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Heterogeneous Vulnerability to the COVID-19 Crisis and Implications for Inequality in Japan*

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Abstract

We study how the COVID-19 crisis could affect earnings inequality across heterogeneous individuals in Japan. We use the Employment Status Survey (ESS) to identify groups of individuals who are more vulnerable to the COVID-19 shocks, which likely affect workers in different industries, occupations, and employment types in different magnitude. We assess the impact using various data and early evidence including expenditures data from the JCB Consumption NOW during the first weeks of the pandemic. Our study identifies significant heterogeneity in vulnerability to the COVID-19 shocks across workers of different types. We find that the crisis will hit low-income groups by more and is likely to significantly exacerbate inequality through multiple channels, calling for urgent and large-scale assistance targeted towards affected individuals.

Keywords: Employment, heterogeneity, gender, employment types, earnings inequality, Japan, COVID-19
JEL classification: E10, E2, J21

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1 Introduction

There is no doubt that the COVID-19 crisis affects the entire nation and the aggregate economy through essentially all the channels and in all directions, where economic activities take place.

A surge in infection risks contracts the demand for goods and services both spontaneously and forcibly by official orders and a lockdown. A rapid decline in aggregate demand leads to an immediate contraction of labor demand, which has already started to manifest as a fall in employment in both intensive and extensive margins. As people refrain from face-to-face interactions and a regular commute using public transportation is restricted, it becomes rapidly and increasingly difficult to maintain jobs that involve many tasks which cannot be completed remotely.

A recession hits different groups of firms and individuals in different ways in general, but the impact on the distribution triggered by the COVID-19 pandemic appears to differ from any of the major recessions experienced over the last century. It directly hits industries that are susceptible to infection risks and that require more social and face-to-face activities. It hits occupations that are not as flexible in a way that an employed individual works and that do not allow many of the tasks to be completed remotely.

Distribution of industries and occupations in which individuals work differs across socio-economic groups of workers in several dimensions, including age, gender and education. We follow the strategy of Kaplan et al. (2020) in categorizing workers across industries and occupations in the degree of vulnerability to infection risks caused by the COVID-19 shocks. Moreover, as documented by Kitao and Mikoshiba (2020), for example, the Japanese labor market is characterized by a peculiar distinction in employment types and it consists of a combination of regular and contingent workers. The latter group is more prone to displacement, especially when the economy falls into a recession. We show that they also differ significantly in their exposures to the two dimensional vulnerability to the COVID-19 infection risks.

This paper uses various sources of micro data before the shock to identify individuals in the labor market that are more susceptible to the Covid-19 shocks. We then attempt to quantify the impact on different groups of individuals in the labor market in response to the COVID-19 crisis, based on the early data after the outbreak of the pandemic and using consumption expenditures data of the JCB Consumption NOW. Watanabe (2020) analyzes that credit card data during the first few weeks of the pandemic finds a rapid decline in purchases across different goods and services, showing a pattern and magnitude that are comparable to those immediately after the Tohoku earthquake in 2011.

We find significant heterogeneity in vulnerability to the COVID-19 crisis across groups of workers in Japan. The crisis is likely to hit harder low-income groups and exacerbate earnings inequality. The effects may persist and worsen inequality significantly if infection

risks remain longer and the recovery is sluggish. The study implies a need for an urgent and large-scale assistance to affected individuals.

There are studies that investigate potential changes in inequality in response to the COVID-19 crisis. Bick and Blandin (2020) present early evidence from the labor market data in the U.S. and show that negative effects are more pronounced among female, older and less educated workers. Alon et al. (2020) argue that the COVID-19 crisis could affect gender inequality in a way that is uniquely different from regular recessions, which interact with adoptions of flexible work arrangement, intra-household reallocation of labor in and outside of one's home, and the larger effects on industries with high female employment shares. Glover et al. (2020) consider heterogeneity in health across individuals in addition to age and industry and study how different policies affect different subgroups of the population during phases of the pandemic.

The paper is organized as follows. In section 2, we use the Employment Status Survey (ESS) data to identify groups of workers that are vulnerable to the COVID-19 shocks. In section 3, we use consumption data from the JCB Consumption NOW during the first weeks of the crisis and assess how the crisis affects economic activities in different dimensions. Section 4 uses data from the previous sections to quantify impact on earnings across workers and how inequality across various dimensions can be affected. Section 5 concludes.

2 Heterogeneous Vulnerability in the Labor Market

2.1 Data

We use the Employment Status Survey (ESS) of the Ministry of Internal Affairs and Communications of Japan to identify groups of individuals who are more vulnerable to the COVID-19 shocks in the labor market. The ESS is a national and regional survey of the Ministry of Internal Affairs and Communications (MIC), conducted on approximately 490,000 households in Japan since 1956, and provides basic data on the conditions of the employment structure across the nation, including detailed information about employment status of each worker, across dimensions of age, gender, industries, occupations, employment type, and firm size. In what follows, we use the most recent survey data of 2017.

2.2 Vulnerability: Industries and Occupations

The infection risk triggered by the COVID-19 crisis and a lock-down policy restrain industries that involve tasks requiring personal and face-to-face interactions. At the level of individual workers, flexibility of working from home becomes a critical factor when a

regular commute using public transportation becomes unsafe and difficult if not impossible. Therefore we divide workers in two dimensions, first, by industries according to the degree of social and face-to-face elements and second, by the flexibility of the work location and possibility of completing tasks remotely and most likely from home. For the first dimension, we allocate industries into two sectors, which we call "ordinary (O)" and "social (S)" sectors, and closely follow the strategy taken in Kaplan et al. (2020). The ordinary (O) sector includes agriculture and forestry, fisheries, mining, construction, manufacturing, utilities, information and communications, road, water and air transport, postal service, wholesale trade, finance and insurance, real estate, compound services and government (except elsewhere classified). The social (S) sector includes railway transport, road passenger transport, retail services, scientific research, professional and technical services, accommodations, eating and drinking services, living-related and personal services, amusement services, education, learning support, medical, health care and welfare, and other unclassified services.

