the term spread. Based on these empirical estimates, the decline in short-term rates accounted for about a half of the decline in net interest margins during 2012–20 (Figure 2).

Figure 2. Interest Rates, Monetary Transmission, and Bank Profits

Impacts of a Decline in Rates and Term Spreads on Bank Net Interst Margins, Provisions, and Loan Growth
(Basis points)

Source: IMF Staff Estimates.

Contributions to the Change in Net Interest Margins
(Percent, all banks)

Source: IMF Staff Estimates.
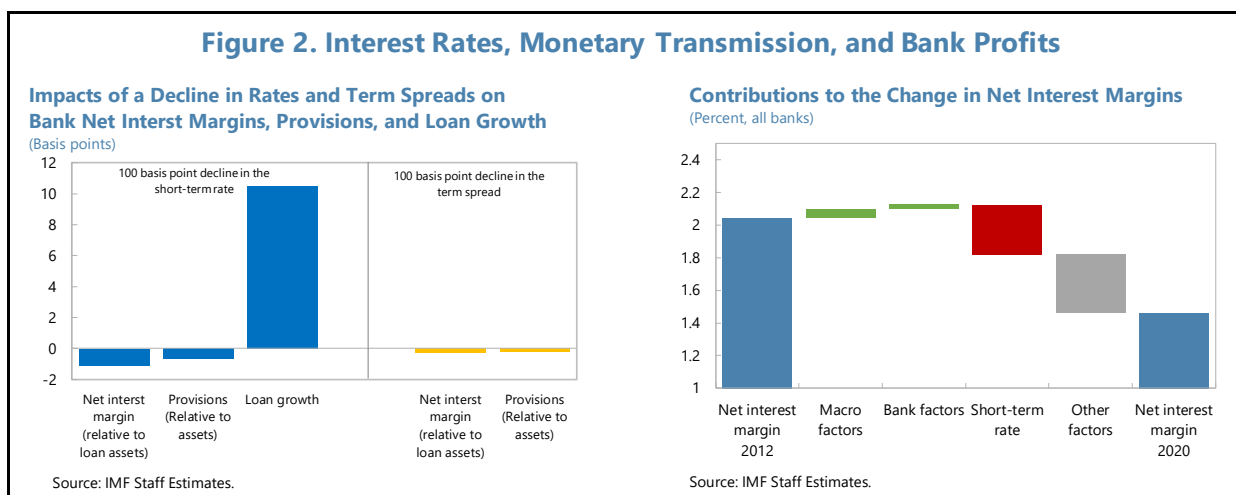
8.   This study further examines whether there is a certain level of interest rate that could have different impacts on bank profitability and lending. The regression analysis is based on the threshold regression as in Wang (2015):

$$Y_{it} = \beta Y_{t-1\ i} + \delta r_{it} + \gamma X_{it} + \theta Z_{it} + \alpha_i + \epsilon_{it}$$

where

$$\delta = \begin{cases} \delta_1 & if \quad r_{it} < r^* \\ \delta_2 & if \quad r_{it} \geq r^* \end{cases}$$

where Y_{it} is the net interest margin or other variables of interest of an individual bank i at year t. Monetary policy indicators (r_{it}) include the three-month short-term interest rate or term spread calculated as the difference between the 10-year Japanese government bond yield and short-term

interest rate. X_{it} is a vector of bank-specific variables and Z_{it} is a vector of macroeconomic and
financial variables such as real GDP growth, inflation, and financial volatility. r^* indicates a threshold where the monetary policy indicator would potentially yield a different impact on the dependent variable.

9.   The effect of low-for-long interest rates appear dynamic. The empirical results suggest that the impact of a decline in short-term interest rates on bank net interest margins appear to be larger when the rates are lower than the estimated threshold of about -0.03

**Impact of a Decline in Rates on Bank Net Interest Margins:
Interest Rate Thresholds**
(Percent, Post-Abenomics sample)

Source: IMF Staff Estimates.

(Table 2). The estimated impact of a decline in bank net interest margin corresponding to a 100-basis-points decline in the short-term rate is nearly double the impact when rates are more negative. It appears that interest rates on lending react more strongly to a change in the level of short-term interest rates than interest rates on deposits. Furthermore, deposit costs could potentially bind by the zero-lower bound of retail deposit rates; hence, net interest margins could have decreased more sharply when the interest rates are below the estimated threshold. As discussed above, the positive effects of accommodative monetary conditions on provisions and loan growth could help mitigate the impact on bank profits, although the impacts are not statistically different across interest rate thresholds.
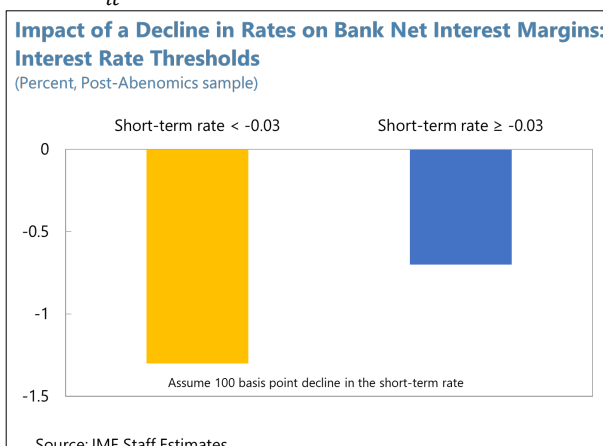
10.   Preliminary results suggest a reversal rate has yet to be reached. The reversal interest rate is often defined as the rate at which accommodative monetary policy reverses its effects and becomes contractionary for lending (Brunnermeier and Koby, 2019). The empirical analysis in this chapter did not find a threshold for short-term interest rates that would associate a cut in interest rates with a decline in loan growth, thus suggesting such a rate has not been reached.

D.   International Experience in Bank Consolidation

11.   An international comparison with the banking sectors that went through consolidation may provide some lessons to Japanese regional banks. The banking sectors in the U.S. and several European countries, including Austria, Italy, Germany, and Spain, saw consolidations over the last decade. The number of commercial banks declined by about 30 percent in the U.S., Italy, and Spain during that period (Figure 3). On the other hand, consolidation among commercial banks were limited in Germany and was primarily among credit unions and credit cooperatives. The effect of consolidation on operation costs, however, appears mixed, with the change in the number of commercial bank branches per population remaining more moderate except in Spain.

Figure 3. Consolidation in Among Commercial Banks

Number of Commercial Banks (2008 = 100)

Source: FAS and staff calculations

Commercial Bank Branches (per 100,000 adults)

Source: FAS and staff calculations
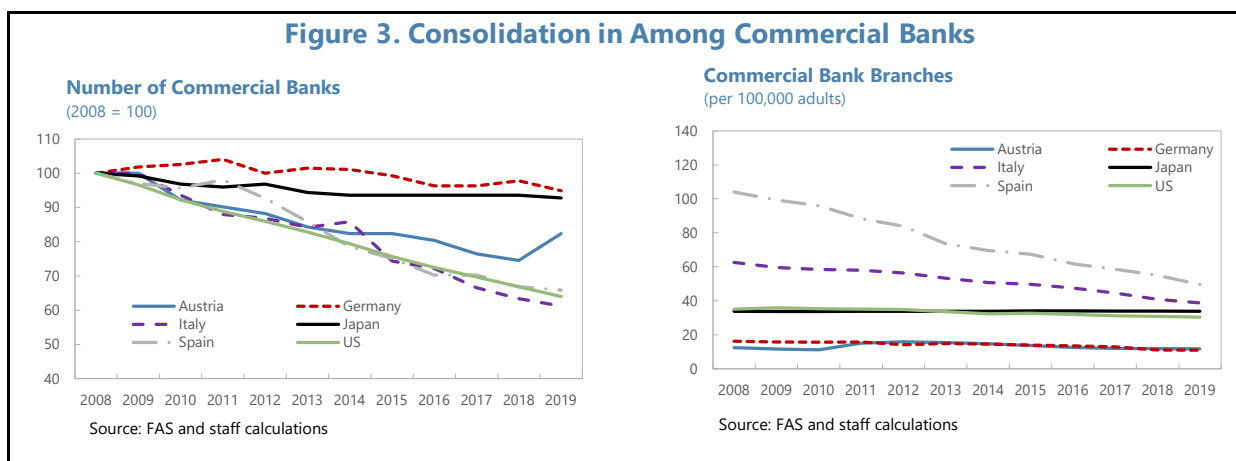
12.   Consolidation is primarily prompted by a difficult operating environment, and further encouraged by policy push in some cases. It should be noted, however, that Japanese regional banks are privately owned and commercially operated, and do not face geographical restrictions on their operations. Therefore, these examples may not be directly applicable to them.

- In *Europe*, the fallout from the Global Financial Crisis and prolonged economic downturn were important factors driving mergers and consolidations. In Italy and Spain, reform of the legal and governance framework to strengthen capitalization and market discipline of cooperative and saving banks provided further impetus. However, consolidations were mostly among cooperative and savings banks, which have social objectives and are often partially owned by local governments.

- In *the U.S.*, the relaxation of geographical restrictions since the early 1980s led to a sharp reduction in the number of banks. Most states removed or relaxed state-level restrictions on statewide branching and inter-state acquisition of banks by early 1990s. The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 removed most restrictions on inter-state acquisition and branching.

E.   Policy Implications

13.   Japan's accommodative monetary policy stance remains appropriate given the priority to support recovery and inflation, but should be accompanied by prudential measures to safeguard financial stability. The low interest environment could put pressure on banks' profitability and slowly erode capital buffers, and could lead to risk taking and a build-up of vulnerabilities. Financial sector policies should be strengthened to safeguard financial stability, including further broadening the scope of systemic risk assessment, enhancing the macroprudential toolkits of Japan's Financial Services Agency (FSA), and encouraging banks to strengthen their risk management.

14.   Efforts should continue to encourage regional banks to diversify their revenue sources and adjust business models. In recent years, regional banks have successfully diversified their revenue sources to enhance non-interest income through consulting services and reduced branch-related expenses. Measures to further incentivize cost reduction and facilitate consolidation of regional banks are welcome steps, including the Bank of Japan's special deposit facility and government subsidies to encourage overhead streamlining, mergers, and business integrations. The exemptions to the anti-monopoly law came into effect in November 2020, lowering the hurdle which previously stopped some planned mergers among regional banks operating in the same region on the ground for concerns around competition. Comparisons with city banks and international peers indicate that there is a scope for regional banks to diversify their revenue sources further, while the room for cost reduction may be shrinking. Leveraging digitalization and investing in IT could be an option to improve efficiency and broaden businesses and client reach. At the same time, market exit should be pursued when appropriate, either through consolidation or orderly closure. In this regard, the introduction of the Early Warning Mechanism is welcome, in which the FSA monitors closely and engage banks in dialogues on their medium-term prospects.

Table 1. Japan: Regression Results 1/

Dependent variables:	Net interest margin (relative to loan assets)		Provision (relative to assets)		Loan growth
	(1)	(2)	(3)	(4)	(5)
Net interest margin (Lag)	0.596***	0.596***	0.204**	0.204**	-0.080**
	(7.201)	(7.201)	(2.041)	(2.041)	(-2.267)
3-mth short-term interest rate	0.011***		0.007**		-10.488*
	(2.889)		(2.421)		(-1.823)
Term spread		0.003***		0.002**	
		(2.889)		(2.421)	
Deposits/Liabilities (Lag)	-0.001	-0.001	0.017	0.017	0.004
	(-0.795)	(-0.795)	(1.600)	(1.600)	(0.034)
Cost-to-income ratio	0.000	0.000			-0.006
	(0.986)	(0.986)			(-1.205)
Non-performing loan ratio	-0.015	-0.015			
	(-0.931)	(-0.931)			
Tier 1 regulatory capital ratio			-0.000	-0.000	0.001***
			(-0.221)	(-0.221)	(6.730)
Real GDP growth	-0.001	-0.001	-0.002*	-0.002**	0.721*
	(-1.235)	(-1.310)	(-1.951)	(-2.011)	(1.975)
Real GDP growth prospect	-0.001	-0.001	-0.001*	-0.001*	0.188*
	(-1.447)	(-1.447)	(-1.854)	(-1.854)	(1.955)
Inflation rate	0.000	0.000**			-0.049*
	(1.511)	(2.162)			(-1.848)
Inflation prospect	-0.000*	-0.000*			0.059*
	(-1.836)	(-1.836)			(1.903)
Volatility	-0.000*	-0.000*			0.074*
	(-1.868)	(-1.789)			(1.871)
Unemployment					1.068*
					(1.766)
Constant	0.022**	0.020**	0.001**	0.000	-10.347*
	(2.572)	(2.481)	(2.451)	(0.399)	(-1.836)
Observations	1,030	1,030	661	661	677
R-squared	0.802	0.802	0.281	0.281	0.026
Number of banks	120	120	117	117	119
Bank fixed effects	YES	YES	YES	YES	YES
Time fixed effects	YES	YES	YES	YES	YES

Source: IMF staff estimates.

1/ The dependent variables are net interest margin (columns 1 and 2), provisions-to-total assets ratio (columns 3 and 4) and loan growth (column 5). The data is at annual frequency covering an unbalanced sample of 120 Japanese banks for the period from 2013 to 2020. Estimates are obtained by ordinary least squares and statistical significance is assessed using heteroscedasticity-robust standard errors. Controls include variables that capture bank-specific and macroeconomic conditions (see text for further details). Further robustness tests are available upon request. T-statistics are reported in parentheses with *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2. Japan: Threshold Regression Results 1/

Dependent variable: Net interest margin	Pre-Abenomics	Since Abenomics
	(1)	(2)
Net interest margin (Lag)	-0.352***	-0.467***
	(-10.987)	(-14.484)
Short-term interest rate if $rate_{i,t} < rate^*$	0.017***	0.013***
	(5.743)	(6.656)
Short-term interest rate if $rate_{i,t} \geq rate^*$	0.001***	0.007***
	(2.755)	(10.089)
Constant	0.007***	0.007***
	(10.246)	(12.919)
Observations	721	721
R-squared	0.171	0.254
Number of banks	103	103
Threshold estimator	0.0643	-0.0256
F-stat	39.18	10.21
p-value	0.0733	0.0267

Source: IMF staff estimates.

