Analysis of Corporate Bankruptcies arising from Human Resource Shortages amid the Changing Working Environment

(Summary)

This paper attempts to understand the financial characteristics of firms that went bankrupt due to human resource shortages by using corporate financial and bankruptcy data obtained from a third-party data vendor. It revealed that firms that went bankrupt due to human resource shortages had different characteristics from other firms in terms of labor cost burden, operational efficiency, and other factors. The FSA will continue to monitor, in a forward-looking manner, the impact of changes in the macro environment on the financial system, such as whether the changing labor situation leads to an increase in credit risk for financial institutions.

I. Introduction

In Japan, the working-age population (15 to 65 years old) has been declining since its peak in 1995 due to the aging of the population and the declining birthrate.[1] In addition, the labor situation is facing major challenges, such as the so-called "2024 problem," in which labor shortages are a concern due to the application of overtime caps to the construction and other industries starting in April 2024,[2] and the so-called "2025 problem," in which the generation born between 1947 and 1949, a large group in terms of population composition, will reach the late-elderly age (over 75 years old). These changes may affect the society from various perspectives in the future. If these changes exacerbate various social and economic challenges, it may have an adverse impact on financial institutions in the form of increased credit risk and decreased lending demand and borrowers. Therefore, it is useful to analyze the impact of changing labor environment on the business conditions of Japanese firms, to ensure

[1] National Institute of Population and Social Security Research, "Population Projections for Japan: 2021 to 2070"
https://www.ipss.go.jp/pp-zenkoku/j/zenkoku2023/pp_zenkoku2023.asp
[2] Ministry of Health, Labour and Welfare
https://hatarakikatakaikaku.mhlw.go.jp/overtime.html
Due to the revision of the Labor Standards Law, the upper limits have been in effect for large companies since April 2019 and for small and medium-sized companies since April 2020. Of these, the upper limits became effective in April 2024 for the construction, transportation, and physician industries, although there was a five-year grace period before they became applicable.

the financial stability.

This report focuses on the recent growing human resources shortages and examines the characteristics of corporate bankruptcies by defining three types of bankruptcies[3]: bankrupted companies caused by human resources shortages ("HR-shortage bankrupt companies"), bankrupted companies caused by other reasons ("other bankrupt companies"), and neither ("surviving companies"). The analysis in this report is based on financial data and bankruptcy data obtained from a third-party data vendor, but it should be noted that the number of HR-shortage bankrupt companies covered in the database is small compared to the total number of bankrupt companies, and thus the sample may be biased.[4]

II. The labor situation in Japan

Figure 1 shows the change in the employment headcount determination D.I., which expresses a company's perception of an excess or shortage of manpower. A positive (negative) value for this indicator indicates that a high percentage of companies believe they have an excess (shortage) of workers. Note that a temporary increase seen from 2020 to 2021 is due to a sharp decline in labor demand following the COVID-19 pandemic and the declaration of a state of emergency.

Figure 2 shows the trend of the D.I. for production and sales equipment, which indicates companies' perception of an excess or shortage of equipment. A positive (negative) value for this indicator indicates that a high percentage of firms consider their facilities to be excessive (insufficient). After peaking in 2009, the sense of excess facilities gradually dissipated, with values for the non-manufacturing sector and the manufacturing sector becoming negative in September 2013 and September 2017, respectively. Subsequently, the sense of excess temporarily strengthened as with the employment headcount D.I., but a sense of shortage is now emerging again. The reasons for this resurgence in the percentage of firms that believe their facilities are inadequate may be due to pent-up demand for capital investment, which had been postponed due to the COVID-19 pandemic, and

[3] Bankruptcy in this report refers to a company that is recognized by Teikoku Databank, Inc. as falling under one of the following six cases: (1) suspension of bank transactions, (2) internal liquidation (when the representative acknowledges bankruptcy), (3) filing for commencement of corporate reorganization proceedings with the court, (4) filing for commencement of civil rehabilitation proceedings with the court, (5) filing for commencement of bankruptcy proceedings with the court, or (6) filing for commencement of special liquidation with the court. The term "bankruptcy data" refers to data on companies that are recognized as falling under one of the six cases listed in the six categories above.

[4] This report analyzes companies for which financial and bankruptcy data are available based on information from Teikoku Databank, Ltd. In this report, "bankrupt firms with insufficient human resources" are defined as those whose bankruptcy factors in the bankruptcy data of Teikoku Databank include "lack of human resources," which indicates difficulty in securing human resources, and "illness or death of the manager," which indicates the absence of successor managers.

expectations for an economic normalization. In addition, the increased demand for capital investment to improve operational efficiency in response to human resources shortages may also have had an impact.