For individual workers' occupations, we group them into two groups, flexible (F) and non-flexible (N) occupations, based on the fraction of workers in each occupation who are likely to have flexibility to work remotely and are less affected by difficulty in commuting to and working in their regular workplace. We use the Survey of Remote Work Implementations by the Ministry of Land, Infrastructure and Transport and define an occupation as flexible (F) if more than 20% of workers within the occupation are able to work remotely and as non-flexible (N) otherwise.[1] (Japanese)The group of flexible (F) occupations includes management professionals, professional and technical workers, and office workers. The group of non-flexible (N) occupations includes sales persons, service workers, security workers, agriculture, forestry and fishery workers, production process workers, transport and machine operators, construction and mining workers, and workers involved in transportation, cleaning, packaging.

Table 1 shows employment shares of workers aged between 25 and 64 in each combination of sectors and occupations. Workers are nearly equally distributed across four cells, with the employment shares that range from 22% to 29%. There is, however, a major difference in average earnings. Workers engaged in jobs with more flexibility tend to earn more than those with less flexibility. Also, workers in industries with more social and face-to-face elements earn less on average.

The group of workers that are most likely affected by the COVID-19 shocks, or the most vulnerable, are those engaged in less flexible and more social jobs and this is the group whose earnings are the lowest in the first place.

[1] http://www.mlit.go.jp/crd/daisei/telework/docs/29telework_jinko_jittai_gaiyo.pdf

Table 1: Employment Share (%, upper) and Average Earnings (in JPY1,000, lower) by Sector and Occupation

	Ordinary	Social
Flexible	21.8% 4,794	23.7% 4,047
Non-flexible	28.7% 3,865	25.9% 2,522

Source: Employment Status Survey (ESS) of MIC, Authors' calculation.

We now study how the distribution of employment shares and average earnings differ across various dimensions of workers. We focus on difference across genders, education levels, across employment status, age, and firm size.

By Gender: Table 2 shows employment shares and average earnings for males and females, respectively. Males have a much higher share of workers in ordinary sector, standing at 65%, than females, at 24%. There is also a significant difference in the distribution of job flexibility between males and females. In total, 39% of males are on more flexible jobs while the share is 53.0% for females. Within the group of flexible jobs, however, females are much more concentrated in social industries than males.

The level of earnings significantly differs across genders, and females earn less than males in all of the four cells. Among females, the most vulnerable group of non-flexible and social jobs take a much larger fraction, at 33.3%, while the share is less than 20% for males.[2]

Table 2: Employment Share (%, upper) and Average Earnings (in JPY1,000, lower) by Gender

(a) Male

	Ordinary	Social
Flexible	23.5% 6,138	15.5% 5,883
Non-flex	41.4% 4,418	19.6% 3,856

(b) Female

	Ordinary	Social
Flexible	19.7% 2,915	33.3% 3,048
Non-flex	13.8% 1,923	33.3% 1,606

Source: Employment Status Survey (ESS) of MIC, Authors' calculation.

[2]See Kitao and Mikoshiba (2020) for more details on difference in earnings, employment types and labor force participation between males and females.

By Education: Table 3 shows the distribution of employment shares and average earnings by education levels of workers. We define workers as high-skilled (H), if they have a college degree or above and low-skilled (L) otherwise. In contrast to the difference between males and females, the share of workers in the ordinary sector is not very different between high-skilled workers, standing at 53.3%, and low-skilled workers, at 49.0%. The flexibility, however, of occupations differs by a significant margin across education groups. Around two-thirds, 65.5%, of high-skilled workers are in flexible jobs, while the ratio is one-third, 35.3% among the low-skilled.

The ordering of the average earnings across four categories is the same for both high-skilled and low-skilled workers, except for the levels of earnings for social and flexible jobs vs ordinary and non-flexible jobs, which are close. High-skilled workers, however, are more concentrated in higher-paid occupations with about one-third, 33.0%, engaged in ordinary and flexible jobs, but a larger fraction of low-skilled workers are in categories with lower average earnings.

Table 3: Employment Share (%, upper) and Average Earnings (in JPY1,000, lower) by Education

(a) High

	Ordinary	Social
Flexible	33.0% 5,289	32.2% 4,574
Non-flex	20.3% 4,474	14.6% 3,371

(b) Low

	Ordinary	Social
Flexible	16.0% 4,269	19.3% 3,596
Non-flex	33.0% 3,673	31.7% 2,323

Source: Employment Status Survey (ESS) of MIC, Authors' calculation.

By Employment Type: The Japanese labor market is uniquely characterized by difference in two major employment types, one called regular employment ($seiki - koyo$) and the other called contingent employment ($hiseiki - koyo$). Workers in the former group are typically more protected from employment adjustments and workers in the latter group are employed with less job security and many are on a short-term employment contract. It is also known that contingent workers earn much less than regular workers and their earnings tend to fluctuate over business cycles.

Table 4 shows a stark difference in the distribution of employment shares and average earnings between regular and contingent workers. While around 60% of regular workers are in the ordinary sector, the share is only one-third, 33.1%, among contingent workers. 44% of contingent workers are in the category that is most vulnerable to the COVID-19 shocks and the share is only 17.2% among the high-skilled. The average earnings of contingent workers are significantly lower across categories. As we will discuss more in

section 4, contingent workers are more vulnerable to business cycle shocks, as documented by 0 Yokoyama, Higa, and Kawaguchi (2019).

Table 4: Employment Share (%, upper) and Average Earnings (in JPY1,000, lower) by Employment Type

(a) Regular Workers

	Ordinary	Social
Flexible	26.0% 5,535	24.0% 5,136
Non-flex	32.8% 4,534	17.2% 3,981

(b) Contingent Workers

	Ordinary	Social
Flexible	12.9% 1,694	23.0% 1,697
Non-flex	20.2% 1,624	43.9% 1,338

Source: Employment Status Survey (ESS) of MIC, Authors' calculation.

By Firm Size: Table 5 shows the distribution of employment shares and average earnings by firm size. We divide firms into two groups, large firms vs medium and small firms, following the employment cutoff for each industry used by the Small and Medium Enterprise Agency.[3]

As we discuss in section 4, small- and medium-sized businesses tend to be more hardly hit by recessions. The composition, however, of individual workers divided according to the two criteria of the COVID-19 vulnerability does not appear to be significantly different between small and medium firms and large firms, although the fraction of non-flexible jobs are slightly higher among workers of small and medium firms, at 56.0%, than among those of large firms, at 53.1%. The level of earnings, however, of workers in flexible jobs is lower by approximately 10% in small and medium firms, and earnings of non-flexible jobs are nearly the same across two groups of firm sizes.