1/ The dependent variable is net interest margin. The data is at annual frequency covering an unbalanced sample of 103 Japanese banks for the period from 2000 to 2020. Controls include variables that capture bank-specific and macroeconomic conditions. Further robustness tests are available upon request. T-statistics are reported in parentheses with *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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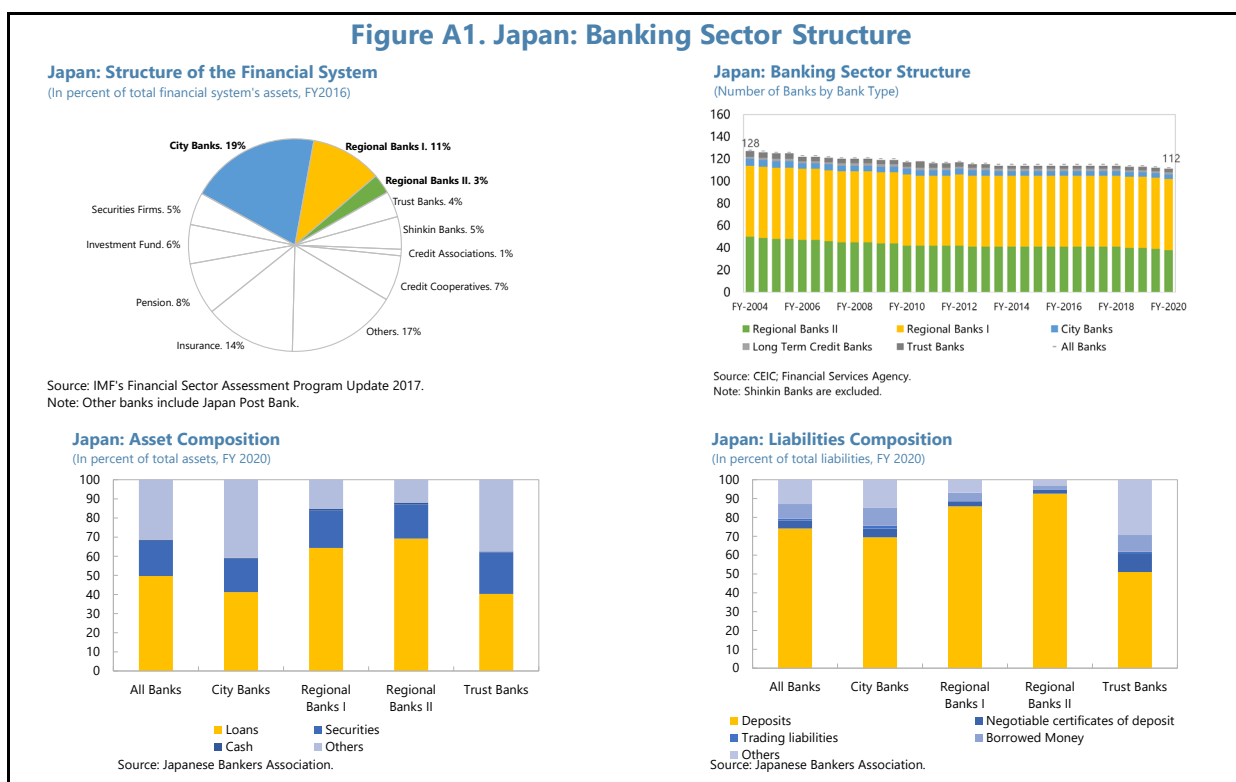Wang, Q., 2015, "Fixed-Effect Panel Threshold Model using Stata," The Stata Journal, 15(1):121-134.

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Appendix I. Banking Sector Structure

1. Banks play a major role in financial intermediation in Japan. The Japanese banking system consists of various types of banks (Figure A1).

- City banks—large and systemic banks—are universal banks, focusing on major domestic corporations and global businesses. There are currently about five city banks which account for about a fifth of total financial system assets. Of which, three banks are Globally-Systemic-Important Banks accounting for 18 percent of total financial system assets.

- Regional banks (tier 1) are usually based in the principal city of a prefecture, and they conduct most of their operations within that prefecture and have strong ties with local enterprises and local governments. As of March 2022, there are 62 tier 1 regional banks, accounting for about 11 percent of financial system assets.

- Regional banks II (tier 2) serve smaller companies and individuals within their immediate geographical regions. Tier 2 regional banks are even smaller banks; over the past decade, the number of tier 2 regional banks has declined over time. They account for only about 3 percent of total financial sector assets.

2. Japanese banks rely largely on domestic deposit-taking and lending operations. Of which, the balance sheets of city banks are relatively more diversified, compared to other types of banks in Japan, while regional banks rely more on funding by retail customer deposits and lending to local businesses than others.

Figure A1. Japan: Banking Sector Structure

Japan: Structure of the Financial System
(In percent of total financial system's assets, FY2016)

City Banks. 19%
Regional Banks I. 11%
Regional Banks II. 3%
Trust Banks. 4%
Shinkin Banks. 5%
Credit Associations. 1%
Credit Cooperatives. 7%
Others. 17%
Insurance. 14%
Pension. 8%
Investment Fund. 6%
Securities Firms. 5%

Source: IMF's Financial Sector Assessment Program Update 2017.
Note: Other banks include Japan Post Bank.

Japan: Banking Sector Structure
(Number of Banks by Bank Type)

Legend: Regional Banks II, Regional Banks I, City Banks, Long Term Credit Banks, Trust Banks, All Banks

Source: CEIC; Financial Services Agency.
Note: Shinkin Banks are excluded.

Japan: Asset Composition
(In percent of total assets, FY 2020)

Categories: All Banks, City Banks, Regional Banks I, Regional Banks II, Trust Banks
Legend: Loans, Securities, Cash, Others

Source: Japanese Bankers Association.

Japan: Liabilities Composition
(In percent of total liabilities, FY 2020)

Categories: All Banks, City Banks, Regional Banks I, Regional Banks II, Trust Banks
Legend: Deposits, Negotiable certificates of deposit, Trading liabilities, Borrowed Money, Others

Source: Japanese Bankers Association.
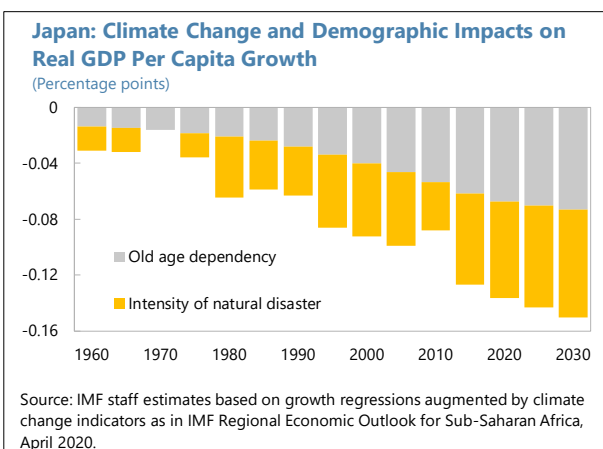
CLIMATE CHANGE POLICY OPTIONS[1]

As one of the countries' most vulnerable to climate change, there is an urgent need for Japan to pursue policies which mitigate global warming and adapt to the fallout from extreme weather events and sea level rise. Japan recently pledged to achieve carbon neutrality by 2050. This study finds that, with strong policy efforts, the carbon neutrality objective could be achieved in a growth-friendly way. Specifically, a comprehensive policy package—including green investment combined with a gradual rise in carbon prices—would help underpin the net zero carbon emissions target by 2050, while having positive impacts on growth, employment, and investment.

A. Climate Change and Potential Consequences

1.   Japan is one of the countries with the highest climate change risks, particularly related to extreme weather, natural disasters, and sea level rise. Climate change has affected Japan through changes in weather patterns and extreme weather events. Rising temperatures have intensified the frequency and severity of weather-related natural disasters. Particularly, the projection under RCP8.5 scenario shows a statistically significant increase of events with extreme precipitation for all areas and seasons by the end of the 21st century (Government of Japan, 2018). Tropical cyclones and storm surges are likely to occur more frequently and intensively, especially in the south of Japan. Climate change will also increase the frequency, size, and duration of extreme heat events, leading causes of weather-related deaths.

2.   Frequent and severe natural disasters combined with unique geographical features also complicate the management of energy sources and supply in Japan. The 2011 earthquake and tsunami led to devastation of the Fukushima Daiichi nuclear power plant on the Pacific coast of northern Japan. To date, there are strong concerns in Japan about restarting nuclear power plants, due to the risk of natural disasters. Geographical constraints, such as Japan being an archipelago or string of islands separated from a continent, hinder Japan's ability to cooperate with other countries on power supply or import electricity from other countries in the event of power shortages. Currently, Japan can rely only on emergency power sources from thermal power to prepare for natural disasters.

3.   Climate change risks could lead to lasting adverse economic consequences. An analysis based on country-level panel regressions of five-year GDP growth on the frequency and intensity of natural disasters as in IMF (2020a) shows a significant negative impact

Japan: Climate Change and Demographic Impacts on Real GDP Per Capita Growth
(Percentage points)

Source: IMF staff estimates based on growth regressions augmented by climate change indicators as in IMF Regional Economic Outlook for Sub-Saharan Africa, April 2020.

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[1] Prepared by Piyaporn Sodsriwiboon (APD). The author thanks Florence Jaumotte (RES) for sharing Japan's specific results from the analysis done for IMF (2020b) as well as Seung Mo Choi and Jiaxiong Yao (both AFR) for sharing the database and computer code used for the analysis in IMF (2020a).

of climate-induced natural disasters on Japan's medium-term growth, similar to its adverse demographic impact (see text chart). Reduced economic activity resulting from an increase in climate-related disruptions will likely cascade into lower tax revenues, while spending needs accelerate with post-disaster relief and rebuilding of damaged infrastructure. These would lead to weakening fiscal and public debt positions.

B. Japan's Climate Change Objectives and Policy Framework

4.   Japan has pledged to achieve carbon neutrality by 2050. Japan, currently the world's sixth-largest emitter of carbon dioxide, committed in October 2020 to reducing net greenhouse gas emissions to zero by 2050. The new goal is in line with targets set by the European Union and the United States. In April 2021, Japan raised its medium-term target to reduce its greenhouse gas emissions by 46 percent in fiscal year 2030 from its fiscal year 2013 levels, up from its earlier goal of 26 percent.

5.   Japan's climate change policies focus on policies to change the energy mix as well as mitigation measures. The Government of Japan (GoJ) plans to increase the share of non-fossil sources including renewables and nuclear to about 60 percent of total power generation by 2030, replacing the current high share of fossil fuels of about 80 percent. In 2012, Japan introduced a carbon pricing mechanism, named the Tax for Climate Change Mitigation (TCCM), on fossil fuel in addition to the Petroleum and Coal Tax. The TCCM tax rate was gradually increased to 289 yen (about $3) per ton of CO_2 emissions in 2016. The revenues from TCCM of about 0.05 percent of GDP have been spent on measures to expand renewable energy and enhance energy efficiency. A voluntary cap-and-trade emission trading mechanism was implemented in Tokyo Metropolitan City and Saitama Prefecture during 2006 and 2012. A Forest Environment Transfer Tax that was introduced in April 2019 with the aim to improve forest management and thereby contribute to CO_2 reduction.

6.   Japan has strong adaptive capacity to handle risks to physical exposures. The annual average of damages caused by weather-related natural disasters appear to be negligible in terms of Japan's gross domestic product (GDP), significantly lower than that of G20 and Asian economy peers. Japan also ranks high on its capacity to cope with weather-related natural disasters, thanks to its well-designed National Adaptation Planning to mitigate the disruptions from weather shocks and advanced adaptive technology built for climate resilience. In this regard, Japan has made significant contributions for mitigating risks of water-related disasters around the world through disseminating knowledge, experiences, and technology transfer, particularly for developing economies.

7.   Japan aims at achieving its climate change commitments in a growth-friendly way. In December 2020, the GoJ laid out a green growth strategy to facilitate private investment through public funding, tax incentives, changes in regulations and standards, and public-private partnerships, as well as green finance (see *2022 Japan: Selected Issues* paper "Climate Finance in Japan"). In addition, the GoJ pledged a 2 trillion-yen (US$18 billion or 0.4 percent of GDP) fund over ten years to promote green investment and innovation including renewables and hydrogen, and budgeted for public investment on disaster-resilient infrastructure of about 6 trillion yen (US$55 billion or 1 percent of GDP) to support the green recovery. The Bank of Japan announced a new funds-

supplying operation to support climate-related investment and loan in June 2021, and it provided more than 2 trillion yen under the new scheme in its first operation in December 2021.

C.   An Enhanced Policy Mix to Meet the Climate Goals

8.   Japan's new impetus to reduce carbon emissions is an important and very positive step forward. The broad strategy to achieve carbon neutrality in a growth-friendly way will require significant investment, particularly to shift energy sources away from fossil inputs. New investment to this end would help jump-start the transition to a low carbon economy and lift Japan on a higher growth path.
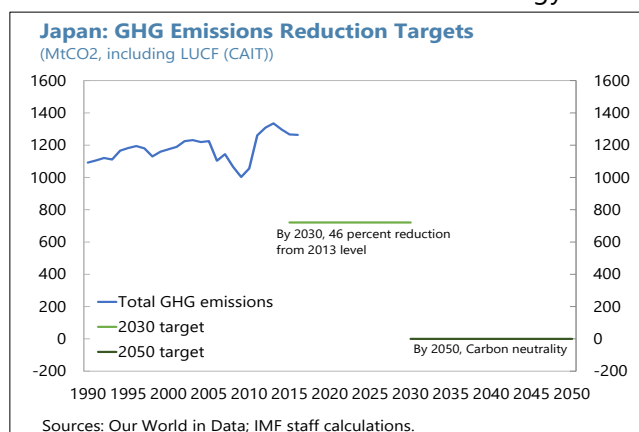
Combining the Green Investment Push with Carbon Pricing
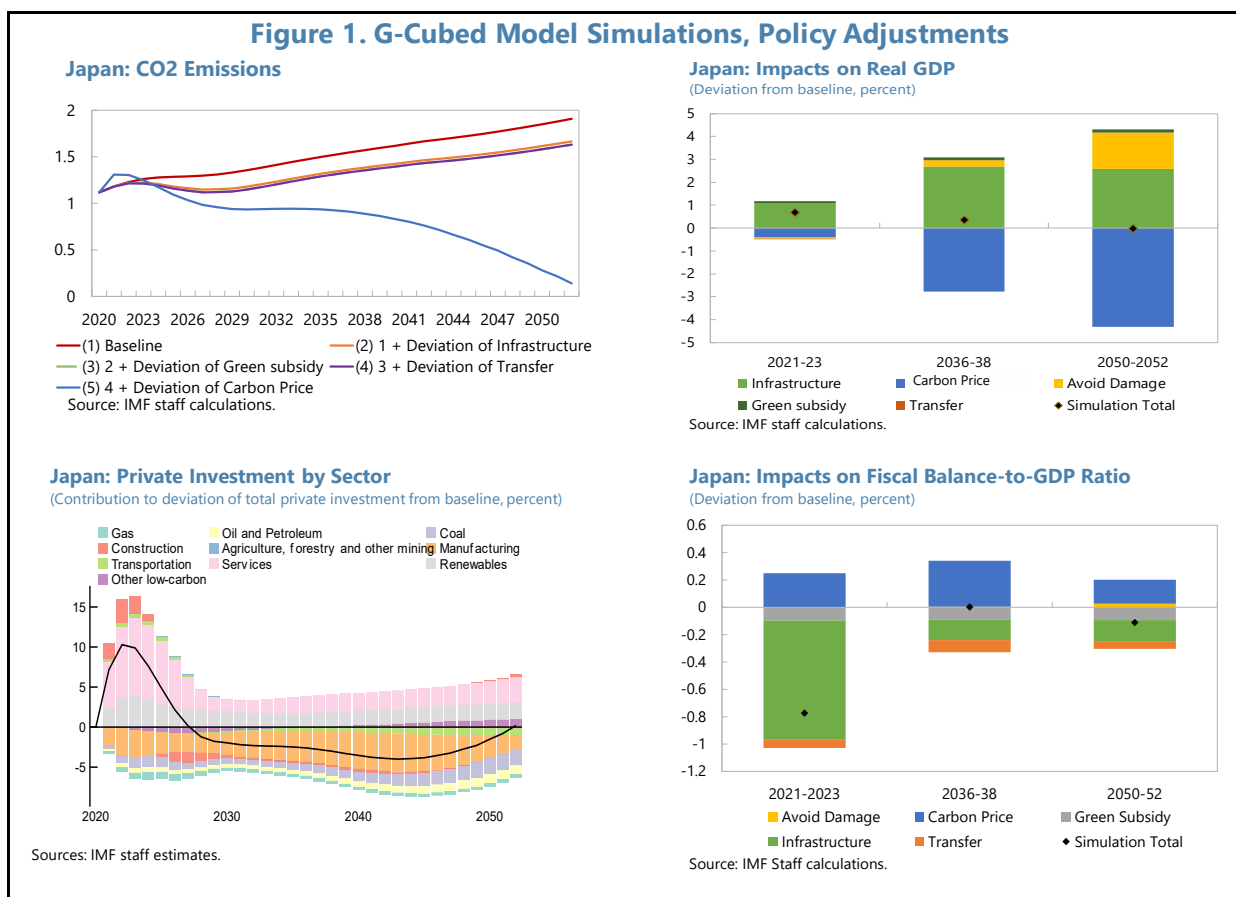
9.   Further efforts will be needed to achieve the ambitious emissions goals. Reaching the goal of zero net emissions by 2050 without carbon pricing would be challenging. Unlike pricing carbon, incentives and subsidies to realign production and innovation toward clean energy could

lower the relative cost of clean energy. A cheaper cost of clean energy not only would incentivize a switch away from high carbon energy, but also, *ceteris paribus*, would increase total energy demand (G20, 2021). This energy demand channel makes subsidies less effective, especially in cases where carbon-intensive energy cannot be easily substituted for. Over time, the fiscal costs to finance these incentives and subsidies will also rise in proportion to the