Figure 3 shows the year-on-year quarterly growth rates of nominal and real wages. At present, the growth rate of nominal wages has been in positive territory due to factors such as labor shortages and inflation. However, the growth rate of real wages as of January-March 2023 is negative due to the high rate of price inflation.

In light of the above, it is possible that the worsening shortage of human resources in Japan is having a ripple effect on trends in capital investment and wages, affecting the survival of firms. Figure 4 shows the number of bankrupt companies and the percentage of HR-shortage bankrupt companies among all bankrupt companies. Unlike the trend in the number of bankrupt companies, the percentage of HR-shortage bankrupt companies is in the single-digit range but is on an upward trend.

Figure 1 :Change in the employment headcount determination D.I.[5]

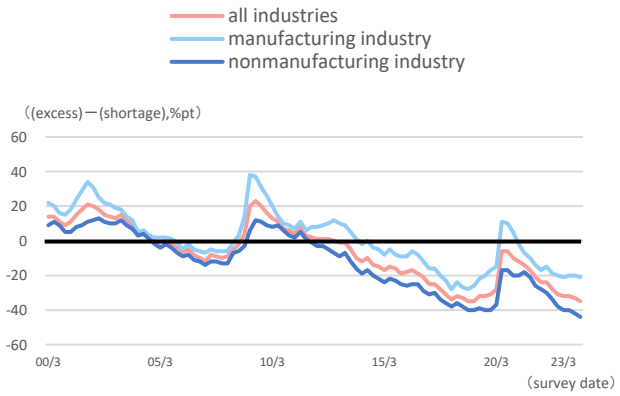
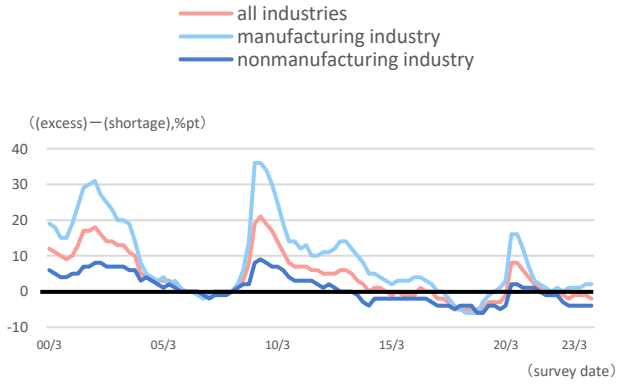


Figure 2 :Trend of the D.I. for production and sales equipment [6]



[5] Source: Bank of Japan, “National Short-Term Economic Survey of Enterprises in Japan.”
[6] Source: Bank of Japan, “National Short-Term Economic Survey of Enterprises in Japan.”

Figure 3: Year-on-year quarterly growth rates of nominal wages and real wages [7]

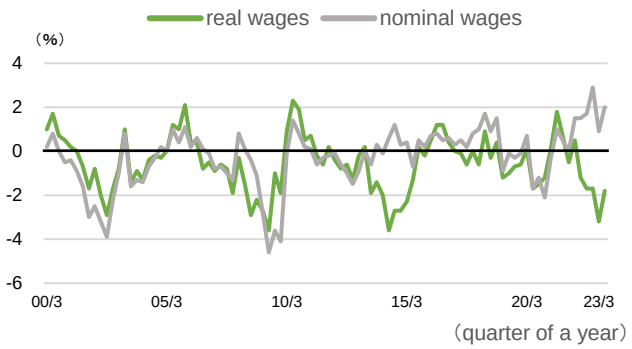
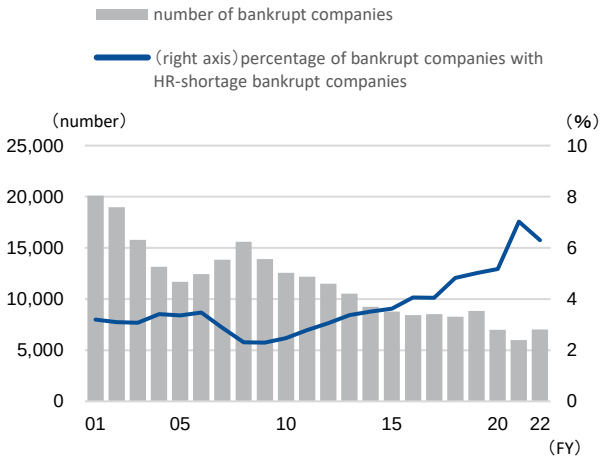