[3]More precisely, a firm is considered large if it has more than 50 employees for retail industry, 100 employees for service and wholesale industries, and 300 employees for manufacturing, construction, transportation and other industries.

Table 5: Employment Share (%, upper) and Average Earnings (in JPY1,000, lower) by Firm Size

(a) Small and Medium Firms

	Ordinary	Social
Flexible	20.2% 4,456	23.9% 3,840
Non-flex	29.2% 384.7	26.8% 251.1

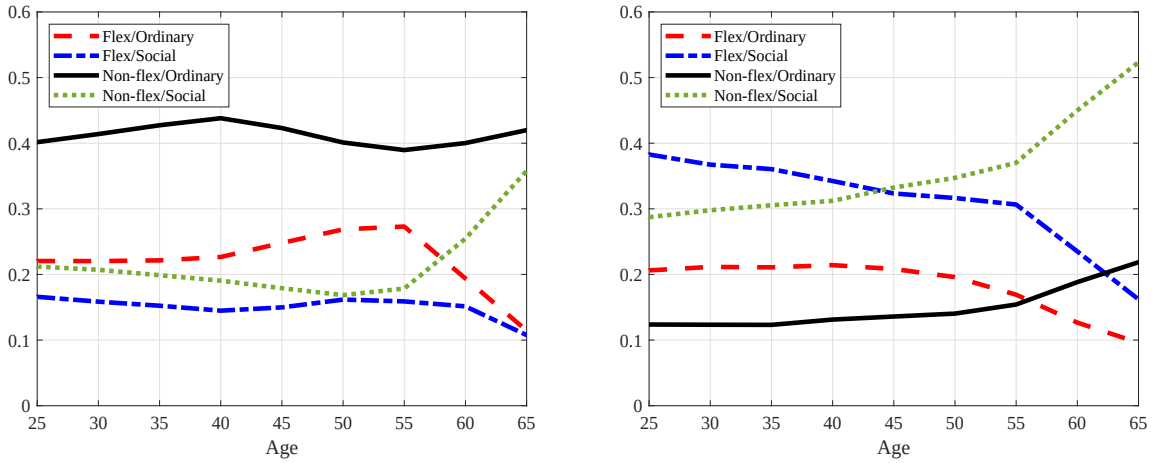
(b) Large Firms

	Ordinary	Social
Flexible	23.4% 5,094	23.5% 4,264
Non-flex	28.1% 3,884	25.0% 2,535

Source: Employment Status Survey (ESS) of MIC, Authors' calculation.

By Age: Figure 1 shows how the distribution of workers' jobs differ by age. Among males, the ordinary and non-flexible category has the highest share across all age groups. The share of social and non-flexible workers are higher in their 50s and 60s, which is mostly explained by a rise in the share of contingent workers in these age groups as shown in Figure 2. Contingent workers tend to be more concentrated in this category of occupations as we saw in Table 4.

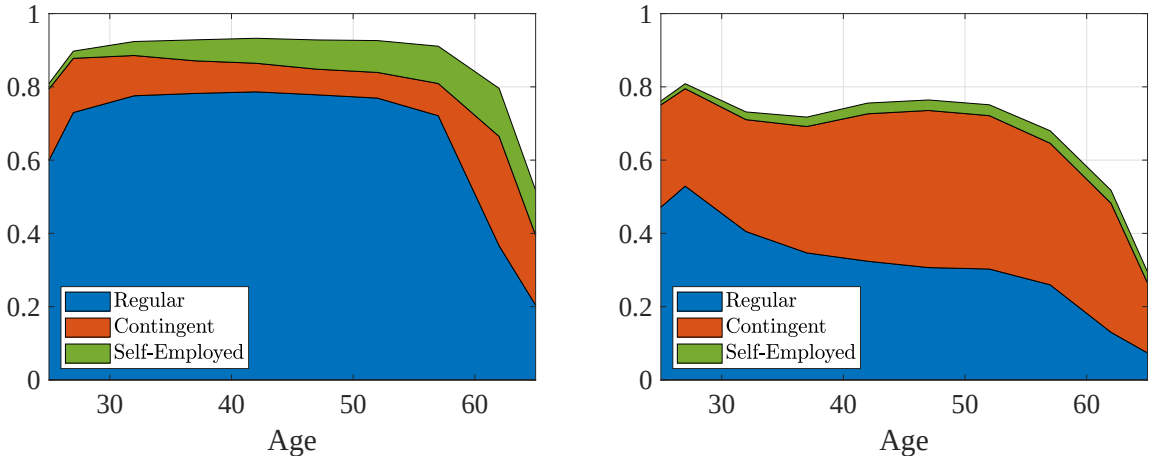
Among females, the share of non-flexible workers rise in age for both ordinary and social sectors. The shift reflects the change in the decomposition of employment types, as with males, but the share of non-flexible workers also rises in age within both regular and contingent workers unlike males.



(a) Male (b) Female

Figure 1: Employment Share (%) by Job Types by Age

Source: Employment Status Survey (ESS) of MIC, Authors' calculation.
Note: The figures show the population distribution of job types by age and gender. The figures are only for the employed. Data is for each 5-year-old bin from age 25/29 to 65/69.



(a) Male (b) Female

Figure 2: Employment Type by Age

Source: Employment Status Survey (ESS) of MIC

Note: The figures show the population distribution of employment types, including non-employed individuals and self-employed workers, by age and gender. Note that detailed information about each worker including occupations and industries is not available for self-employed workers and our analysis is focused on regular and contingent employed workers, https://www.stat.go.jp/data/shugyou/2017/index.html. Data is for each 5-year-old bin from age 25/29 to 65/69.

3 Early Expenditure Data during the COVID-19 Crisis

3.1 Data

In this section, we use credit card transaction data from the JCB Consumption NOW during the initial several weeks of the COVID-19 crisis.[4] The database covers transactions of one million random samples of active credit card users from the total of 100 million JCB card members. The data is released two weeks after the collection of expenditure data and classified in various dimensions including detailed macro and micro sectors, regions, and card member's age and gender.

3.2 Changes in Expenditures across Various Dimensions

Goods vs Services: Figure 3 shows year-on-year (YOY) changes in expenditures by sector, between the first half of January and the second half of March.[5]

[4] https://www.jcbconsumptionnow.com/en

[5] All figures on expenditures data (Figures 3 to 9) are based on nominal expenditures. The CPI growth rate is 0.7, 0.4 and 0.4 (year-on-year %, MIC) in January, February and March 2020, respectively, and

Nearly all industries experienced a massive decline in expenditures, in the first and second half of March, except for a few industries including e-commerce, which experienced a rise of 6% during the second half of March, and electricity which increased by 2%. The largest decline occurred in motor vehicles and eating out, both standing at 18% in the second half of March, and in travel, at 15%.