Japan: GHG Emissions Reduction Targets
(MtCO2, including LUCF (CAIT))

By 2030, 46 percent reduction from 2013 level

— Total GHG emissions
— 2030 target
— 2050 target

By 2050, Carbon neutrality

Sources: Our World in Data; IMF staff calculations.

increased use of clean energy. Conversely, carbon pricing is a highly effective policy tool, because it raises the overall cost of energy and creates first-order reductions in energy demand. This can further amplify the incentives to shift away from carbon-intensive to clean energy.

10.   This study analyzes a comprehensive policy package as envisaged in Japan's current plans and complemented with carbon pricing. The purpose is to illustrate the role that an initial green investment push can play in combination with carbon pricing to reduce carbon emissions substantially, as in IMF (2020b). The proposed policy package includes (i) green energy supply policies consisting incentives and subsidies on clean energy production and a 10-year green public investment program focused on low-carbon energy sectors, high energy-efficient building, and climate-resilient infrastructure, (ii) carbon pricing calibrated to achieve an 80 percent reduction in carbon emissions by 2050 after accounting for emission reductions from the green supply policies, (iii) compensatory transfers to households, recycling part of carbon tax revenues through targeted cash transfers to help protect the purchasing power of low-income households, and (iv) supportive macroeconomic policies to facilitate debt financing, with the debt increase to finance green spending partly offset by the additional carbon revenues. Detailed assumptions underlying the policy package are described in the Appendix.

Figure 1. G-Cubed Model Simulations, Policy Adjustments

Japan: CO2 Emissions

Japan: Impacts on Real GDP
(Deviation from baseline, percent)

— (1) Baseline — (2) 1 + Deviation of Infrastructure
— (3) 2 + Deviation of Green subsidy — (4) 3 + Deviation of Transfer
— (5) 4 + Deviation of Carbon Price
Source: IMF staff calculations.

■ Infrastructure ■ Carbon Price ■ Avoid Damage
■ Green subsidy ■ Transfer ◆ Simulation Total
Source: IMF staff calculations.

Japan: Private Investment by Sector
(Contribution to deviation of total private investment from baseline, percent)

■ Gas ■ Oil and Petroleum ■ Coal
■ Construction ■ Agriculture, forestry and other mining ■ Manufacturing
■ Transportation ■ Services ■ Renewables
■ Other low-carbon

Sources: IMF staff estimates.

Japan: Impacts on Fiscal Balance-to-GDP Ratio
(Deviation from baseline, percent)

■ Avoid Damage ■ Carbon Price ■ Green Subsidy
■ Infrastructure ■ Transfer ◆ Simulation Total
Source: IMF Staff calculations.

11. **With strong policy efforts, the carbon neutrality objective could be achieved in a growth-friendly way** (Figure 1)[2].

- Under a business-as-usual scenario, Japan's carbon emissions are projected to continue rising and reach 2 Gigaton CO2 by 2050.

- An initial green investment push combined with steadily rising carbon prices would deliver the needed emissions reductions toward carbon neutrality by 2050 at reasonable output effects[3]. The short-run positive effect from a green investment push would have the double benefit of supporting the recovery from the COVID-19 crisis and putting in place the conditions for the

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[2] An initial uptick of Japan's CO2 emissions is resulted from capital flow adjustments across fossil-fuel exporters and non-fossil regions, assuming the comprehensive policy package is simultaneously implemented. Investment capital would shift away from high carbon-intensive regions to a relatively less carbon-intensive regions such as Japan and Europe. When the carbon prices are small, such capital inflows offset the impact of carbon prices on Japan's investment leading to a temporary increase in CO2 emissions in Japan. Nevertheless, as carbon prices rise, the impact of carbon prices dominates the effect of international capital flows.

[3] Carbon pricing could, in addition, help mobilize green investment in the cost-effective way, as it helps equate the marginal costs of CO2 emission across different aspects. The scale-up of public investment could also help address the potential market failures or externalities. For example, investments in clean technology networks might not be adequately supplied by the private sector even with carbon pricing (e.g., high voltage transmission lines to accommodate intermittent renewables).
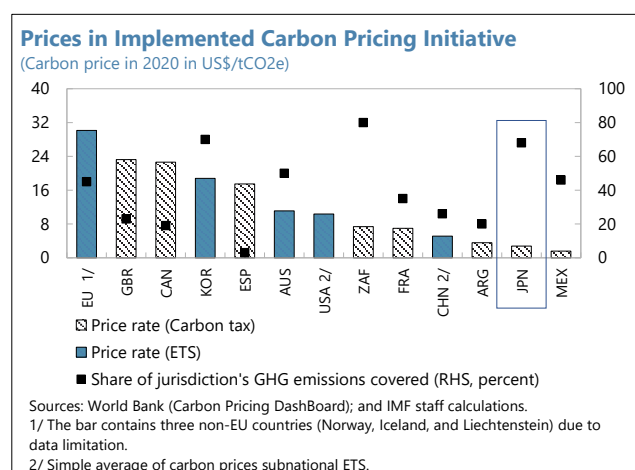
transition to a low-carbon economy. But a green investment push alone is unlikely to reduce emissions to net zero.

- Carbon pricing is therefore critical to mitigation, as it incentivizes both energy efficiency gains and a reallocation of resources from high- to low-carbon activities. To facilitate such a transition, affected households will be compensated for the impacts of higher carbon prices, which will help maintain their purchasing power and consumption levels. Over time, the benefits of climate mitigation in the form of avoided damages grow larger and the policy package boosts GDP and growth above that of the baseline.

- On fiscal front, the policy package would initially weaken the budget balance and require debt financing since carbon revenues are smaller than the initial spending on infrastructure, subsidies, and compensatory transfers to households. As carbon prices would continue to rise, carbon revenues will eventually be broadly sufficient to finance the policy package. It is important to note that the GoJ has launched various initiatives to help catalyze significant green private investment. Should the green private investment materialize, this could help alleviate fiscal pressures and provide additional boost through productivity improvement as the efficiency of private investment would be relatively high compared with that of public investment.

Options for Carbon Pricing Policies

12.   The analysis highlights that carbon pricing should be an integral component of the policy package for emissions reduction.
Carbon pricing is considered the most efficient tool to address the negative externalities from emissions. It also directs investment and innovation toward low-carbon technologies, improving the energy mix and efficiency. Carbon pricing policies can take different forms—a carbon tax or cap-and-trade system. The following discusses the options, applicability, and trade-offs of these carbon pricing tools.

Prices in Implemented Carbon Pricing Initiative
(Carbon price in 2020 in US$/tCO2e)

☒ Price rate (Carbon tax)
■ Price rate (ETS)
■ Share of jurisdiction's GHG emissions covered (RHS, percent)

Sources: World Bank (Carbon Pricing DashBoard); and IMF staff calculations.
1/ The bar contains three non-EU countries (Norway, Iceland, and Liechtenstein) due to data limitation.
2/ Simple average of carbon prices subnational ETS.

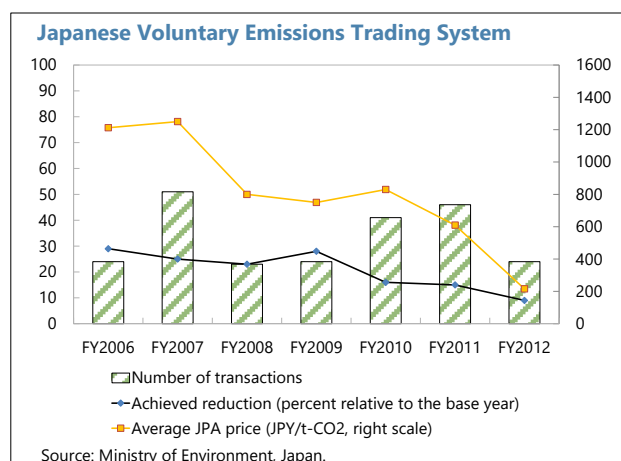**13.   There is scope to scale up and broaden the carbon tax.** A broad-based carbon tax would provide a robust price signal that would reduce energy demand and redirect investment to low-carbon or cleaner technologies. Japan has in place a Tax for Climate Change Mitigation (TCCM) on fossil fuel, in addition to the Petroleum and Coal taxes. Nevertheless, the TCCM tax rate remains very low, and the rate and its coverage could be expanded further to cover other high-carbon sectors and activities. Arguably, Japan's fuel prices are high due to layers of gasoline taxes, the petroleum and coal tax, and TCCM. Among advanced economy peers, the effective fossil carbon rate—comprising explicit carbon tax and fuel excise tax rates—is lower in Japan than in France, Germany, and the United Kingdom, but higher than in Canada and the United States. In this context, the existing fuel tax scheme could be streamlined,

and further integrate carbon charges into the scheme while extending them to carbon-intensive energy sources and economic activities.

14.   A cap-and-trade system with full sectoral coverage is broadly equivalent to a carbon tax. Given the same sectoral coverage, both systems can achieve the same carbon prices and raise the same amount of revenue (IMF, 2020c and 2021). However, an explicit carbon tax provides more certainty about future prices, while a cap-and-trade system provides more certainty about the emissions reduction. In practice, a cap-and-trade system could be more costly to set up and administer.

15.   Japan's cap-and-trade scheme could be relaunched, with the scheme broadened and further strengthened. The Government of Japan implemented the Japanese Voluntary Emissions Trading System (JVETS) during FY2006-12. The JVETS covered carbon emissions from industrial processes (production and energy consumption), offices (energy consumption), and waste management (waste incineration, waste combustion, and waste recycling). Alongside, the J-Credit Scheme was also created to certify credits for emissions reduction achieved by firms. At its peak, the JVETS covered only 0.01 percent of
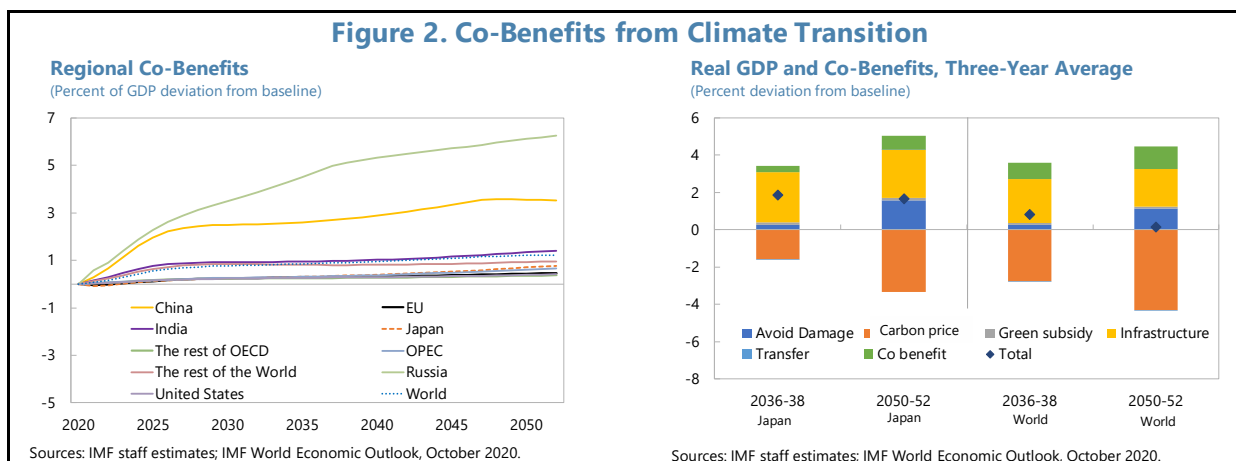

Japanese Voluntary Emissions Trading System

Number of transactions
Achieved reduction (percent relative to the base year)
Average JPA price (JPY/t-CO2, right scale)
Source: Ministry of Environment, Japan.

2013 emissions with very few transactions occurring. The auctioned price was low at about JPY 810 or US$7.4 and highly volatile (EDF, 2015). Price volatility could discourage investment and undermine political support for climate policy. Given the infrastructure for the cap-and-trade system previously in place, the system could be reintroduced and expanded to all emissions. To anchor a more stable carbon price path, the price signal should also be strengthened, including by setting an auction price floor.

Other Considerations for Mitigation Policies

16.   Regulations that limit emissions could be an alternative policy tool, if carbon pricing is politically challenging. Regulations can help start the transition to a low-carbon economy. Nevertheless, regulations may require complex and multiple rules for different sectors, as the government will need to identify where and by how much emissions should be reduced. This would likely be costly for economic activity and administratively expensive, and not generate income to support or finance the clean transition (G20, 2021).

17.   Feebates can help complement other mitigation policies. A feebate scheme, such as levies imposed on power generators with above average emissions per kilowatt hour (kWh) and rebates for generators with below average emissions per kWh, could be an instrument to foster change in the energy mix. Feebates can be targeted to specific markets including the power sector

and the transportation sector, among others, and their impact on emissions will depend on the size of the market and its energy intensity.

Figure 2. Co-Benefits from Climate Transition

Regional Co-Benefits
(Percent of GDP deviation from baseline)

Real GDP and Co-Benefits, Three-Year Average
(Percent deviation from baseline)

Sources: IMF staff estimates; IMF World Economic Outlook, October 2020.

Sources: IMF staff estimates; IMF World Economic Outlook, October 2020.

18.   Japan's contributions to regional and global decarbonization are welcome. The model simulations suggest a concerted effort to tackle climate change globally could generate substantial positive externalities where all countries would benefit (Figure 2). Japan is providing financial support for decarbonization and agreed to halt all new direct government support for unabated coal power generation abroad by the end of 2021. Looking ahead, further efforts to enhance carbon pricing in Japan and climate finance to less-developed economies will help contribute to the global efforts on climate policy.