Figure 4: Number of bankrupt companies



III. Analysis of HR-shortage bankrupt companies

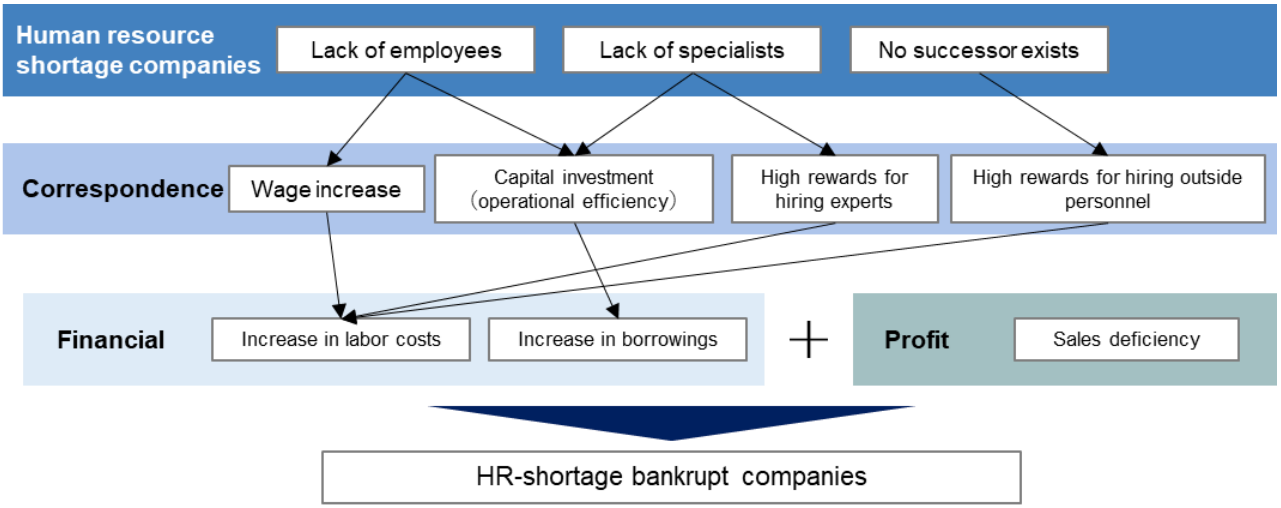
As mentioned in the previous section, the worsening of the human resource shortage and the rising trend in the ratio of companies that have gone bankrupt due to human resource shortages have been observed. In this chapter, the distribution and trend of each financial indicator up to bankruptcy are examined, in order to understand the characteristics of firms that went bankrupt due to a shortage of human resources.

1. Background to human resource shortage bankruptcies

In examining bankruptcies caused by human resource shortages, the transmission channels of bankruptcy are briefly summarized in Figure 5. While there is a wide range of measures that can be taken to address human resource shortages, this report focuses mainly on the burden of labor costs, in light of the recent trend of a wage increase.

[7] Source: Ministry of Health, Labour and Welfare, “Provisional Report of Monthly Labour Survey”

Figure 5: Background to human resource shortage bankruptcy[8]



2. Comparison of the distribution of financial indicators by bankruptcy status

First, the distribution of financial indicators are analyzed for each bankruptcy categories. i.e., "HR-shortage bankrupt companies," "other bankrupt companies," and "surviving companies." For the HR-shortage bankrupt companies and other bankrupt companies, the figures for the fiscal year of the bankruptcy are used, and for the surviving firms, the figures for the latest fiscal year available before the end of September 2023 are used. In this section, the distributions are presented without considering the industry sector in order to ensure sufficient sample size and to grasp the overall trend.

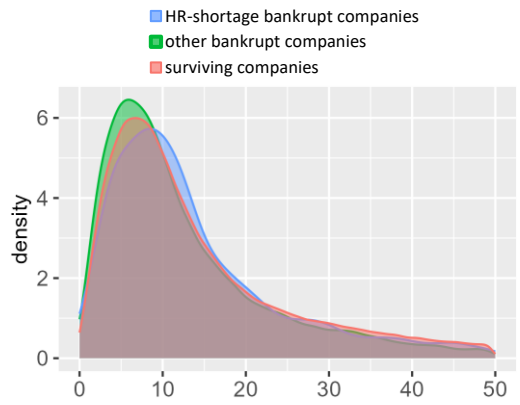
Figures 6 and 7 show the distribution of the labor cost over net sales ratio and the labor share, respectively. A comparison of the medians of the labor cost over net sales ratio and the labor share for HR-shortage bankrupt companies and other bankrupt companies revealed that the labor cost burden may be heavy for HR-shortage bankrupt companies, as both ratios are high.