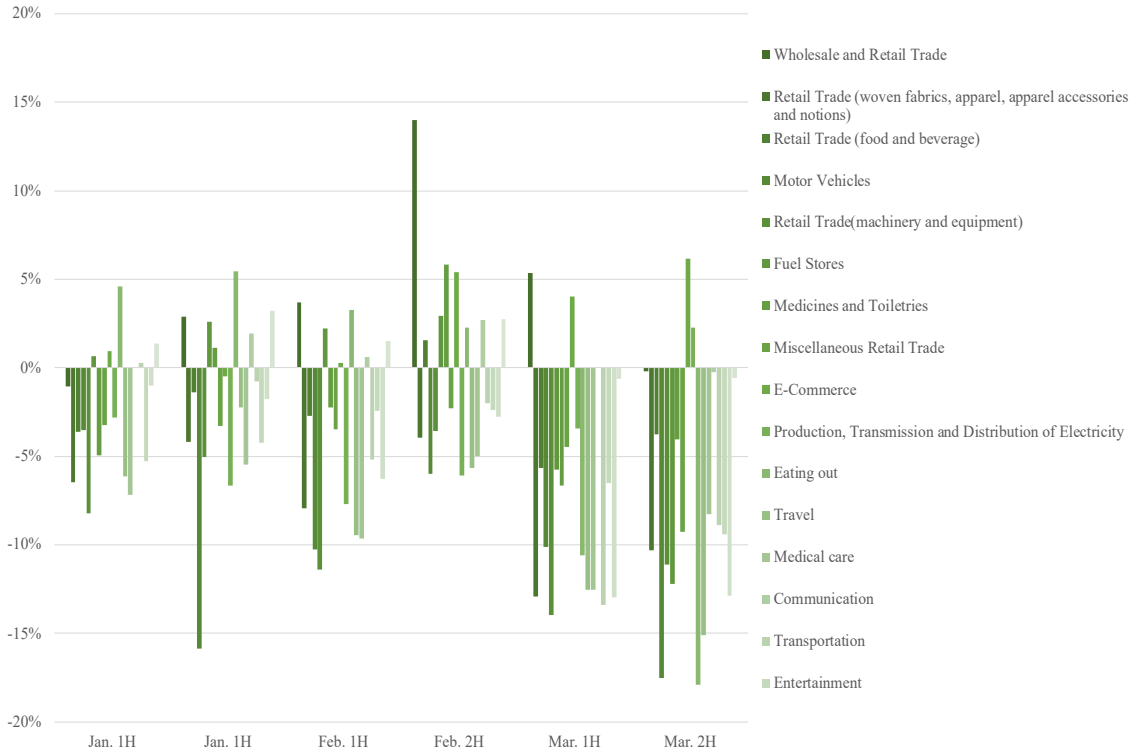


Figure 3: Change in Expenditure by Detailed Sectors (% change, year-on-year)

Source: : JCB Consumption NOW
Note: This figure shows changes in credit card expenditure compared to the same period of the previous year. Data is from the first half of January (January 1-15) to the second half of March (March 16-31). Figures are based on nominal expenditures.

In Figure 4, we group industries into goods and services sectors, following Watanabe (2020). Both sectors experienced a significant decline in the first and second half of March. Expenditures decreased by about 8% in the service sector, by a larger magnitude than in the goods sector, which fell by 5%, in the first half of March. Both sectors experienced a decline of a similar magnitude in the second half of March.

they are not taken into account in the calculation.

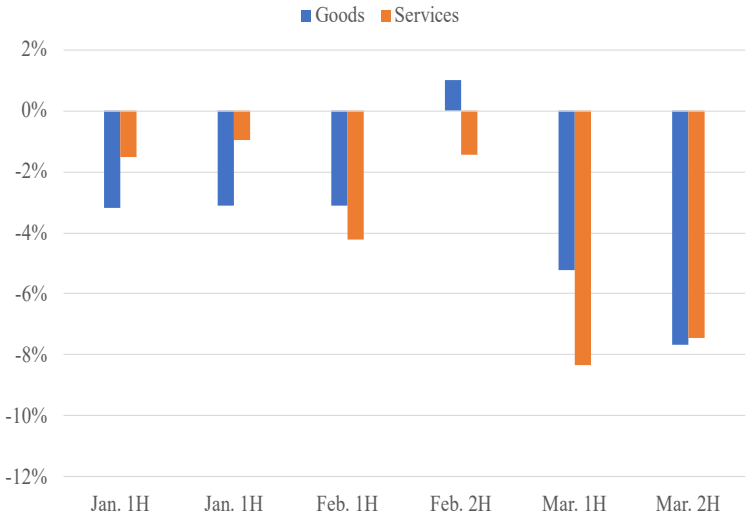


Figure 4: Change in Expenditure by Sectors: Goods vs Services (% change, year-on-year)

Source: : JCB Consumption NOW

Note: This figure shows changes in credit card expenditure compared to the same period of the previous year. Classification of sector follows JCB Consumption NOW. Goods sector consists of Wholesale and Retail Trade, Retail Trade (woven fabrics, apparel, apparel accessories and notions), Retail Trade (food and beverage), Motor Vehicles, Retail Trade (machinery and equipment), Fuel Stores, Medicines and Toiletries, Miscellaneous Retail Trade and E-Commerce. Service sector consists of Production, Transmission and Distribution of Electricity, Eating out, Travel, Medical care, Communication, Transportation, Entertainment, Accommodation and Online content delivery. Figures are based on nominal expenditures.

Flexible and Non-flexible: We now attempt to infer impact on workers across different types jobs, grouped by the dimensions that represent vulnerability to the COVID-19 crisis, as we discussed in section 2, namely, flexibility of work arrangement for an occupation and a degree of social and face-to-face elements for an industry.

To compute effects of flexibility, we use shares of flexible and non-flexible workers in each industry from the ESS as discussed in section 2. For retail sectors, we allocate total expenditures into retail and wholesale industries of the sold goods and services, based on retail and wholesale margins of each sector, and allocate the rest to either the manufacturing or agriculture industries. We then use the shares of flexible and non-flexible industries in each of the subdivided industries.