Energy Sector Reforms

19.   Japan has made significant progress on energy sector reforms to fully liberalize wholesale and retail energy markets. These reforms help secure stable power supply and curtail electricity costs. In addition, a Legal Unbundling Act was adopted in April 2020, allowing the transmission and distribution sectors (regulated sectors) to be unbundled from generation and retail companies (competitive sectors), thus enhancing flexibility and transparency.

20.   Looking ahead, reforms should further enhance competition and promote non-fossil energy sources. Priority areas include (i) administrative and regulatory reforms to ease regulations (e.g., the Cropland Act, the Act on Establishment of Agricultural Promotion Regions, and other red-tape bureaucracy, which restrict land use and prevent investment in the renewable energy sector); (ii) reforms to create a market to facilitate access to new sources of energy (large hydro, nuclear, and other renewables), along with a non-fossil certified market where small retailers can procure non-fossil energy; (iii) the introduction of an indirect auction system for the usage of transmission lines across regions that will promote price competitiveness; and (iv) the establishment of a balancing market that can procure and trade flexibly in accordance with a public offering of adjustment power.

D. Conclusions and Policy Recommendations

21.   Japan's carbon neutrality pledge is an important step forward to cope with climate change risks. While policies to achieve the new climate target are being developed, Japan's current climate change strategy relies primarily on green private investment, as well as subsidies and incentives for green energy and technological innovation. The idea is to shift energy consumption into electricity, and to increase the share of renewable energy in the electricity sector. Reducing emissions will be especially challenging given that the country relies heavily on fossil fuels for its energy needs with a small share of renewables and constraints (such as on land use) on building more renewable capacity. Nonetheless, reaching the goal of zero net emissions by 2050 without carbon pricing would be challenging.

22.   Japan's climate change policy mix could be further enhanced, with carbon pricing being a central component of the policy package for emissions reduction. This study finds that a comprehensive policy package—including green energy investment combined with a gradual rise in carbon prices—would have net positive impacts on growth, employment, and investment. In particular, carbon pricing would help amplify current incentives for green private investment, accelerate a shift from high- to low-carbon energy sources, and underpin the emissions reduction target. Compensatory transfers financed partly by carbon tax revenues could be provided for affected households, helping maintain their purchasing power and consumption levels. These should be complemented by reforms to enhance competition in the energy sector and promote non-fossil energy sources.

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Appendix I. G-Cubed Model

1.   **To gauge the long-term dynamics of temperatures, carbon emissions, and the effects of mitigation policies on carbon emissions and the macroeconomic dynamics in the short, medium, and long term, the analysis utilizes the G-cubed global macro model with detailed energy sectors as in IMF (2020b).**

2.   **The G-cubed model is a multi-country, multi-sector intertemporal general equilibrium model, which has been used for a variety of policy simulations including the implications of greenhouse gas policy, tax, and other macroeconomic policies.** There are 10 regions, 20 economic sectors, and economic agents including heterogeneous households, firms, governments within each region and economic sector in the model. A general equilibrium model features detailed energy sectors (see chart), forward-looking agents, real and nominal rigidities such as wage rigidities and adjustment costs on firms in the short run, as well as fiscal and monetary policies. CO_2 emissions are measured through the burning of fossil fuels in energy generation. The model contains fossil fuels and clean energy sectors. The model draws on the estimates of carbon removal technologies from Fuss et al (2018).
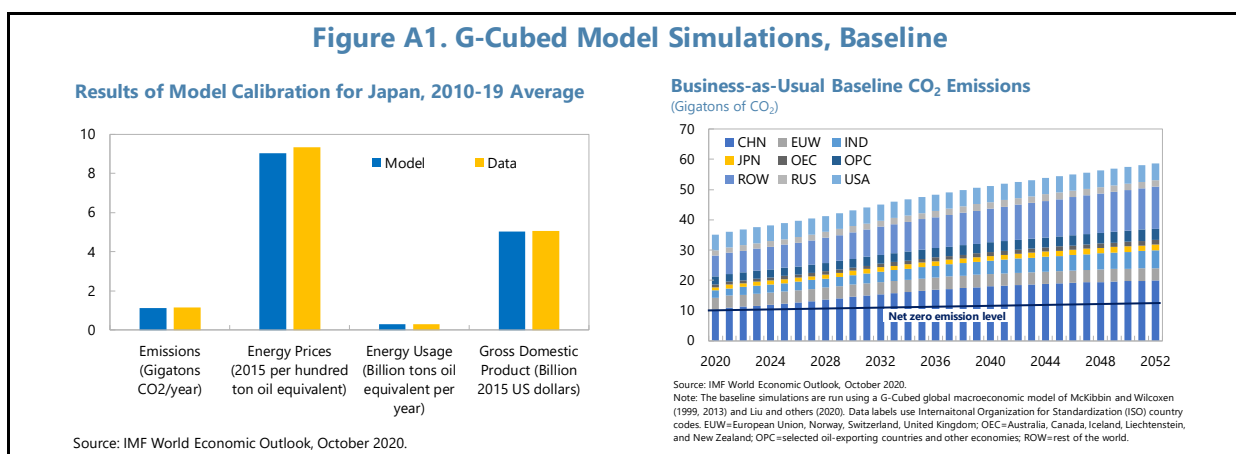
Structure of G-Cubed Model

Region	Sector	Broad description
Australia China Europe India Japan Oil-exporting developing economies Rest of the OECD Rest of the World Russian Federation United States	Coal generation Natural gas generation Petroleum generation Nuclear generation Wind generation Solar generation Hydroelectric generation Other generation	Energy generation sectors
	Electricity delivery Gas extraction and utilities Petroleum refining Coal mining Crude oil extraction	Energy sectors other than generation
	Construction Other mining Agriculture and forestry Durable goods Nondurable goods Transportation Services	Goods and Services

Source: IMF World Economic Outlook, October 2020.

3.   **A scenario analysis considers a *baseline or business-as-usual scenario* reflecting carbon emissions without policy adjustments, and a *policy scenario* entailing strong policy adjustment to reduce significantly net carbon emissions to zero by 2050.** Specifically, a baseline scenario is based on the initial dynamics from 2018 to 2019 and subsequent projections from 2019 onwards for sectoral productivity growth rates by sector and by country (Figure A1). Sectoral productivity growth is driven by labor force growth and labor productivity growth. On the other hand, a policy scenario aims at achieving the net zero carbon emissions by 2050 with a comprehensive policy package and a concerted effort at the global level. The objective of net zero emissions by 2050 is operationalized as a reduction of gross emissions by 85 percent, with natural emissions sinks and some deployment of carbon capture and storage technologies to absorb the remaining emissions. The policy package comprises:

- Carbon pricing: Carbon prices are calibrated to achieve the 80 percent reduction in emissions by 2050, after accounting for green investment. This entails an annual growth rate of carbon prices of around 7 percent over the period of 2019-2050. For Japan, this would imply carbon prices to reach US$16 a ton of CO_2 by 2030 and US$64 a ton of CO_2 by 2050.

- Green supply policies: An 80 percent subsidy rate on renewables production and 10-year green public investment program starting at 1 percent of GDP and linearly declining to zero over 10 years. Public investment is assumed to take place in renewable and other low-carbon energy sectors, as well as climate-resilient and high energy-efficient infrastructure. The assumption related to public investment is assumed for illustrative purpose only. Alternatively, should this be substituted by private investment, there will be additional benefits in term of fiscal savings and investment efficiency gain.

- Compensatory transfers: Households would receive compensation equal to ¼ of carbon tax revenues. Such transfers should sufficiently allow poorer households to be able to maintain their purchasing power through targeted cash transfers.

- Supportive macro policies: The policy package is expected to require additional debt finance for the first decade and occur against a backdrop of low-for-long interest rates in a low inflation context which would help facilitate debt finance.

- Estimates of the induced innovation response and the avoided damages from climate change are also included.

4.   The simulation results present the net outcomes of policy adjustments on key macroeconomic variables such as real GDP growth, investment, employment, and fiscal balances, compared to those of the baseline. At a broad level, mitigation policies affect carbon emissions and the macroeconomy through the price of fossil fuel energy relative to clean energy and overall energy prices. The simulations also account for resource reallocation across different economic sectors through various channels, as some sectors contract and others expand.

Figure A1. G-Cubed Model Simulations, Baseline

Results of Model Calibration for Japan, 2010-19 Average

Business-as-Usual Baseline CO_2 Emissions
(Gigatons of CO_2)

Source: IMF World Economic Outlook, October 2020.

Source: IMF World Economic Outlook, October 2020.
Note: The baseline simulations are run using a G-Cubed global macroeconomic model of McKibbin and Wilcoxen (1999, 2013) and Liu and others (2020). Data labels use Internaitonal Organization for Standardization (ISO) country codes. EUW=European Union, Norway, Switzerland, United Kingdom; OEC=Australia, Canada, Iceland, Liechtenstein, and New Zealand; OPC=selected oil-exporting countries and other economies; ROW=rest of the world.

CLIMATE FINANCE IN JAPAN[1]

The government of Japan has emphasized the need to develop a financial system that can support the transition to a low carbon economy and manages the financial stability implications of the transition and the impact of climate change. Regulatory initiatives are underway to achieve these goals yet more will be needed. Green financial products and markets are developing but remain still small. Climate-related reporting and disclosure, important for the development of green financial markets and the management of financial stability risks, are still limited. Progress is being made on assessing the financial risks associated with climate change.

A.   Introduction and Regulatory Approaches

1.   Mitigating and adapting to climate change will require large investments from the private sector. Japan's green growth strategy recognizes the need to mobilize private sector investment including in the decarbonization of energy production, industrial processes, transport, and housing. The development of green financial products and markets can contribute to this goal, but carbon pricing and other fiscal measures are essential to achieve net zero carbon emissions by 2050 (see *2022 Selected Issues* paper "Climate Change Policy Options"). They are also paramount to provide price signals for the private sector to efficiently allocate capital toward climate-friendly activities and to manage climate risk exposures.

2.   Climate change poses risks to the financial system and the wider economy. Policymakers, regulators, and the private sector increasingly recognize climate change's important implications for the financial sector.[2] The potential impact of climate risks is large if global mitigation efforts are insufficient. Climate risks are also nonlinear, hard to estimate, and depend on actions taken in the next years. Losses from climate-related risks affect the financial system directly, through price impairment, reduced collateral values, and underwriting losses, and indirectly, through lower economic growth and tighter financial conditions.

3.   Several government actors are involved in regulating and developing climate finance in Japan. The Bank of Japan (BoJ) is integrating climate considerations in its monetary policy and financial stability functions. The Financial Services Agency (FSA) is analyzing and monitoring the financial implications of climate change, developing supervisory guidance for financial institutions, contributing to guidelines for green market development, and working on a climate scenario pilot jointly with the BoJ. The Ministry of the Environment (MoE) has released guidelines for green financial products and environmental disclosures and supports the development of green financial products and markets including through subsidy and pilot programs. The Ministry of Economy, Trade and Industry (METI) plays a role in providing incentive programs for sustainable finance and has jointly with MoE and FSA released guidelines for transition finance.

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[1] Prepared by Jochen M. Schmittmann (OAP). The author thanks Yun Gao (OAP) for excellent research assistance.

[2] See Furukawa et al. (2020) for a survey of literature on the channels through which climate change affects the financial system.

4.   The BoJ released its strategy on climate change in July 2021. The BoJ views support to the private sector in tackling climate change as consistent with its mandate to ensure macroeconomic and price stability, while emphasizing due consideration to market neutrality. On the financial stability side, the BoJ will include climate risk considerations in micro-prudential surveillance, develop quantitative assessments of climate financial risks in cooperation with the FSA, and encourage financial institutions to enhance climate disclosures. The BoJ intends to strengthen its climate research, continue to help advance climate finance in international fora, purchase green government bonds as part of its foreign currency reserve management, and strengthen incorporation of climate consideration in its own operations and communication.

5.   The BoJ is supporting private financial institutions' efforts to address climate change through a fund-provisioning measure. Under the measure, since December 2021, the BoJ is offering zero interest loans to financial institutions for green loans/bonds, sustainability-linked loans/bonds, and transition finance. Financial institutions will be allowed to add twice the amount of their loans/investments under the scheme to the reserve remuneration tier that carries zero interest, an incentive given that part of banks' reserves at the BoJ are remunerated at -0.1 percent. The duration of the loan will be one year, but rollover is permitted, effectively providing long-term funding through the measure. Interest from financial institutions was strong in the first auction in December 2021 with slightly more than 2 trillion yen disbursed.

B. Green Financial Products and Markets in Japan

6.   The mainstreaming of climate change considerations in investment management and the development of green financial products are important to tackle climate change. Both can contribute to the pricing of climate related risks and the allocation of capital toward lower carbon activities. In investment management, climate issues are often integrated with a broader set of environmental, social and governance considerations (ESG).[3] The integration of climate change in investing takes various forms with different degrees of impact. Approaches include, for example, engagement with company management on climate issues, exclusion of high polluting firms or sectors from investment mandates, or portfolio tilts to firms leading on addressing climate risks. In the green debt space, product innovation in recent years has led to rapid growth globally (Schmittmann and Chua 2021). The main debt products with climate change relevance are green bonds and loans which link the use of debt proceeds to green purposes defined in guidelines and standards and sustainability-linked bonds and loans which contain overall sustainability targets for the borrowing entity.

7.   Investor interest in climate issues is rising in Japan. Many of the largest asset owners and investment managers in Japan have signed up to the Principles for Responsible Investment (PRI) pledging to integrate ESG into their investment process, ownership practices, and support ESG disclosures. The Japan Sustainable Investment Forum, a non-profit dedicated to advancing sustainable finance, finds in a survey of investment managers that the most common method of

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[3] See IMF (2019) for an overview of sustainable finance.

engagement is exercising shareholder voting rights, but deeper approaches including ESG integration in investment processes are gaining traction (Figure 1.1). Banks are also involved in the development of green financial products and markets including through green, sustainability-linked, and transition loans.
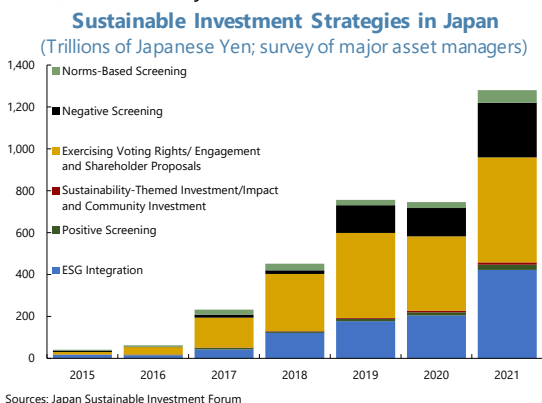
8.   **Sustainable financial products are growing**. Flows into ESG themed equity funds have increased strongly in recent years, in line with the global trend (Figure 1.2). Popular Japanese ESG equity indices have performed in line with or outperformed the broad market in recent years, which likely supported inflows in related fund products (Figure 1.3). Issuance of green debt has been rising, mostly green bonds ($12.7 bn issuance in 2021), while green loan origination plunged last year (from $1.5 bn in 2020 to $0.3 bn in 2021) (Figure 1.4). About half of green bonds are issued by financial institutions, 30 percent by other companies, and 20 percent by government agencies. Green loans are predominantly made to non-financial corporates. Sustainability-linked bonds and loans, new financial innovations, grew fast in 2021 to $1.1 bn and $2.4 bn, respectively, from less than $0.3 mn for bonds and loans combined in the prior year. The rapid adoption of sustainability-linked loans may have contributed to the decline in green loans in 2021. Japan is also promoting transition finance as a debt label that can overlap with other green and sustainability-linked debt types but can also include other activities not eligible under standards for green and sustainability-linked debt. Despite rapid growth, climate related debt remains a small fraction of total debt.