Table 1: Number of samples[9]

	n	manufacturing	wholesale	construction	service	retall	transportation	real estate	other
HR-shortage bankrupt companies	1,637	17.9%	35.7%	13.9%	18.9%	6.1%	4.3%	3.0%	0.2%
other bankrupt companies	45,094	23.3%	31.3%	11.3%	18.6%	8.3%	3.4%	3.3%	0.5%
surviving companies	1,036,355	22.2%	29.7%	9.8%	22.1%	7.2%	4.0%	4.4%	0.6%

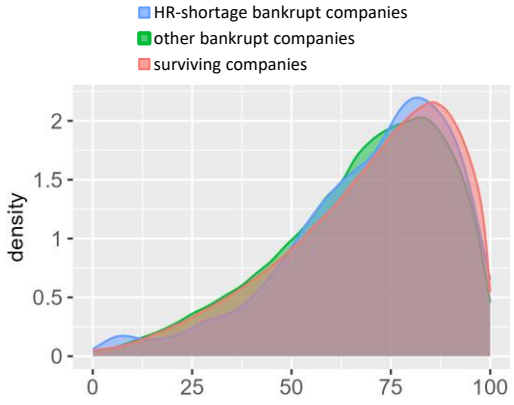
[8] Other possible measures include mergers and acquisitions.
[9] The period covered is April 2001 to September 2023.

Figure 6: Ratio of labor cost to net sales(%)[10]



	median	mean
HR-shortage bankrupt companies	10.41	14.14
other bankrupt companies	8.70	11.76
surviving companies	8.90	11.88

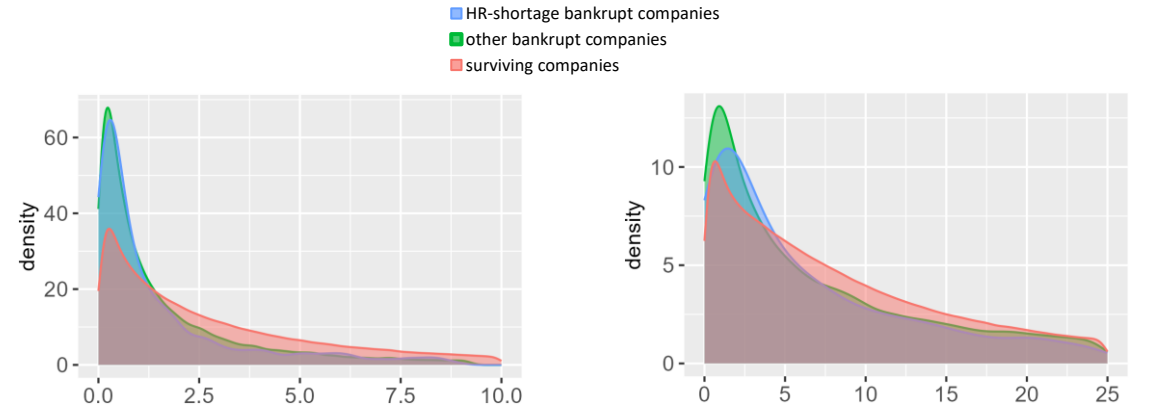
Figure 7: Labor share(%)[11]



	median	mean
HR-shortage bankrupt companies	82.15	75.54
other bankrupt companies	77.44	67.77
surviving companies	74.77	65.95

In Figures 8 through 10, the distribution of profitability, safety, and productivity indicators are shown respectively. Again, the median values indicate that the dependence on debt as the safety indicator, and turnover of tangible fixed assets as the productivity indicator, tend to be higher for HR-shortage bankrupt companies.

Figure 8: The profitability index
(Left: ratio of ordinary income to net sales(%)[12]; Right: ROE(%)[13])



	median	mean
HR-shortage bankrupt companies	0.26	-0.93
other bankrupt companies	0.38	-0.56
surviving companies	1.61	2.52

	median	mean
HR-shortage bankrupt companies	2.97	7.96
other bankrupt companies	3.77	9.45
surviving companies	6.21	9.43

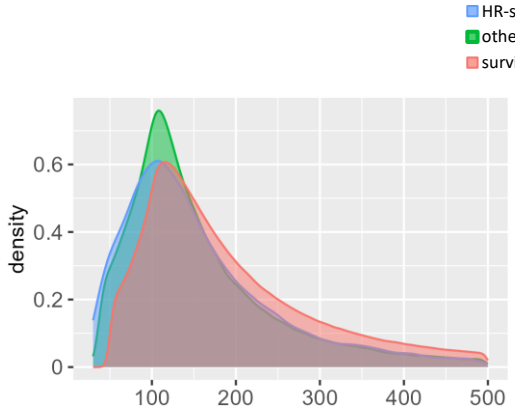
[10] labor cost ÷ sales × 100 (labor cost = salary expense + directors' compensation + bonus expense + directors' bonus + welfare expense)

[11] labor cost ÷ value added × 100 (value added = operating income + real estate rent + interest payment and discount expenses +depreciation costs + taxes and dues + labor cost)