Figure 5 shows changes in consumption expenditures by flexibility according to the above criteria. In the first half of March, expenditures fell by slightly more in the non-flexible sector than in the flexible sector, and the difference significantly widened in the second half of May, implying a larger and growing impact on workers with less flexibility.

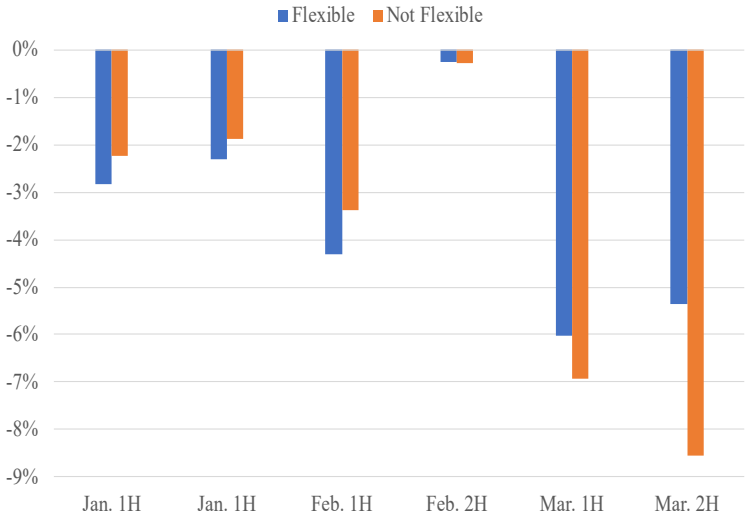


Figure 5: Change in Expenditure: Flexible vs Non-flexible (% change, year-on-year)

Source: : JCB Consumption NOW, Employment Status Survey (ESS) of MIC, Economic Census for Business Activity of Ministry of Economy, Trade and Industry (METI) and MIC, Authors' calculation. Note: This figure shows changes in credit card expenditure compared to the same period of the previous year. Classification for flexible or non-flexible occupation follows the flexibility of work arrangement explained in the main text. To compute effects of flexibility, we use shares of flexible and non-flexible workers in each industry. For retail sectors, we allocate total expenditures into retail and wholesale industries of the sold goods and services, based on retail and wholesale margins of each sector, and allocate the rest to either the manufacturing or agriculture industries. We then use the shares of flexible and non-flexible industries in each of the subdivided industries. Figures are based on nominal expenditures.

Ordinary and Social: Following similar steps taken in computing effects of flexibility, we divide expenditures into ordinary and social sectors. Figure 6 shows a major difference in expenditures between the two sectors started, which started in as early as early February and the difference significantly widened in March. Sales in the social sector declined by more than 10% in the second half of March, while the change is around 5% in the ordinary sector.

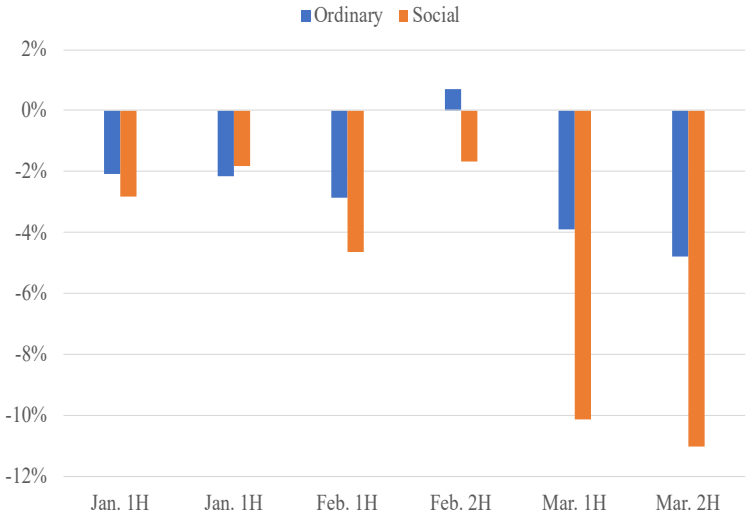
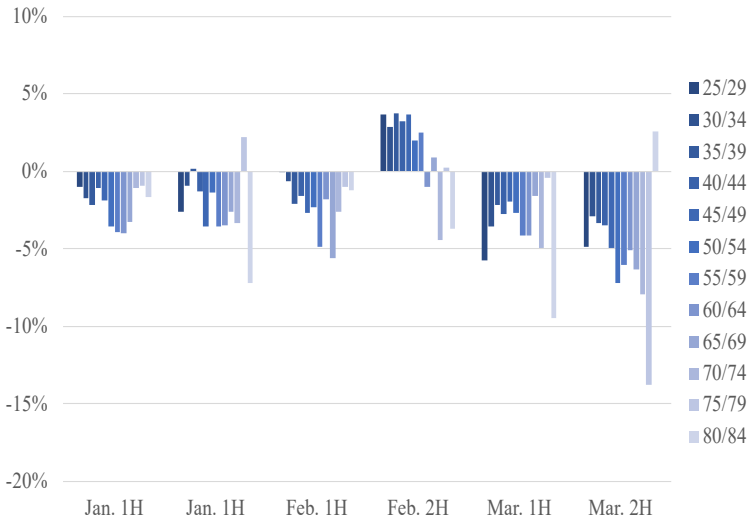


Figure 6: Change in Expenditure: Ordinary vs Social (% change, year-on-year)

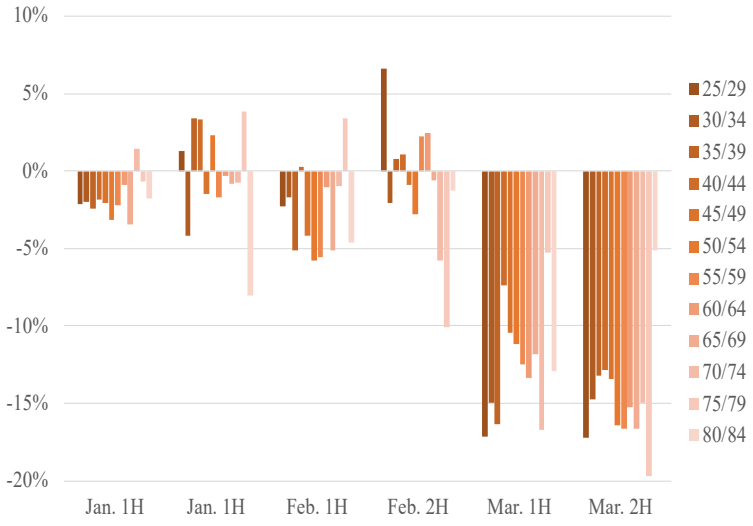
Source: : JCB Consumption NOW, Economic Census for Business Activity of METI and MIC, Authors' calculation.