9.   **Government initiatives have supported the development of green financial products**. The MoE is promoting the adoption of green financial products. It has published guidelines for green bonds, green loans, and sustainability-linked loans, and more broadly given guidance on ESG finance, environmental reporting, responsible banking, and the application of TCFD recommendations for climate scenario analysis. FSA, METI and MoE have jointly released guidance on transition finance. The MoE provides a subsidy program for green bond issuance to defray costs associated with issuing green bonds including for external review and consulting fees.

10.   **The development of green financial products requires a robust ecosystem of guidelines, assurances, data provision, and impact measurement to avoid greenwashing concerns.** Lead by the MoE, Japan has made progress on providing guidance and support for green financial markets and products. To ensure the environmental integrity of green products and avoid greenwashing (false or exaggerated claims of green benefits), monitoring, assurance, and review of green financial products need to be strengthened. Data and reporting on environmental impact, use of proceeds, and other aspects of the 'greenness' of green financial products and issuers need to improve to allow investors to verify environmental claims. Taxonomies of green activities would help investors and borrowers to determine the environmental impact and classification of their activities.

Figure 1. Green Financial Products and Markets

*1. Investment managers increasingly incorporate some form of sustainability consideration.*

Sustainable Investment Strategies in Japan
(Trillions of Japanese Yen; survey of major asset managers)

Sources: Japan Sustainable Investment Forum

2. Flows into sustainability themed funds have been strong in Japan, in line with the global trend.

ESG Equity Fund Flows
(Millions of U.S. dollars)

Sources: EPFR
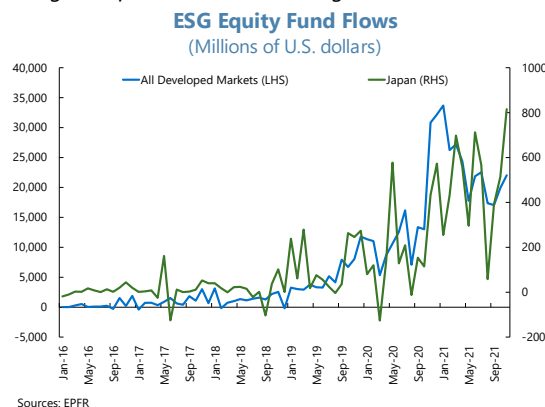
3. Popular Japanese ESG equity indices have performed in line or better than the market.

Japanese ESG Equity Indices
(Indices; Jan-18=100)

Sources: Bloomberg
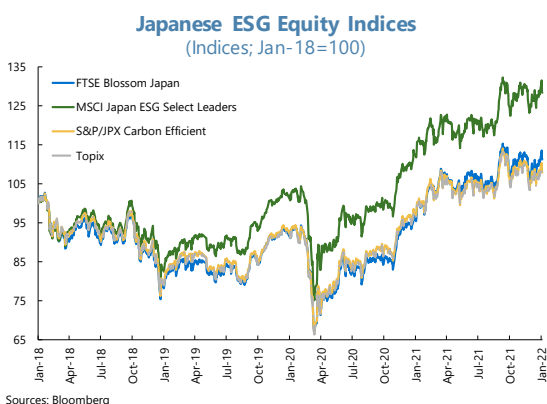
4. Sustainable debt issuance has been rising but remains a small fraction of conventional debt.

Sustainable Debt Issuances by Japanese Entities
(Billions of U.S. dollars)

Sources: BloombergNEF
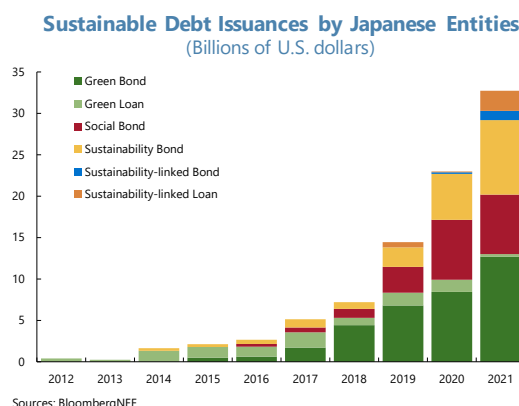
C.   Climate Disclosures and Reporting

11.   Reliable and comparable climate-related data are crucial to assess financial stability risks, properly price and manage climate-related risks, and take advantage of the opportunities arising from the transition to a low-carbon economy (NGFS 2021). There are currently large gaps in the availability of climate data that hinder these objectives. For example, corporate emission reporting, locational data of assets to assess physical and transition risks, and impact reporting for green debt are often insufficient. There is also a lack of forward-looking exposure analysis. The NGFS[4] has identified a mix of needed policy interventions based on three

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[4] The Network for Greening the Financial System (NGFS), launched in 2017, is a group of central banks and supervisors willing to share best practices and contribute to the development of environment and climate risk management in the financial sector and to mobilize mainstream finance to support the transition toward a sustainable economy. The FSA joined the NGFS in 2018 and the BoJ joined in 2019.

broad themes: rapid convergence towards a common and consistent set of global disclosure standards; efforts towards a minimally accepted global taxonomy; the development and transparent use of well-defined and decision-useful metrics, certification labels, and methodological standards.
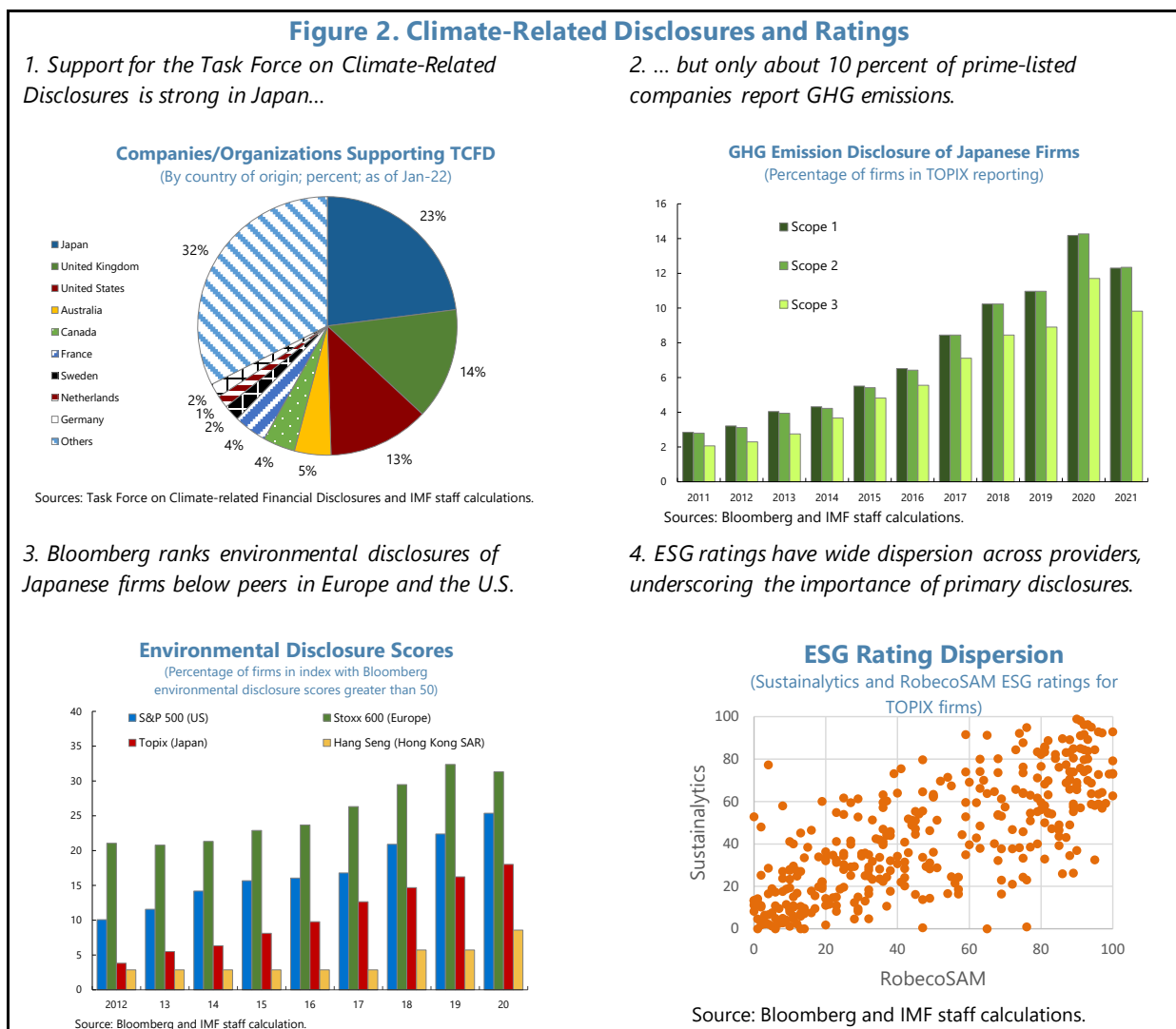
12.   The government of Japan encourages climate reporting and disclosure. The MoE provides environmental reporting guidelines and the government encourages climate reporting in particular based on guidance from the Task Force on Climate-Related Financial Disclosures (TCFD). Major emitters of greenhouse gases (GHG) report emissions to MoE which is made public, however, matching this data with corporate financial data is challenging. Revisions to Japan's Corporate Governance Code, which is not legally binding, require companies to develop a basic sustainability policy and disclose initiatives on sustainability, and, for prime market listed companies, to enhance the quality and quantity of climate-related disclosures based on TCFD recommendations or equivalent international frameworks. Based on the revised code, the Tokyo Stock Exchange is planning to require prime listed companies to make TCFD-consistent disclosures on a comply or explain basis.

13.   Progress has been made on climate data in Japan, but more will be needed to develop green financial markets and manage climate risks. Japanese companies and organization are among the main supporters of TCFD (Figure 2.1). Meanwhile, GHG emission disclosures among Japanese firms are limited with about 14 percent of firms in the TOPIX stock index reporting narrow scope 1 emissions and fewer firms reporting scope 3 emissions that include a company's value chain (Figure 2.2).[5] Environmental disclosures by Japanese firms lag those of firms listed in the European Union (EU) and the United States (US) although the gap is narrowing, according to Bloomberg (Figure 2.3). Private data providers strive to supply ESG data including on climate-related issues, but methodologies are often opaque and there is a lack of consistency across providers making it difficult for investors to rely on private ratings (Figure 2.4).

14.   The government's and other stakeholders' focus on improving climate data and reporting is commendable but additional measures should be considered. It will be important to continue working on disclosure standards and guidelines in Japan and through international fora including the TCFD, the Financial Stability Board (FSB), the newly formed International Sustainability Standards Board (ISSB) and the NGFS. Broadening and deepening climate disclosures by corporates, financial institutions and investors is needed. Disclosure requirements in the Corporate Governance Code are welcome and consideration should be given to legally binding minimum disclosure requirements. Development of a green taxonomy in line with international developments or equivalent guidance on what constitutes a green activity would be useful. Certification labels and external reviews and assurances should be strengthened. Plans to develop a code of conduct for

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[5] Scope 1 emissions cover direct emissions from owned or controlled sources. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the reporting company. Scope 3 includes all other indirect emissions that occur in a company's value chain. The lower reporting share in 2021 compared to 2020 is due to data submission lags.
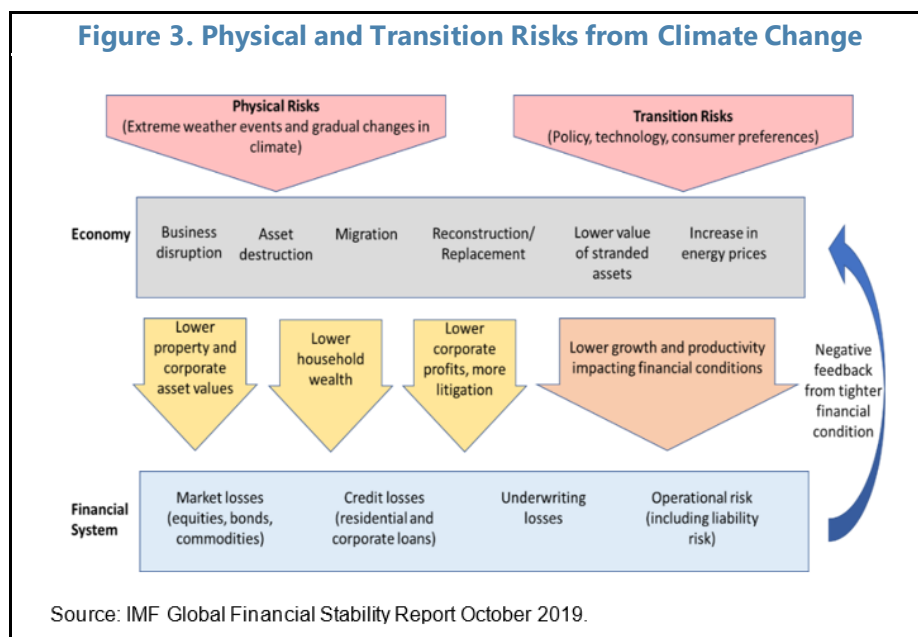
ESG rating agencies and data providers could help address some concerns over transparency and reliability.

Figure 2. Climate-Related Disclosures and Ratings

1. Support for the Task Force on Climate-Related Disclosures is strong in Japan...

Companies/Organizations Supporting TCFD
(By country of origin; percent; as of Jan-22)

- Japan
- United Kingdom
- United States
- Australia
- Canada
- France
- Sweden
- Netherlands
- Germany
- Others

23%
32%
14%
13%
5%
4%
4%
2%
1%
2%

Sources: Task Force on Climate-related Financial Disclosures and IMF staff calculations.

2. ... but only about 10 percent of prime-listed companies report GHG emissions.

GHG Emission Disclosure of Japanese Firms
(Percentage of firms in TOPIX reporting)

Scope 1
Scope 2
Scope 3

Sources: Bloomberg and IMF staff calculations.

3. Bloomberg ranks environmental disclosures of Japanese firms below peers in Europe and the U.S.

Environmental Disclosure Scores
(Percentage of firms in index with Bloomberg environmental disclosure scores greater than 50)

S&P 500 (US)
Stoxx 600 (Europe)
Topix (Japan)
Hang Seng (Hong Kong SAR)

Source: Bloomberg and IMF staff calculation.

4. ESG ratings have wide dispersion across providers, underscoring the importance of primary disclosures.

ESG Rating Dispersion
(Sustainalytics and RobecoSAM ESG ratings for TOPIX firms)

Source: Bloomberg and IMF staff calculations.