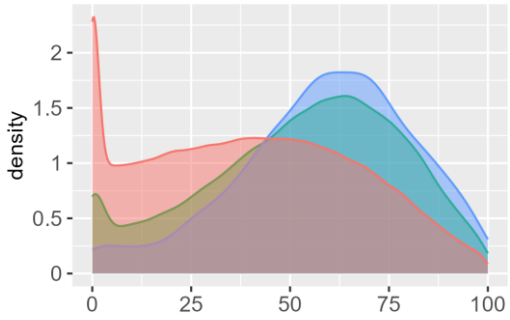
[12] ordinary income ÷ sales × 100

[13] net income ÷ equity×100

Figure 9: The security index
(Left: liquidity ratio(%)[14]; Right: degree of dependence on debt (%)[15])

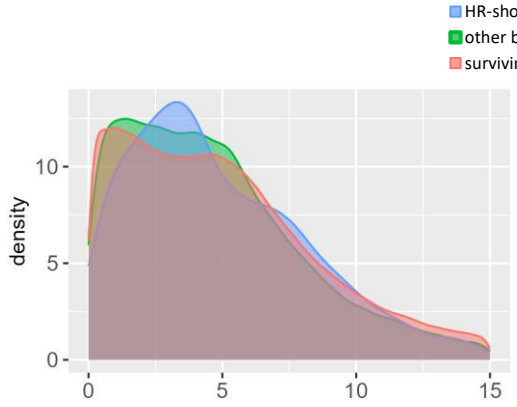


	median	mean
HR-shortage bankrupt companies	64.13	66.26
other bankrupt companies	57.79	56.00
surviving companies	40.12	40.67

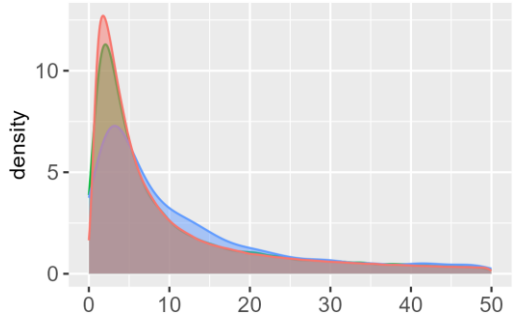


	median	mean
HR-shortage bankrupt companies	133.86	158.59
other bankrupt companies	131.76	157.26
surviving companies	168.13	210.75

Figure 10: The productivity index
(Left: labor productivity (millions of yen)[16];
Right: tangible fixed assets turnover (number of turnings)[17])



	median	mean
HR-shortage bankrupt companies	3.93	4.56
other bankrupt companies	3.90	4.50
surviving companies	4.50	5.44



	median	mean
HR-shortage bankrupt companies	13.31	61.00
other bankrupt companies	8.71	38.53
surviving companies	8.51	80.76

3. Comparison of trends in financial Indicators by bankruptcy status

Next, the trends in financial indicators up to bankruptcy are analyzed for HR-shortage bankrupt companies and other bankrupt companies. This section used the changes in the past five fiscal years

[14] current assets ÷ current liabilities × 100
[15] (short-term loans + long-term loans + interest expense - employee deposit) ÷ (total assets + amount notes receivable discounted + amount notes receivable endorsed) × 100
[16] value added/number of employees
[17] sales/tangible fixed assets

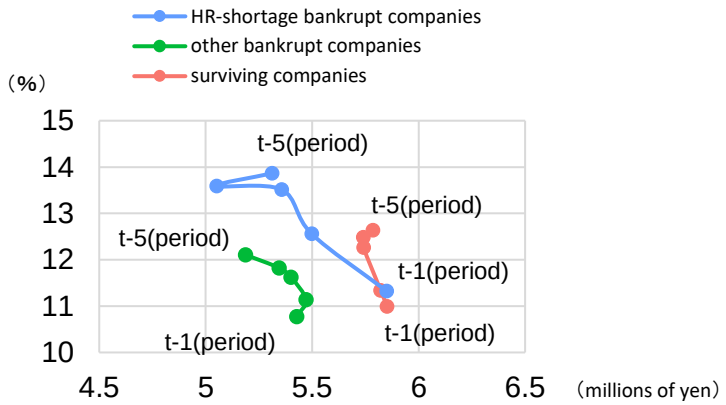
up to the previous period of bankruptcy (from t-5 to t-1) when the year of bankruptcy is set as period "t". For reference, the figures for surviving companies are also included by defining the latest financial year available as the "t-1 period." The number of verified samples by industry breakdown is shown in Table 2, although industry is not taken into account in this section.