Note: This figure shows changes in credit card expenditure compared to the same period of the previous year. Industrial classifications for ordinary or social sectors follow the degrees of social and face-to-face elements as explained in the main text. Ordinary sector consists of E-Commerce, Production, Transmission and Distribution of Electricity, Communication and Online content delivery. And, Social sector consists of Eating out, Travel, Medical care, Transportation, Entertainment and Accommodation. Especially, we decompose Retail Trade into Ordinary and Social based on margin by Economic Census for Business Activity. Figures are based on nominal expenditures.

By Age and Gender: Figure 7 shows changes in expenditures across age groups, in ordinary and social sectors, respectively. Purchases declined across all age groups in both ordinary and social sectors, except for purchases of those aged 80/84 in the ordinary sector. The decline is somewhat smaller among middle-aged individuals aged 30s and 40s for males and aged 40s for females. The decline of social goods is larger among younger individuals aged late 20s and 30s in the first half of March. In the second half, the larger decline is observed among both the young and the old.



(a) Ordinary



(b) Social

Figure 7: Change in Expenditure by Age: Ordinary vs Social (% change, year-on-year)

Source: : JCB Consumption NOW, Authors' calculation.
Note: This figure shows changes in credit card expenditure copared to the same period of the previous year. Data is for each 5-year-old bin from age 25/29 to 80/84. Figures are based on nominal expenditures.

Figure 8 shows changes in expenditures by gender, summarized into ordinary and social sectors. Throughout March, males reduced expenditures by more than females in the social sector.[6]

[6]Within the social sector, males reduced expenditures on eating-out and travel by a larger percentage than females. In the second half of March, for example, expenditures on eating-out by males declined by 40%, while the decline was approximately 20% among females.

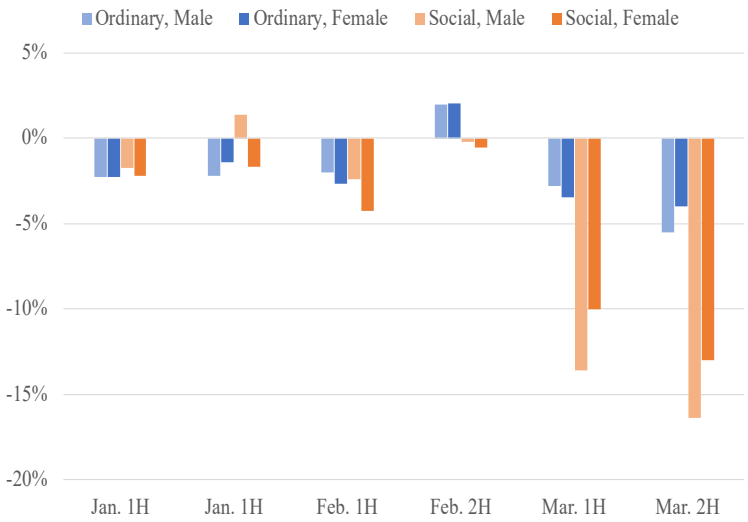
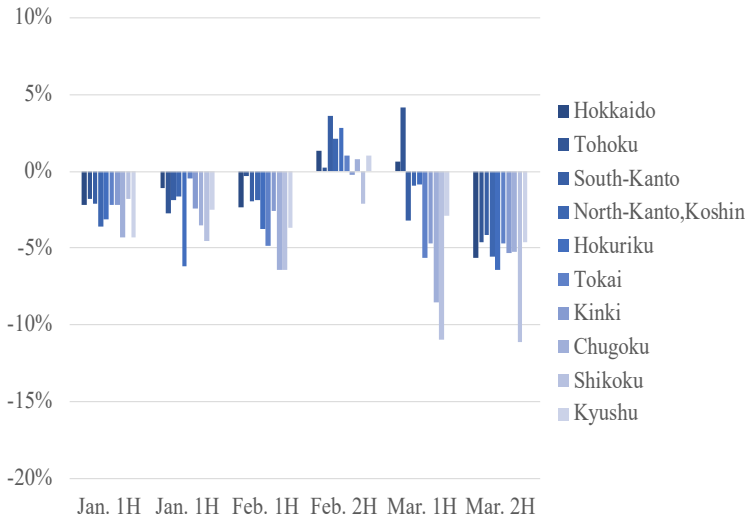


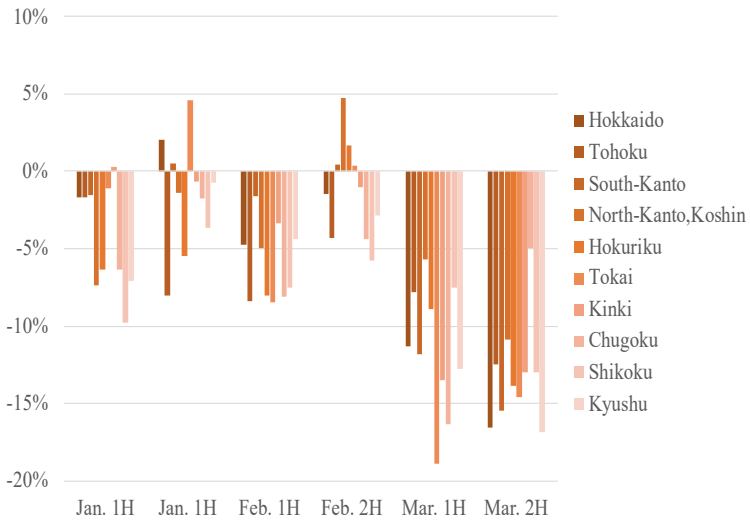
Figure 8: Change in Expenditure: By Gender (% change, year-on-year)

Source: : JCB Consumption NOW, Authors' calculation.
Note: This figure shows changes in credit card expenditure copared to the same period of the previous year. Figures are based on nominal expenditures.