D. Climate Risk Exposures

15.   Climate change affects the financial system through two broad channels (Figure 3). Physical risks arise from climate change related damage to property, infrastructure, and land. Transition risk results from changes in climate policy, technology, and consumer and market sentiment during the adjustment to a lower-carbon economy. Japanese financial institutions are exposed to physical risks through their exposures to corporations, households, and countries that experience climate shocks, or indirectly, through the effects of climate change on the wider economy and feedback effects within the financial system. Exposures manifest themselves, for example, through increased default risk of loan portfolios, lower values of assets, and higher insurance liabilities. Transition risks materialize, for example, through exposure to firms with business models and technology not in line with low carbon emissions. Japan's 2050 carbon

neutrality target will require radical changes in sectors such as automotive, energy, and cement. Some companies are unlikely to adapt fast enough and some assets may become stranded, while other firms could thrive through developing climate friendly business models and technology.

Figure 3. Physical and Transition Risks from Climate Change

Source: IMF Global Financial Stability Report October 2019.

16.   The quantification of climate financial risks is difficult, but progress is being made by regulators and the private sector. Most studies point to potentially very large overall economic and financial costs from climate change.[6] Challenges in estimating climate financial risks include long time horizons, uncertainties about policy responses and adaptation, various feedback loops, and the non-linearity of climate risks with potential for catastrophic tail events. These challenges notwithstanding, it is important to advance the analysis of climate financial risks to inform risk management, encourage engagement with affected firms to address risks, and avoid a sudden disorderly reassessment of valuations. In Japan, work on climate scenario pilot analysis is underway by the BoJ and FSA in cooperation with large financial institutions and in the private sector more generally based on TCFD recommendations.

17.   Japan is exposed to climate physical and transition risks. On physical risks, Japan has experienced stronger atmospheric warming and more surface temperature anomalies than the global average (MoE Japan, 2018). Real estate in low-lying coastal areas where the bulk of Japan's population is concentrated is at risk from flooding. The frequency of natural disasters in Japan has been on the rise (Figure 4.1). On transitional risks, reaching net zero GHG emissions by 2050 will require higher carbon pricing and large shifts in Japan's economic structure. For example, assets related to coal power plants, a major source of electricity in Japan, could become unviable. However, the transition to a low carbon economy offers opportunities as well. Japan is well placed to take a
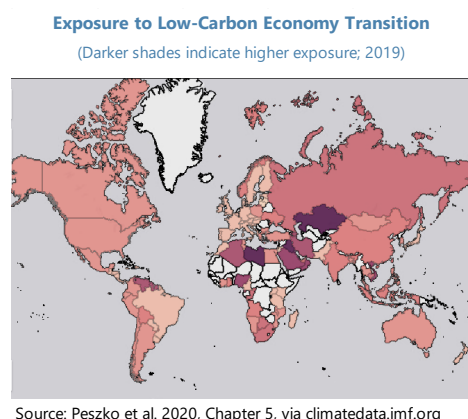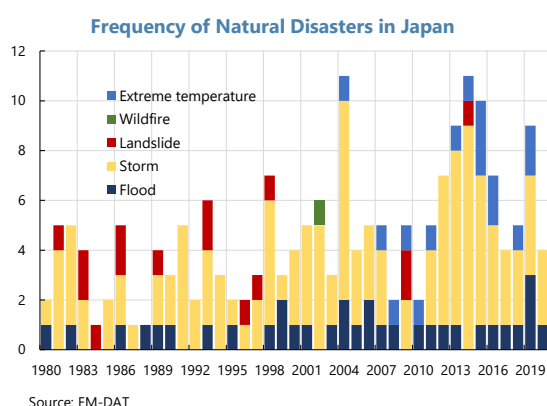
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[6] Burke, Hsiang, and Miguel (2015) suggest that average global incomes may be reduced by up to a quarter by 2100. For financial losses, the Cambridge Centre for Risk Studies (2015) estimates losses in trillions of U.S. dollars, and the Economist Intelligence Unit (2015) estimates that the value of typical equity portfolios could decline by half.

leading role in low carbon technologies. Overall, a study by the World Bank finds Japan to be less exposed in aggregate to transition risks than many other countries, particularly those with large fossil fuel sectors (Figure 4.2).[7] That said, it is important to note that Japanese financial institutions (FIs) and investors have large direct exposures to climate risks across the world given Japan's large stock of foreign direct and portfolio investment.

Figure 4. Natural Disasters and Transition Exposure

1. Natural disasters have occurred more frequently in Japan. Climate change is expected to increase the frequency and severity of extreme weather events.

Frequency of Natural Disasters in Japan

Source: EM-DAT

2. Japan's exposure to the transition to a low-carbon economy is less than for many commodity dependent economies.

Exposure to Low-Carbon Economy Transition

(Darker shades indicate higher exposure; 2019)

Source: Peszko et al. 2020, Chapter 5, via climatedata.imf.org

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18.   Stock market valuations in Japan do not appear to reflect firms' emission intensities. For companies in the TOPIX stock index, there is little difference in the ratio of stock price to earnings (P/E), a common valuation measure, between firms with high and low GHG emissions (Figure 5.1). This suggests limited market attention to the risks high emission firms could face in the transition to a low carbon economy, for example, through carbon pricing and regulation. There is also no evidence that investors value firms that report emissions higher (Figure 5.2).

19.   Stock return sensitivities to climate related risk factors provide insights into markets' views on climate risk exposures. On an industry level (worldwide), stocks in the energy, basic materials, and utilities sectors are most sensitive to a climate risk factor after controlling for standard equity pricing factors (Figure 5.3).[8] Stock returns for other sectors, including technology and industrials, are not sensitive to the climate risk factor. This information can help to identify risk exposures for investors and banks. As discussed below, the sectors identified by equity markets as particularly exposed to climate risks are the same as identified by the TCFD and Japanese G-SIBs in their climate risk scenario analysis. Turning to the stock price sensitivity of banks to the climate risk factor, Japanese banks along with most EU banks have negative sensitivity to the factor, implying that markets view these banks as hedges against climate risks (Figure 5.4). In contrast, banks in major oil and other commodity producers including Russia, Brazil, Mexico, and Canada

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[7] https://openknowledge.worldbank.org/handle/10986/34011

[8] Standard pricing factors included in the stock return regressions are the Fama-French factors and a momentum factor. See the CARIMA project website for methodological details: https://www.uni-augsburg.de/de/fakultaet/wiwi/prof/bwl/wilkens/sustainable-finance/downloads/

show high sensitivity to climate risks. Looking at the temperature sensitivity of stock markets around the world, analysis in the April 2020 GFSR found that in many countries, stocks with the highest sensitivity to temperature earn lower returns than others, after controlling for standard risk factors, suggesting mispricing, and lack of attention to temperature-related variables. The idea is that temperature sensitive stocks should offer investors higher not lower returns to compensate them for taking on temperature risk which is likely to rise with climate change. This temperature-related pricing anomaly is also found for Japanese stocks but is economically small although statistically significant at the 10 percent level (Figure 5.5).
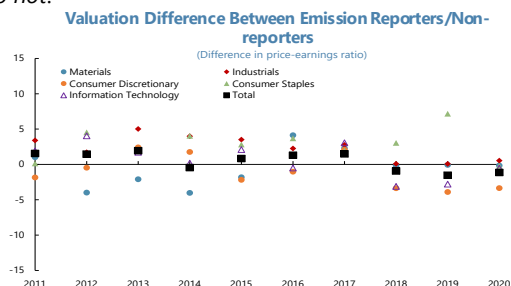
Figure 5. Market-Implied Climate Risk Pricing

1. There does not appear to be a consistent valuation difference between high and low emission intensity firms...
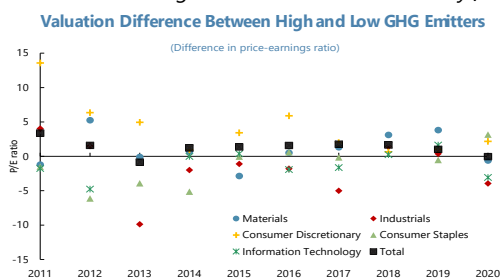
Valuation Difference Between High and Low GHG Emitters
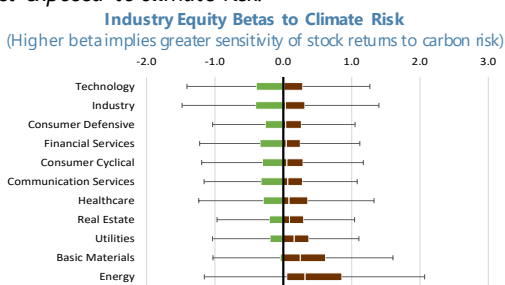(Difference in price-earnings ratio)

Source: Bloomberg and IMF staff calculation.
Note: "total" includes all 11 sectors according to the GICS sector calssification. Emission intensity measured by GHG emissions scaled by assets.

2. ...or between firms that report emissions and firms that do not.

Valuation Difference Between Emission Reporters/Non-reporters
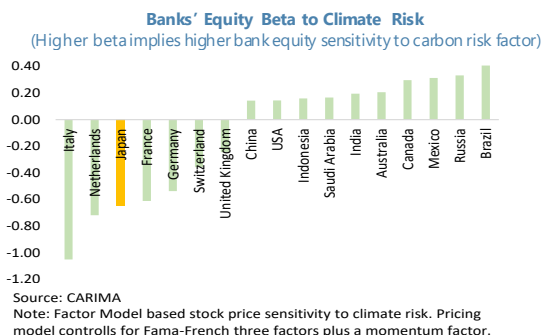(Difference in price-earnings ratio)

Source: Bloomberg and IMF staff calculation.
Note: "total" includes all 11 sectors according to the GICS sector calssification. Emission intensity measured by GHG emissions scaled by assets.

3. Stock return sensitivities to a climate risk factor suggest that energy, basic materials, and utilities are most exposed to climate risk.

Industry Equity Betas to Climate Risk
(Higher beta implies greater sensitivity of stock returns to carbon risk)

Source: CARIMA
Note: Carbon betas are factor loadings on a climate risk factor in stock return regressions. Other factors included in the regression are the Fama-French factors and a momentum factor.

4. Japanese banks' stock returns are negatively correlated with a climate risk factor.

Banks' Equity Beta to Climate Risk
(Higher beta implies higher bank equity sensitivity to carbon risk factor)

Source: CARIMA
Note: Factor Model based stock price sensitivity to climate risk. Pricing model controls for Fama-French three factors plus a momentum factor.

5. Japanese stocks with the highest sensitivity to temperature earn slightly lower returns than the others, suggesting mispricing, and lack of attention to temperature-related variables (April 2020 GFSR).

Equities' Temperature Sensitivity
Abnormal equity returns of firms with the highest sensitivity to temperature
(Percent, 1998-2017)
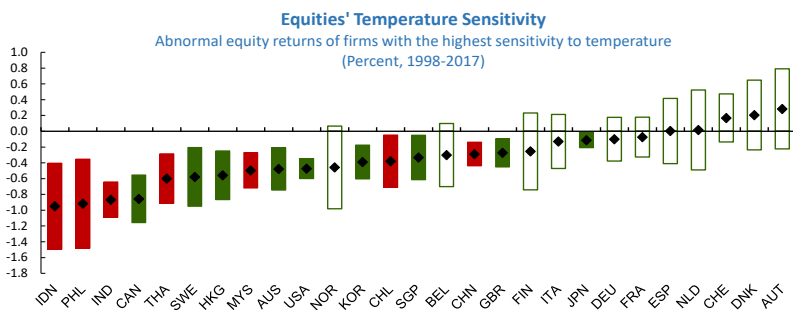
Sources: Global Financial Stability Report, April 2020, Chapter 5 (Refinitiv Datastream; and IMF staff calculations)
Note: Black diamonds show the difference in stock return performance between firms with high temperature sensitivity (top quintile) and all other firms. Red (emerging market and developing economies) and green (advanced economies) bars show the 90 percent confidence intervals of the differences. Solid bars indicate significance at the 10 percent level or less. Data labels use International Organization for Standardization (ISO) country codes. See Online Annex 5.4 GFSR April 2020 for a definition of temperature sensitivity.

20.   Japanese banks are exposed to climate risks through their loan and investment portfolios in Japan and abroad. The carbon intensity of Japanese banks' loan portfolios is relatively low in cross-country comparison (Figure 6.1).[9] Data on fossil financing for the Japanese G-SIBs suggests that these banks provide about 3 percent of their loan volume to fossil energy companies (Figure 6.2). This is less than banks in the US and Canada, but higher than for European and Chinese banks. However, considering the size of Japanese banks' total loan books, the level of exposure to climate risks is still significant.

21.   The quality of climate risk disclosures varies across banks. More than 65 Japanese financial institutions including the three Japanese global systemically important banks (G-SIBs) joined as supporters of TCFD. The G-SIBs and some of the smaller banks publish climate risk reports following TCFD guidelines. These reports typically include a discussion of corporate governance arrangements in the climate context, climate strategy and risk management, and climate metrics and targets.

22.   Loan exposures to sectors at risk from the transition to a low carbon economy are highest for G-SIBs. Japanese G-SIBs assess loan exposures to electric utilities and fossil fuel companies as having the highest transitions risks (Figure 6.3). This is in line with TCFD recommendations and the sectoral sensitivities to climate risk in stock markets. Real estate is viewed by many banks as the sector most at risk from physical risks, especially flooding.[10] For G-SIBs, loans to utilities and fossil fuel companies account for around 6-7 percent of total loans (Figure 6.4). For smaller Japanese banks including regional banks exposure to these sectors tends to be much lower.

23.   G-SIBs' climate scenarios suggest manageable credit costs related to climate change. Estimates of maximum annual credit costs from transition risks are significantly below 0.1 percent of total loans. Credit costs related to physical risks are estimated to be much smaller. The banks acknowledge high uncertainty including in relation to policies and time horizon, and the preliminary nature of results as scenario analysis is being developed. The scenarios focus on the direct impact of climate change on default in exposed sectors. They do not consider wider macroeconomic implications of climate change. The banks acknowledge the need for ongoing improvements in climate scenario analysis. Given that outcomes will greatly depend on firms' actions to adapt to climate risks, the climate scenarios support banks' engagement with clients on managing and mitigating climate related risks.

| Japanese G-SIB's Self-Reported Climate-Related Credit Cost Scenarios (Billions of Yen)			
Bank	**Transition Risks (energy and utilities exposure)**	**Physical Risks**	**Total loans 2020**
Mitsubishi UFJ Financial Group, Inc	10 to 90 each fiscal year	38 cumulative by 2050	110,856
Mizuho Financial Group	120 (dynamic scenario) to 310 (static scenario) cumulative by 2050	52 cumulative by 2050	85,513
Sumitomo Mitsui Financial Group	2 to 10 per year through 2050	30-40 cumulative by 2050	84,581
Sources: Banks' TCFD reports. Note: See banks' TCFD reports for scenario design. Scenarios follow TCFD recommendations but are not fully compareable due to different assumptions and scope. Sectors included in the transition risk analysis are energy and utilities. Physcial risk scenarios focus on natural desasters especially flooding. Numbers are for IEA below 2C scenario for transition risks.			