Table 2: The number of samples [18]

	n	manufacturing	wholesale	construction	service	retall	transportation	real estate	other
HR-shortage bankrupt companies	406	15.8%	29.3%	17.7%	18.5%	8.9%	4.7%	4.9%	0.2%
other bankrupt companies	11,557	19.7%	28.0%	15.3%	20.6%	8.5%	3.5%	3.8%	0.5%
surviving companies	182,214	16.5%	24.0%	13.7%	25.8%	7.9%	4.2%	7.1%	0.9%

Figure 11 shows labor productivity on the horizontal axis and the labor cost over net sales ratio on the vertical axis. Compared to other bankrupt companies, the labor productivity of HR-shortage bankrupt companies in the t-5 period was not low, and the labor cost over net sales ratio was not high. On the other hand, the decline in labor productivity and the increase in labor cost over net sales ratio may be larger than those of the other bankrupt companies when observed over the span up to the t-1 period.

Figure 11:Trend of productivity and labor cost
(Median; X axis: labor productivity; Y axis: labor cost over net sales ratio)



Focusing on labor productivity (value added divided by number of employees), which has shown a larger declining trend than other bankrupt companies, Figures 12 and 13 show the trend of labor productivity by decomposing it by sales and property, plant and equipment. Although it is necessary to pay attention to the large standard error in sales per worker for HR-shortage bankrupt companies, it was confirmed that the decline in sales per worker may be larger and the labor equipment ratio is

[18] The period covered is April 2001 to March 2023.

lower than that of other bankrupt companies.

Figure 12: Decomposition by sales (median)
(Left: sales per worker (millions of yen)[19]; Right: value added ratio (%)[20])

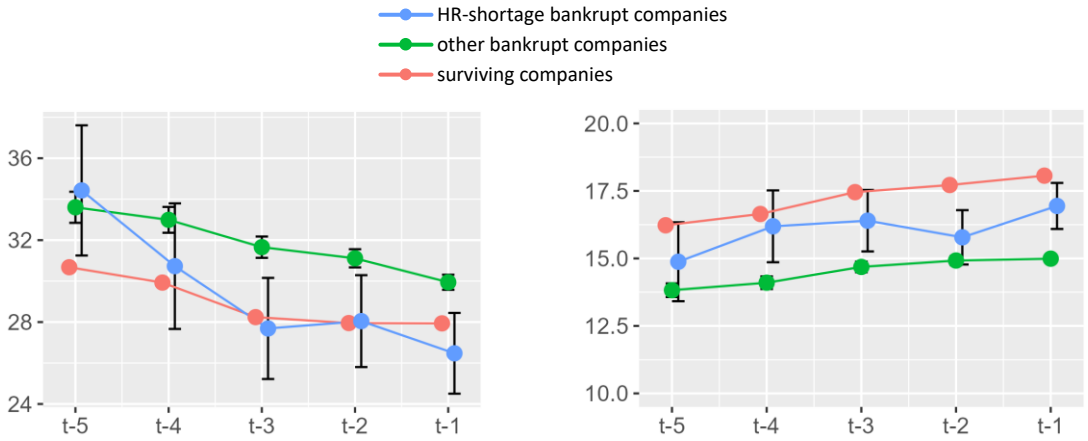
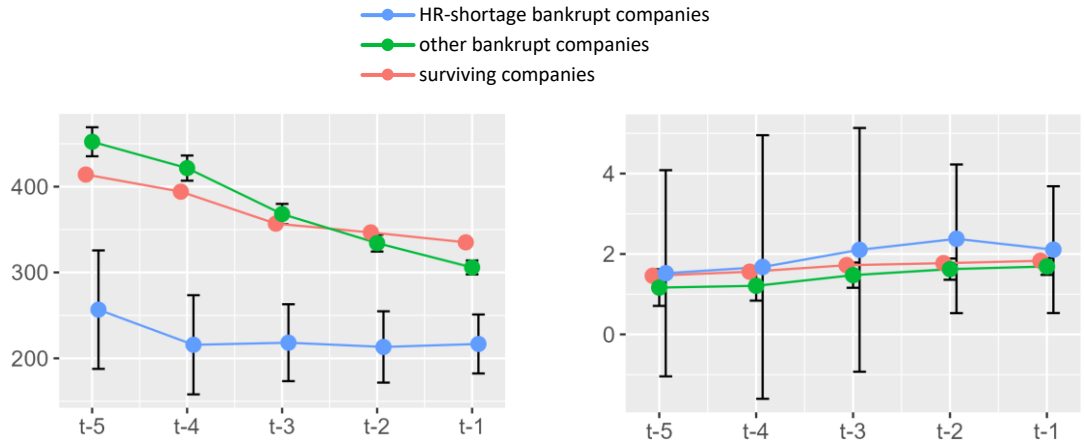


Figure 13: Decomposition by property, plant and equipment (median)
(Left: labor equipment ratio (%)[21]; Right: equipment productivity (millions of yen)[22])