By Region: It remains unknown how and if the COVID-19 crisis will affect inequality across regions, perhaps through the impact on heterogeneous industrial composition and through either temporary or long-term reallocation of the Japanese people. Although changes in this potentially important dimension of inequality is not a focus of our paper, Figure 9 shows changes in expenditures across regions in ordinary and social sectors, respectively. Expenditures in the social sector declined by more than those in the ordinary sector across regions. Social expenditures declined by 11 to 17% in all regions in the second half of March, except for Chugoku region.



(a) Ordinary



(b) Social

Figure 9: Change in Expenditure by Region: Ordinary vs Social (% change, year-on-year)

Source: JCB Consumption NOW, Authors' calculation.
Note: This figure shows changes in credit card expenditure compared to the same period of the previous year. Figures are based on nominal expenditures.

4 Heterogeneous Impact of the COVID-19 Crisis

4.1 COVID-19 Shocks through Different Channels

As discussed in section 2, the two channels through which the COVID-19 crisis affects vulnerability of individual workers are, first, whether a worker's occupation requires more

face-to-face transactions, which are hard to be completed remotely, and, second, whether a worker is in industries whose output and operations involve more social elements than others.

Changes in the labor market can be evaluated only after the release of the national labor market data. Early expenditure data, however, examined in section 3 provide us with some indications as to how the crisis affects workers through channels of our interest.

Based on observed differences across the two dimensions as discussed in section 3, we evaluate how the COVID-19 crisis can bring about different changes on earnings of heterogeneous workers. As shown in section 3, expenditures declined in essentially all sectors in March, but there is a major difference between expenditures in flexible and non-flexible sectors, and between ordinary and social sectors, as shown in Figures 5 and 6.

In addition to the two dimensions of heterogeneity across workers, a downward trend over business cycles in general tends to hurt employment of contingent workers by more than regular workers, who are more protected from an employment adjustment. Yokoyama et al. (2019) study how firms adjust employment of regular and contingent workers in response to exogenous shocks, exploiting heterogeneous dependence of manufacturing firms on international trade and their response to fluctuations in exchange rates. The study reveals greater employment risks of contingent workers in response to aggregate shocks, which implies an additional element of vulnerability that will hit contingent workers in response to the COVID-19 crisis, besides their occupational characterization summarized in Table 4b.

Figure 10 shows changes in the number of the unemployed, who are separated from a job during the previous year, by employment type of the previous job. It is expressed as a ratio to the average stock of the employed in each employment type, based on the Labor Force Survey of the MIC. It shows that there was a surge in separations among both types workers during the financial crisis of 2007-2009, but the separation rate rose more sharply among contingent workers than among regular workers.

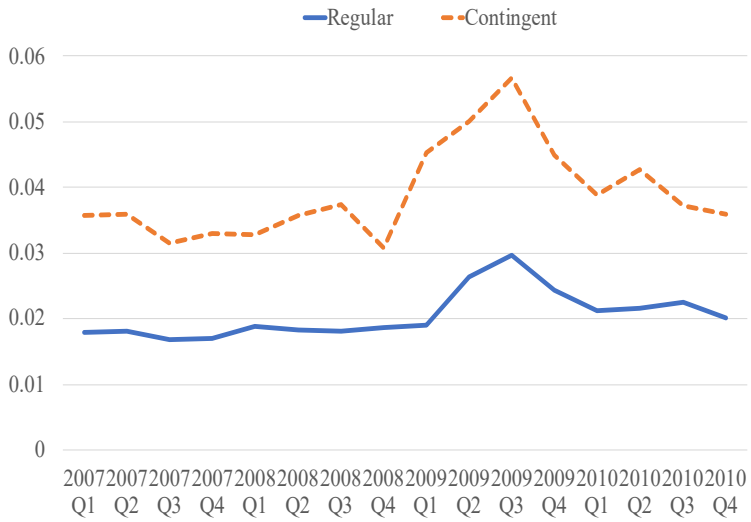


Figure 10: Separation rates (%) by Employment Type during the Financial Crisis

Source: Labor Force Survey of MIC
Notes: This figure reports separation rates (%) for different employment types. The solid line shows the separation rates for regular workers. The dashed line shows the separation rates for contingent workers.

Obviously, there are other dimensions of heterogeneity across workers that may affect an impact from the COVID-19 crisis. For example, there may be different dynamics across regions depending on the composition of industries and demographics in each region. Moreover, firms of different sizes may adjust employment and work hours of their employees in different ways. We leave exploration in these directions for future work as we learn more from the data.

4.2 Some Scenario Analyses

Based on the three dimensions of heterogeneity across workers discussed above, we run a simulation and assess how earnings of different workers could change in response to the COVID-19 crisis. We do not, or are not yet able to, quantify aggregate effects of the COVID-19 shocks and changes in the wage level that would occur at the macro level. Our focus in the simulation exercise here is to assess how effects can differ across workers, in three dimensions of heterogeneity; flexible vs non-flexible occupations, social vs ordinary sectors, and regular vs contingent employment types, and how the COVID-19 crisis could exacerbate inequality as a result of these changes.

We normalize earnings of workers by those in flexible and ordinary jobs on regular employment. We assume a relative change in earnings of non-flexible workers, based on the difference between flexible and non-flexible expenditures as shown in Figure 5, which is computed as the sum of sales of each industry allocated to occupational composition of the industry based on the ESS data. The ratio used for non-flexible workers is 0.979,

relative to 1.0 of flexible workers.

Similarly, we set the relative earnings in the social sector at 0.935, relative to 1.0 in the ordinary sector, based on the difference across two sectors as shown in Figure 6. Earnings of contingent workers is set to 0.980 relative to those of regular workers, based on the difference in the employment adjustment observed during the financial crisis as shown in Figure 10.

Note that the values we used in this simulation exercise are based on the suggestive evidence that we could infer from early expenditure data and employment data during the financial crisis of 2007-2009. They are by no means precise prediction of the changes in relative earnings and we need to wait for the release of data to quantify heterogeneous impact of the COVID-19 shocks in the labor market. We do not attempt to evaluate changes in the aggregate wage level and the analysis below is focused on heterogeneous changes in earnings suggested by these sets of data.

Given these caveats, results shown in Table 6 suggests significant heterogeneity in potential effects on earnings across workers in response to the COVID-19 shocks. Between males and females, males on average suffer more from the flexibility shock as shown in the first column (1) of the table, while the social shock shown in column (2) is significantly larger for females, with their earnings level falling by 4.16% relative to flexible, social and regular workers, while the magnitude is about a half at 2.19% for males. The employment-type shock, as shown in column (3), hits females harder because they have a much larger fraction of contingent workers than males, as we saw in section 2.