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[9] The IMF has developed the carbon footprint adjusted loans to total loans (CFALTL) indicator for selected countries. CFALTL indicator is obtained by multiplying domestic loans to a specific industry by their corresponding carbon emission factors, summing over all industries and dividing the final result by total domestic loans.

[10] Loans to agriculture, food, and forestry are also viewed as high exposure to physical risks. However, this loan category is small for most Japanese banks.

24.   Climate risks are important for other financial institutions including insurers, pension funds, and asset managers. Insurers and pension funds are vulnerable to climate risks in their investment portfolios given the long-term nature of their assets. On the liability side, insurers are exposed to physical risks including from more frequent and severe natural disasters. Major Japanese insurers support TCFD and publish TCFD reports. Several insurers publish climate stress scenario analysis. Pension funds and asset manager are improving their climate disclosures. For example, the Government Pension Investment Fund (GPIF) publishes an analysis of climate-related risks and opportunities in its portfolio including value at risk measures under different temperature scenarios.


Figure 6. Banks' Portfolio Exposure to Climate Risks

1. The overall emission intensity of bank loans in Japan is relatively low compared to other countries.

Bank Loan Emission Intensities
(Tons CO2/Millions USD in loans; 2015)
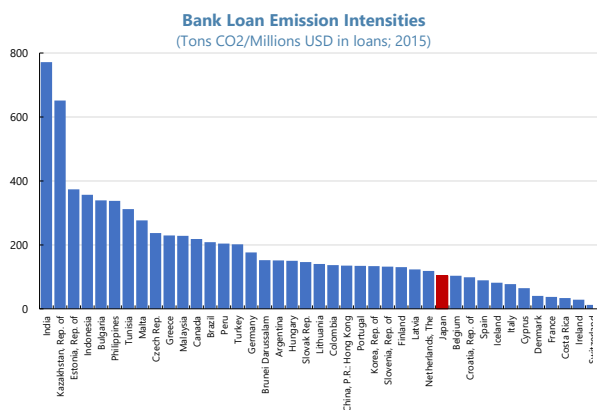
Source: IMF staff calculations; climatedata.imf.org.

2. Large Japanese banks provide less fossil fuel related funding than US banks, but more than European banks.

Fossil Financing by Banks
(Percent of overall loans)
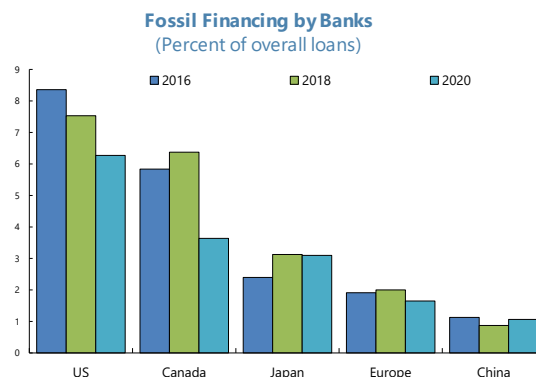
Sources: Banking on Climate Change 2021, Bloomberg, IMF staff calculation
Note: Calculations based on banks provided in Banking on Climate Change report. For Japan, SMBC Group, Mizuho, and MUFG are included.

3. Banks have begun to evaluate the climate risk exposures of their portfolios. Utilities and fossil fuel are typically seen as most exposed to transition risk.

Qualitative Evaluation of Risks and Opportunities by Sector
(Mizuho Financial Group; H=high, M=medium, L=low)

Sector	Transition risk	Physical risk	Opportunities
Electric utilities	H	M	H
Oil & gas	H	M	M
Coal	H	M	L
Logistics	M	M	M
Automobiles	M	M	H
Metals & mining	M	M	M
Chemical	M	M	M
Agriculture, food & forestry	M	H	M
Steelmaking	M	M	L
Real estate property	L	H	M

Source: Mizuho Financial Group, TCFD Report 2021

4. Loan exposures to utilities and energy are highest among the Japanese G-SIBs. Smaller banks tend to be less exposed.

Selected Banks' Loan Exposure to Energy and Utilities
(In percent of total loans)
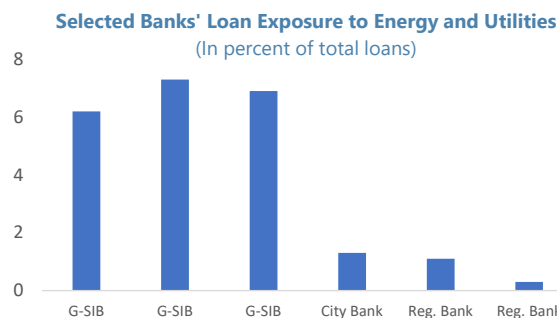
Source: IMF staff calculations. Banks' sustainability reporting.

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25.   Continued improvements in the analysis of climate risks across the financial system are needed. Ongoing efforts to analyze climate risks by Japanese regulators are commendable, including the development of climate scenario analysis and supervisory guidance on climate risk management, research on the effects of climate change on the financial system, and engagement on

the international level at the FSB and NGFS to advance methodologies and guidelines. Many Japanese FIs have made progress in analyzing their exposure to climate risks and putting in place strategies to address risks. These efforts need to be continued and intensified. As guidelines and methodologies advance, consideration should be given to mandatory climate risk management and disclosure practices.

E.   Conclusion

26.   Further policy efforts would strengthen Japan's capacity to manage climate financial risks. Building on climate finance initiatives underway, priorities include improving data and disclosures, building expertise among financial institutions and regulators, and developing risk measurement and management approaches including scenarios. On data and disclosure, minimum compulsory disclosure requirements in addition to the legally non-binding requirements in the Corporate Governance Code should be considered and the scope of corporates and financial firms subject to reporting should be extended. Climate risk management guidelines for banks, insurers, and asset managers would support mainstreaming of climate risk assessments and promote common standards and plans to issue supervisory guidance for banks and insurers are welcome. The BoJ's and FSA's efforts on advancing climate finance research including through international cooperation in the context of the NGFS are commendable and will help mainstreaming climate finance. The publication of the BOJ's climate strategy is welcome. The BoJ could study the merits of incorporating climate-related risks in its asset purchase and collateral policies.

27.   The burgeoning market for green financial products will need an ecosystem that includes investor and issuer expertise, and data, ratings, and assurance providers to ensure the integrity of green finance instruments. The authorities play an important role in supporting the private sector through guidelines, for example the MOE's green bond standards and the recently released transition finance guidelines, support schemes, and supervision. Data and disclosure improvements will also be needed to develop green financial markets. Labeling of financial products including investment funds could be considered to make green investments more accessible and provide quality assurances to end investors. Green taxonomies or equivalent approaches would support the private sector in classifying activities and reduce greenwashing and reputational risks.

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DIGITALIZING THE JAPANESE ECONOMY[1]

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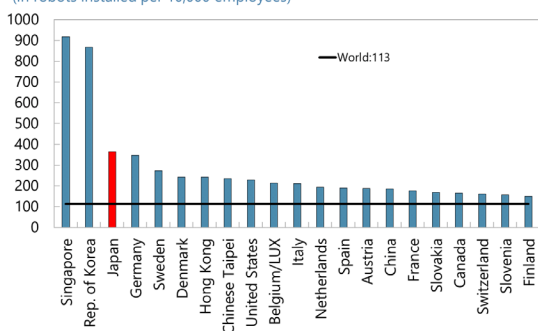
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[1] Prepared by Purva Khera and Rui Xu (both APD).

[2] The full ranking can be found at IMD World Competitiveness Centre.

Figure 1. Japan's Digital Competitiveness

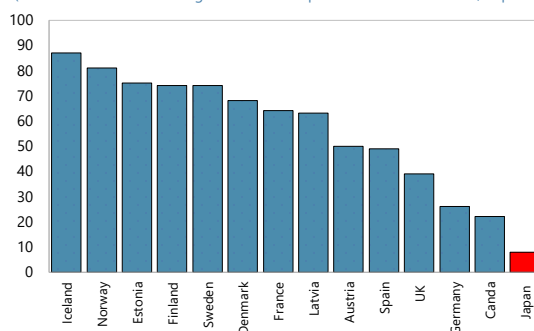**Robot Density in the Manufacturing Industry 2019**
(In robots installed per 10,000 employees)

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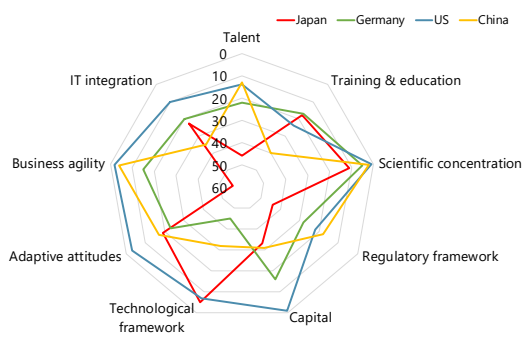
Source: IMD.
Note: The numbers in the graph are the rankings in the surveyed countries.

Digital Competitiveness in Select Asia Pacific Countries (2020)
(Max score is 100)
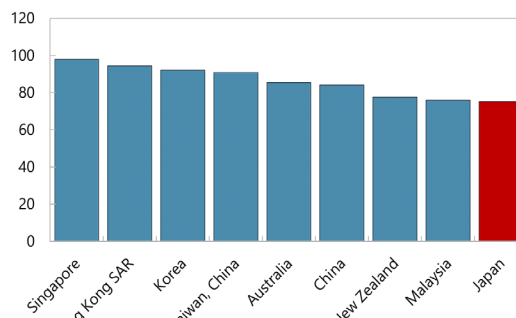
Sources: IMD World Digital Competitiveness Ranking 2020

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

ICT Capital Investment
(2005=100)

Sources: EUKLEMS, Staff Calculation

Contribution to Labor Productivity Growth
(in percent)

Sources: EUKLEMS and Staff Calculation

Labor Productivity
(GDP in dollars per hour worked)

Source: OECD.

ICT Capital Stock Per Hour of Labor Input
(in 2015, US=100)

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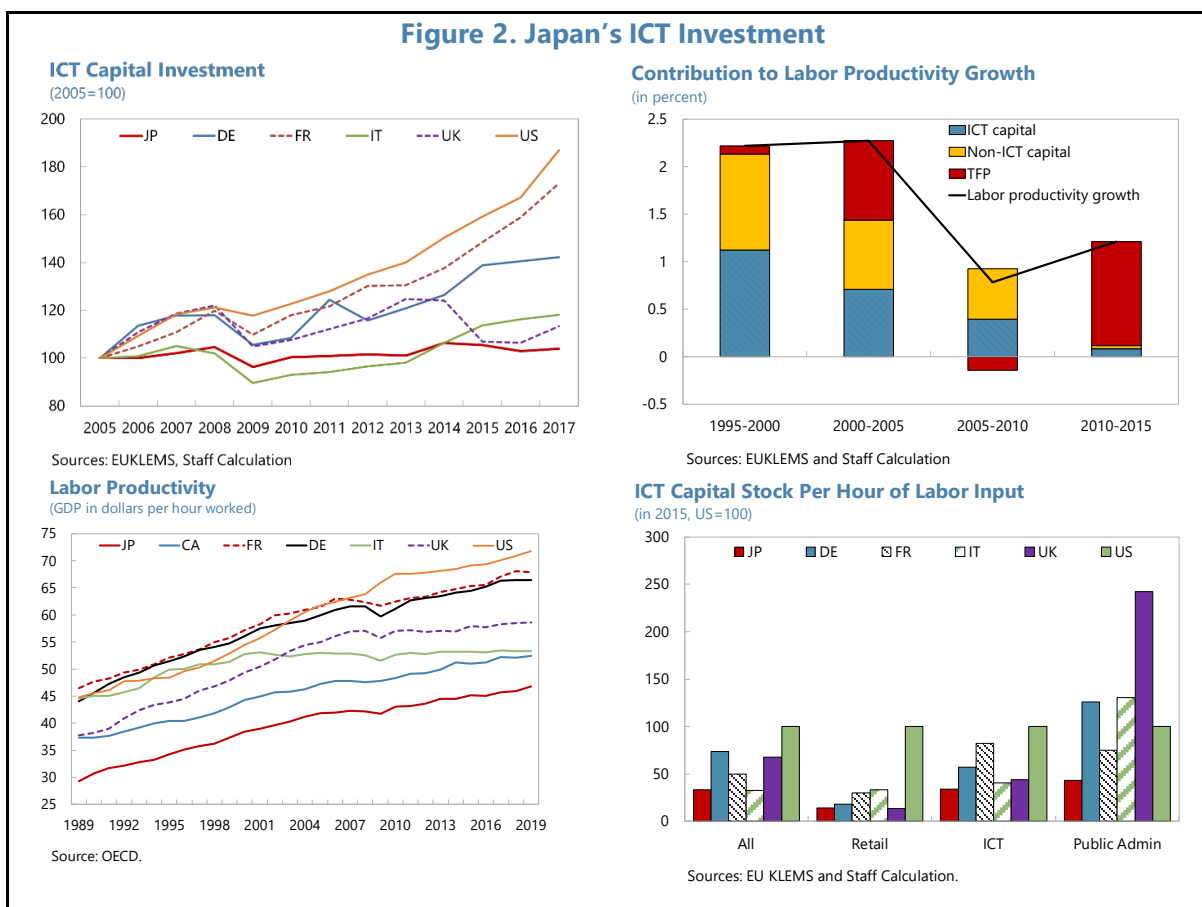
4. **While the pandemic has accelerated the change in consumption behavior towards increased online shopping and e-commerce, there remains a sizeable scope for expansion (Figure 3).** [3] In 2020, e-sales grew by close to 20 percent in Japan. The percentage of households that engage in online spending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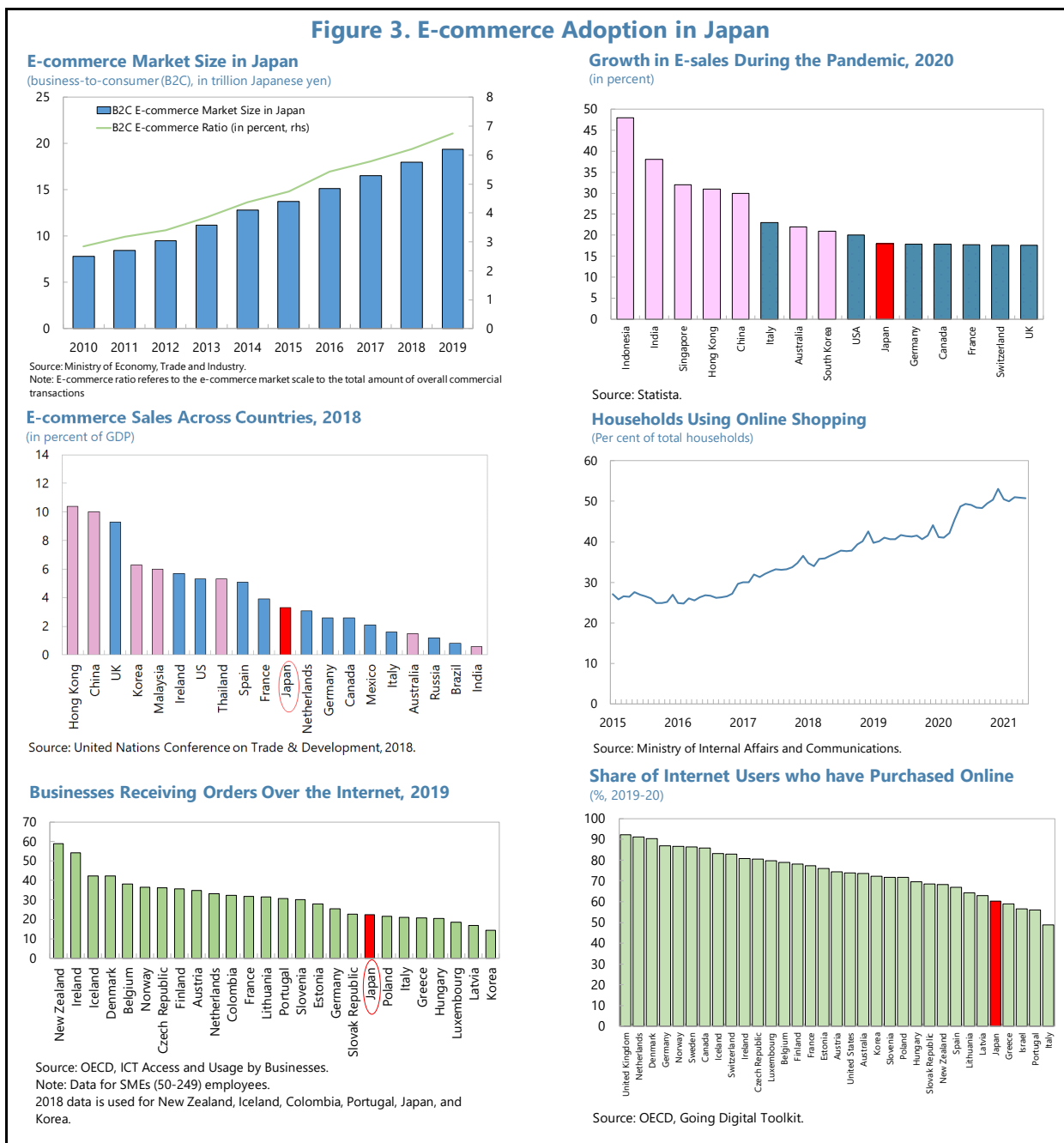2017 and peaked at close to 51 percent (June 2020) in the midst of the pandemic, including amongst the older population. However, despite recent growth, Japan's e-commerce accounts for only close to 3 percent of GDP, much lower than peers in Asia and other advanced economies. There remains significant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