[19] sales ÷ number of employees
[20] value added ÷ sales × 100
[21] property, plant and equipment ÷ number of employees × 100
[22] value added ÷ property, plant and equipment

Figure 14: Degree of dependence on borrowings (%; median)

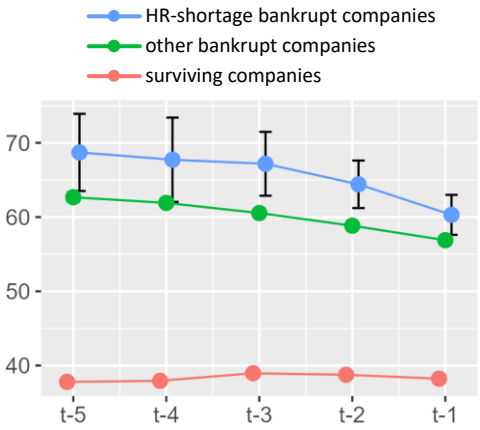
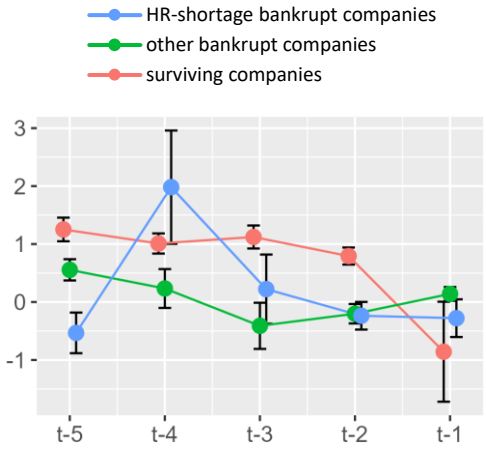


Figure 15: Change in the number of employees (mean)



(X axis: period, Error bars: standard error)

Figure 14 shows the degree of dependence on borrowings and Figure 15 shows the change in the number of employees from the previous quarter. The degree of dependence on borrowings by HR-shortage bankrupt companies remained high. No trend of increase or decrease in the number of employees from the previous period could be observed for the HR-shortage bankrupt companies.

4. Estimation of financial characteristics of HR-shortage bankruptcies

It was suggested that HR-shortage bankrupt companies are subject to progressively heavier labor cost burdens, are more dependent on borrowing, and may have inadequate operational efficiencies. To examine these trends, the following multinomial logistic regression is conducted.

$$\begin{cases} y_{B,i} = ln\left(\frac{P_{B,i}}{P_{A,i}}\right) = \alpha_B + \sum_{m=1}^{4} \beta_{B,m} explanatory\ \ variable_{m,i} + \sum_{n=1}^{4} \beta_{B,n} control_{n,i} + \varepsilon_{B,i} \\ y_{C,i} = ln\left(\frac{P_{C,i}}{P_{A,i}}\right) = \alpha_C + \sum_{m=1}^{4} \beta_{C,m} explanatory\ \ variable_{m,i} + \sum_{n=1}^{4} \beta_{C,n} control_{n,i} + \varepsilon_{C,i} \end{cases}$$

$$\begin{pmatrix} A: human\ \ resource\ \ shortage\ \ bankrupt \\ B: other\ \ bankrupt \\ C: surviving \\ i: company \end{pmatrix}$$

Table 3: Explanatory variables and controls

<Explanatory variables>

regression 1 (v1)

(1) ⊿labor productivity(※a)

(2) ⊿labor cost over net sales ratio(※a)

(3) labor equipment ratio

(4) degree of dependence on borrowings

(※a) difference from the previous period

regression 2 (v2)

(1) ⊿sales per worker(※b)

(2) ⊿labor cost per worker(※b)

(3) labor equipment ratio

(4) degree of dependence on borrowings

(※b) difference from the previous period of the natural logarithm

regression 3 (v3)

(1) labor productivity

(2) labor cost over net sales ratio

(3) labor equipment ratio

(4) degree of dependence on borrowings

regression 4 (v4)

(1) sales per worker(※c)

(2) labor cost per worker(※c)

(3) labor equipment ratio

(4) degree of dependence on borrowings

(※c) natural logarithm

<Controls>

(1) ratio of ordinary income to net sales

(2) size (the natural logarithm of the current period capital)

(3) year dummies (the period covered is March 2002 to March 2023)

(4) industry dummies (manufacturing, wholesale, construction, service, retail, transportation and communications, real estate, others)

The estimation equations used consist of a regression equation ($y_{B,i}$) that examines the characteristics of other bankrupt companies relative to HR-shortage bankrupt companies and a regression equation ($y_{C,i}$) that examines the characteristics of surviving companies relative to HR-shortage bankrupt companies. The list of variables for each regression equation is shown in Table 3, and four regressions v1 through v4 were conducted for each variable. The samples used in the estimation are the same as those shown in Table 2.