By employment type, contingent workers face a larger impact from both the flexibility and social shocks. They also directly suffer from the employment type shocks and in total, the shock lowers earnings by 7.40% relative to the benchmark type.

Low-skilled workers receive a larger impact on their earnings by all of the three shocks than high-skilled workers. In total, their earnings fall by 5.29% relative to the benchmark type, while the decline is 3.99% for high-skilled workers.

Within each of the gender, employment type and skill categories, those who are more hardly hit by the COVID-19 shocks earn less prior to the crisis. The analysis suggests that the COVID-19 crisis is very likely to increase earnings inequality in the dimensions we considered here and it could exacerbate overall inequality at the aggregate level by a significant margin.

Table 6: Relative Effects of Various COVID-19 Shocks on Earnings (1)

	(1) Flex	(2) Social	(3) Emp.	(1)-(3) All	Avg Earn	Emp. Share
Male	1.30%	2.19%	0.28%	3.73%	493.9	53.9%
Female	1.00%	4.16%	1.10%	6.16%	238.7	46.1%
Regular	1.06%	2.58%	0.00%	3.62%	484.4	67.4%
Contingent	1.36%	4.18%	2.02%	7.40%	152.5	32.6%
High	0.74%	2.92%	0.36%	3.99%	461.4	33.9%
Low	1.38%	3.19%	0.81%	5.29%	332.5	66.1%

Source: ESS 2017 of MIC, JCB Consumption NOW, Authors' calculation.
Notes: This table reports effects of various types of shocks on earnings, average earnings, and employment shares for different groups. The estimates of the effects are percentage point differences in declines in annual earnings. Changes in earnings of workers at flexible occupations, ordinary sectors, and in regular employment types are normalized to zero. The first column shows the relative decline in earnings if the relative earnings for non-flexible jobs decline by 2.3%. The second column shows the relative decline if the relative earnings in social sectors decline by 6.5%. The third column shows the relative decline if the relative earnings for contingent workers decline by 2%. The fourth column shows the relative decline if all of these three changes occur simultaneously. The fifth column shows the average annual earnings (in JPY 10,000) for each group in 2017. The sixth column shows the employment shares for each groups in 2017.

Table 7 shows effects on earnings by combination of gender, employment type and skill level. Across different groups, flexibility shock, shown in column (1) in the table, affects low-skilled workers by more than high-skilled workers, suggesting more challenges in continuing to complete the same set of tasks as in the pre-crisis period among these workers.

Shocks to the social sector bring about a large impact on female workers across different groups with a decline of earnings by 3.8 to 4.5% relative to the benchmark earnings of flexible, ordinary and regular workers. Effects of the flexible shocks also differ by skill types conditional on gender and employment type and high-skilled within each group experience a larger decline in earnings relative to the low-skilled.

Combining the three shocks, the effects differ in a wide range of 3.04% to 7.68%. Within each gender, contingent and low-skilled workers are affected most negatively, who face a decline of 6.75% to 7.68% in earnings, respectively, relative to the benchmark group. The group also earn the least amount within each gender.

Table 7: Relative Effects of Various COVID-19 Shocks on Earnings (2)

	(1) Flex	(2) Social	(3) Emp.	(1)-(3) All	Avg Earn	Emp. Share
MHR	0.82%	2.23%	0.00%	3.04%	5,753	20.8%
MLR	1.59%	1.86%	0.00%	3.43%	5,069	25.7%
MHC	1.15%	3.58%	2.02%	6.62%	2,301	2.3%
MLC	1.81%	3.07%	2.02%	6.75%	2,165	5.2%
FHR	0.38%	3.87%	0.00%	4.24%	3,725	7.0%
FLR	0.79%	3.76%	0.00%	4.52%	3,634	13.9%
FHC	0.74%	4.53%	2.02%	7.15%	1,447	3.9%
FLC	1.39%	4.45%	2.02%	7.68%	1,301	21.3%

Source: ESS 2017 of MIC, JCB Consumption NOW, Authors' calculation.
Notes: This table reports effects of various types of shocks on earnings, average earnings, and employment shares for different groups. The estimates of the effects are percentage point differences in declines in annual earnings. Changes in earnings of workers at flexible occupations, ordinary sectors, and in regular employment types are normalized to zero. Each column reports the same variable as in Table 6. Each row reports the effects on workers with different gender, education, and employment types; M=male, F=female; H=college and above, L=below college; R=regular, C=contingent.

5 Conclusion

The COVID-19 crisis is different from other recessions we experienced during the past century. The distribution of negative effects across individuals is strikingly different from that of a typical recession. It hurts industries that rely more on social and face-to-face transactions. It hurts occupations that lack flexibility in work arrangement and involve many tasks which cannot be completed remotely. Moreover, a recession in general hurts a particular group of workers under a contract with less job security.

We use the Employment and Status Survey (ESS) of 2017 to identify groups of workers in Japan who are more vulnerable to shocks triggered by the COVID-19 pandemic. We use expenditure data from the JCB Consumption NOW to assess impact of the COVID-19 crisis across different sectors of the economy and quantify how earnings of heterogeneous workers respond to shocks.

Our results indicate that the COVID-19 crisis will have more pronounced negative effects on workers with lower income. It will hurt females by more than males on average, the low-skilled by more than the high-skilled and contingent workers by more than regular workers. Investigating different impacts across workers reveals that the COVID-19 crisis will exacerbate inequality in multiple dimensions.

Our finding suggests the need for the government to respond immediately and provide financial support to those vulnerable groups of individuals who are being severely hit by the crisis. It is critical that the government closely monitors labor market data to identify affected individuals and pays close attentions to their financial conditions to mitigate economic distress at an individual level.

Demand shocks caused by the surge in infection risks and supply shocks that hit the whole economy, but most significantly the social sector, will together affect production and wage dynamics of different sectors. It also remains to be seen how long these shocks will persist and how many more months, if not years, the government needs to support affected individuals and firms with rising public expenditures. The economic recovery from the crisis will also depend on how to deal with the expanded debt after the crisis in Japan, which already had an elevated level of public debt before the crisis. How these factors interact and determine the transition path of macro and micro variables is an important question that goes beyond the scope of this paper, which we explore in our ongoing research (Kikuchi et al. (2020)).

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