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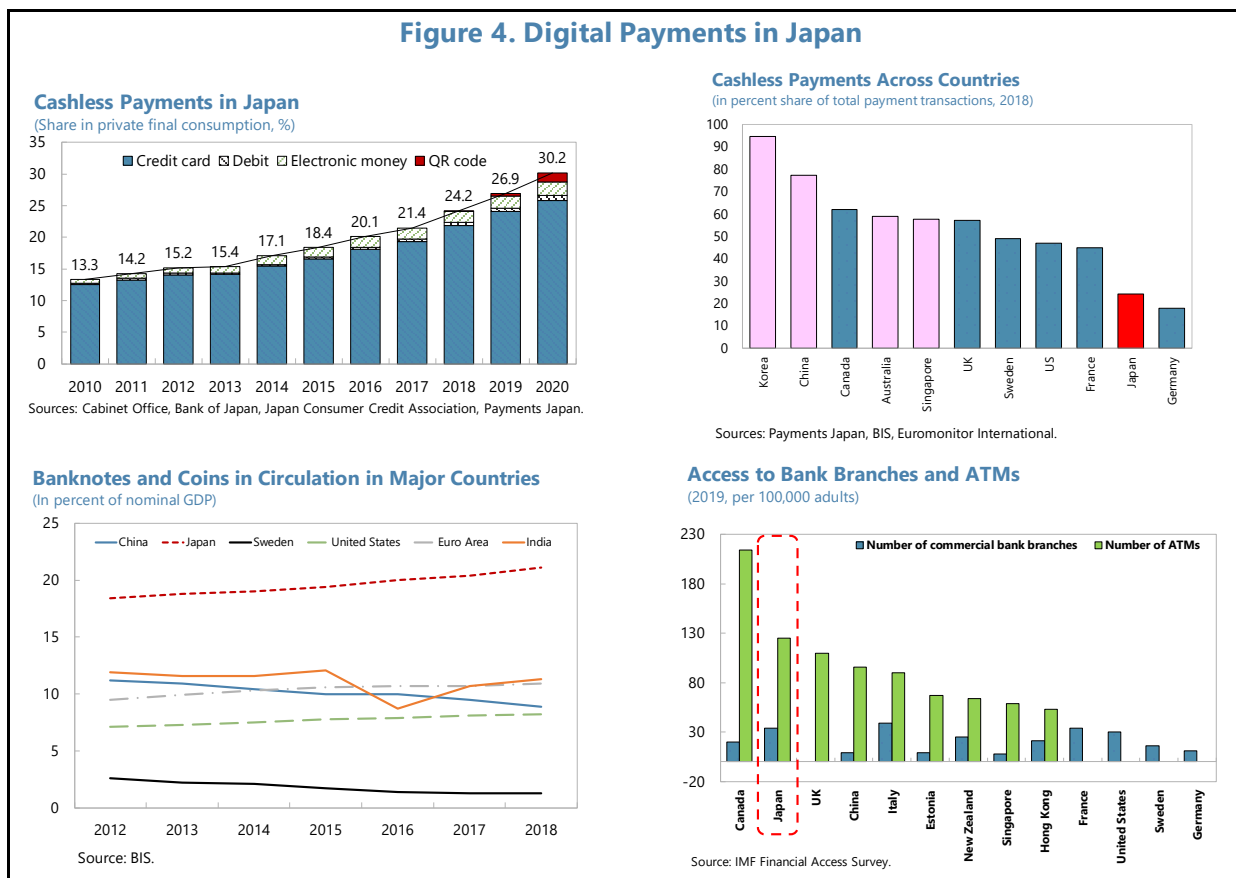[3] E- commerce refers to business-to-consumer commerce, and does not include business-to-business sales.

[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 referes to the e-commerce market scale to the total amount of overall commercial transactions

Growth in E-sales During the Pandemic, 2020
(in percent)

Source: Statista.

E-commerce Sales Across Countries, 2018
(in percent of GDP)

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

Households Using Online Shopping
(Per cent of total households)

Source: Ministry of Internal Affairs and Communications.

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.

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, %)

Cashless Payments Across Countries
(in percent share of total payment transactions, 2018)

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

Sources: Payments Japan, BIS, Euromonitor International.

Banknotes and Coins in Circulation in Major Countries
(In percent of nominal GDP)

Access to Bank Branches and ATMs
(2019, per 100,000 adults)

Source: BIS.

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

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[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:

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

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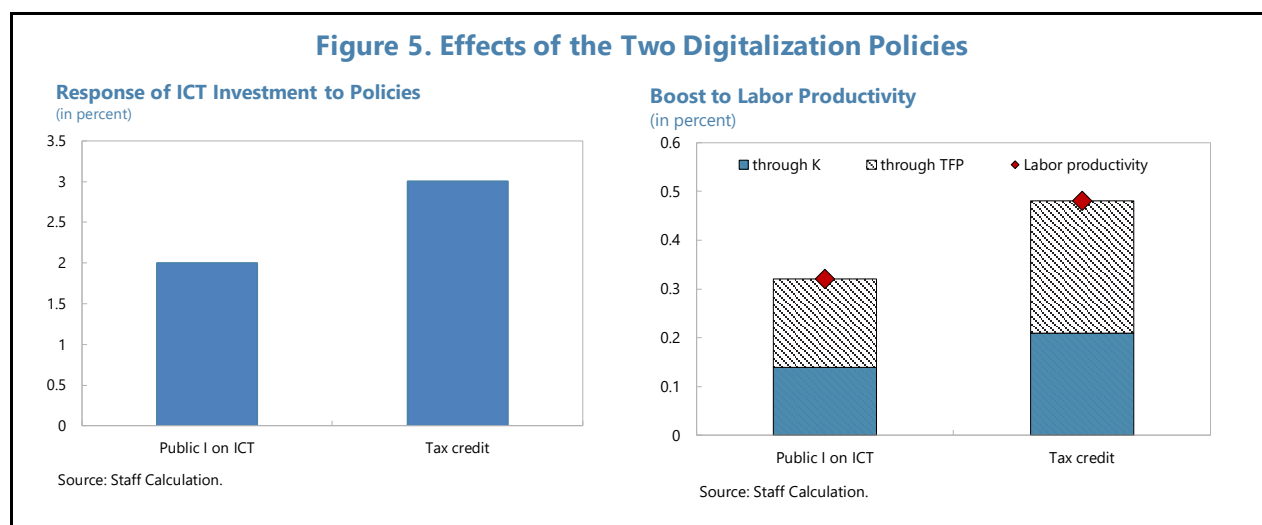
10.   The combined impact of these two policies could increase Japan's ICT investment by about 5 percent, raising labor productivity by about 0.8 percent. There are two channels through which ICT capital contributes to labor productivity. First, ICT capital enters production

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[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).
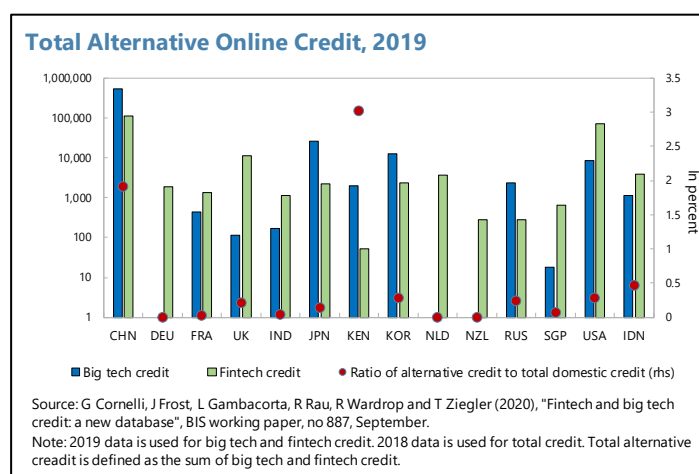

Figure 5. Effects of the Two Digitalization Policies

Response of ICT Investment to Policies (in percent)

Boost to Labor Productivity (in percent)

Source: Staff Calculation.

Source: Staff Calculation.

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.
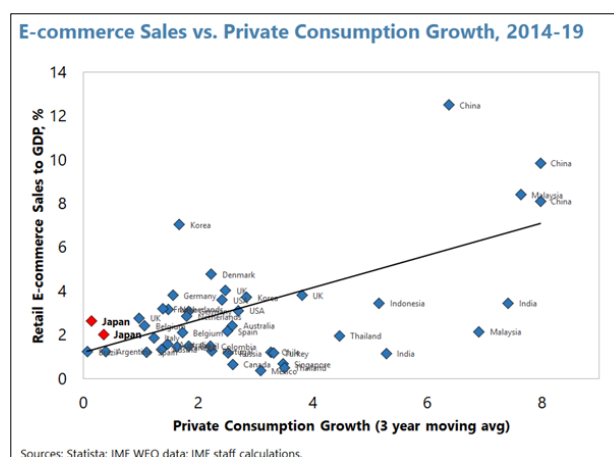
12.   Wider adoption of digital financial services could also enhance productivity and efficiency. Supplying cash to society is costly, estimated by the Nomura Research Institute to cost around $15 billion per year (0.3 percent of GDP) in Japan.[9] As adoption of digital payments becomes widespread, 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,

Total Alternative Online Credit, 2019

Source: G Cornelli, J Frost, L Gambacorta, R Rau, R Wardrop and T Ziegler (2020), "Fintech and big tech credit: a new database", BIS working paper, no 887, September.
Note: 2019 data is used for big tech and fintech credit. 2018 data is used for total credit. Total alternative creadit is defined as the sum of big tech and fintech credit.

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

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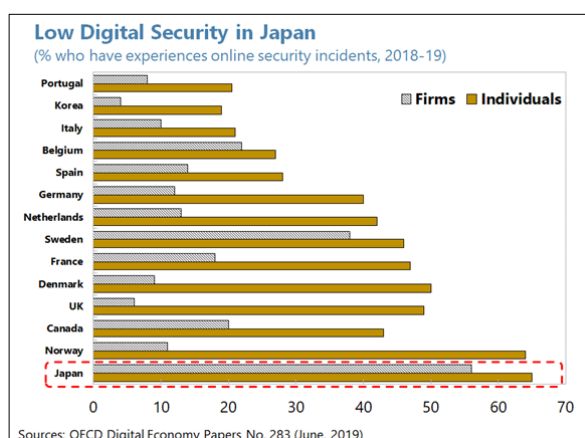
15.   To mitigate potential adverse effects on unskilled workers, it is essential to increase labor market mobility and reorient government spending on digital-related education and labor skills, including digital financial literacy. The digital transformation may lead to displacement of unskilled workers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

Government Spending on Proactive Labor Market Policies
(% of GDP, 2018)

Legend: Skills development, Direct govt. hiring, Entrepreneurial support, Matching, Hiring support

Sources: OECD data, Public expenditure and participant stocks on labor market policies.

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.
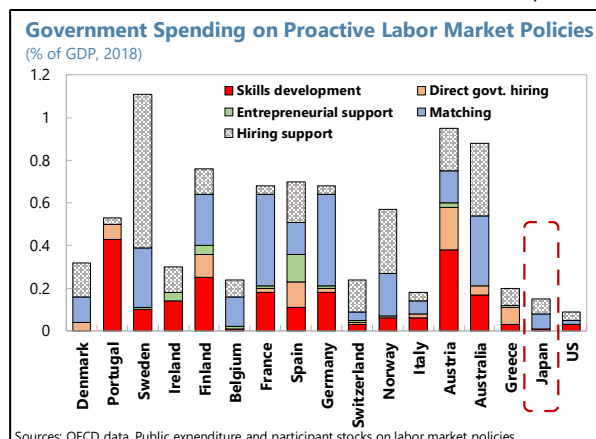
16.   Data privacy, consumer protection, and cybersecurity regulations need to be strengthened, while more needs to be done to promote interoperability. Recent cyberattack incidents have exacerbated general mistrust in the digital economy and discouraged its adoption. In a 2019 survey of Japan's financial institutions, more than 70 percent recognized that the threat of cyberattacks is growing. There is also lack of interoperability[11] and fragmentation of different payment platforms, undermining network effects and user convenience.

Low Digital Security in Japan
(% who have experiences online security incidents, 2018-19)

Legend: Firms, Individuals

Sources: OECD Digital Economy Papers No. 283 (June, 2019)

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[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:

$$\max_{\{c_t\}} \sum_{t=0}^{\infty} \beta^t u(c_t)$$

$$\text{subject to } c_t + (1-\theta)I_t^{ICT} + I_t^{NICT} = f(k_t^{ICT}, k_t^{NICT}) - T(t)$$

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}): $f(k_t^{ICT}, k_t^{NICT}) = A_t \cdot \left(k_t^{NICT}\right)^{\beta} \cdot \left(k_t^{ICT}\right)^{\gamma}$; 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 $f(k_t^{ICT}, k_t^{NICT}) = A_t \cdot \left(k_t^{NICT}\right)^{\beta} \cdot \left(k_t^{ICT}\right)^{\gamma}$ 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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