For the explanatory variables ($explanatory\ \ variable_{m,i}$), in v1, the difference in labor productivity from the previous period ($\triangle labor\ \ productivity$) is used to confirm the transition in productivity, and

the difference in the labor cost over the net sales ratio from the previous period ($\triangle labor\ cost\ over\ net\ sales\ ratio$) is used to confirm the transition in the labor cost burden. For the explanatory variables in v2, the differences from the previous period in the natural logarithm transformations of sales per worker and labor cost per worker ($\triangle sales\ per\ worker$, $\triangle labor\ cost\ per\ worker$) are used for the same purpose. For v 3 and v4, the characteristics of the levels are verified by including the figures themselves for the relevant period instead of the difference from the previous period, respectively. In addition, in each estimation equation, the labor equipment ratio and the degree of dependence on borrowings, which have shown distinctive features in the previous analyses, are also included as explanatory variables. Furthermore, return on sales, size (the natural logarithm of the current period capital), year dummy and industry dummy are used as control variables ($control_{n,i}$), where $\varepsilon_{B,i}$ and $\varepsilon_{C,i}$ represent error terms.

5. Estimation results

Table 4 shows the estimation results of the multinomial logistic regression. Since the comparison is done against HR-shortage bankrupt companies, a positive (negative) coefficient for an explanatory variable means that HR-shortage bankrupt companies are negatively (positively) correlated with the corresponding explanatory variable relative to other bankrupt companies or surviving companies.

The results of v1 and v3, which focus on productivity and labor cost burden, show that the positive correlation in $\triangle labor\ productivity$ and the negative correlation in $\triangle labor\ cost\ over\ net\ sales\ ratio$ for other bankrupt companies and surviving companies were significant. It indicates that HR-shortage bankrupt companies had worsened productivity and faced with higher labor cost burdens than other bankrupt companies. The negative correlation was also significant for the labor costs over net sales ratio, indicating that the ratio was higher for HR-shortage bankrupt companies. In addition, a significant positive correlation was found for labor productivity for the other bankrupt companies, but no significant difference was found for the surviving companies. This may be due to the fact that surviving companies include firms that have been in business for a short period of time, which is generally considered to have low labor productivity.

The results of v2 and v4 focus on the breakdown of the labor cost to sales ratio. The positive correlation for $\triangle sales\ per\ worker$ and the negative correlation for $\triangle labor\ cost\ per\ worker$ for

both other bankrupt companies and surviving companies were significant, suggesting that the increase in the labor cost over net sales ratio for HR-shortage bankrupt companies was caused by both a decrease in sales per employee and an increase in labor cost per employee. In addition, the signs of the coefficients indicate a low labor equipment ratio and a high degree of dependence on borrowers for HR-shortage bankrupt companies, which may be due to the immature automation, the burden of debt repayment, and the negative impact on cash flow.

Table 4: Results of logit estimation

	v1				v3			
	other bankrupt companies		surviving companies		other bankrupt companies		surviving companies	
	coefficient	Std.Error	coefficient	Std.Error	coefficient	Std.Error	coefficient	Std.Error
Constant	2.692	0.75 ***	5.898	0.74 ***	3.198	0.75 ***	6.347	0.74 ***
⊿labor productivity	0.170	0.03 ***	0.237	0.03 ***				
⊿labor cost over net sales ratio	-10.715	1.68 ***	-8.338	1.67 ***				
labor productivity					0.049	0.02 **	-0.012	0.02
labor cost over net sales ratio					-3.465	0.33 ***	-1.937	0.32 ***
labor equipment ratio	0.037	0.01 ***	0.033	0.01 ***	0.027	0.01 ***	0.030	0.01 ***
degree of dependence on borrowings	-0.004	0.00 ***	-0.030	0.00 ***	-0.003	0.00 ***	-0.030	0.00 ***
pseudo-R2	0.35				0.35			

	v2				v4			
	other bankrupt companies		surviving companies		other bankrupt companies		surviving companies	
	coefficient	Std.Error	coefficient	Std.Error	coefficient	Std.Error	coefficient	Std.Error
Constant	2.751	0.75 ***	5.910	0.74 ***	1.438	0.78 †	5.336	0.76 ***
⊿sales per worker	1.558	0.20 ***	1.850	0.20 ***				
⊿labor cost per worker	-1.144	0.19 ***	-0.600	0.19 **				
sales per worker					0.479	0.08 ***	0.192	0.08 *
labor cost per worker					-0.150	0.08 †	0.047	0.08
labor equipment ratio	0.036	0.01 ***	0.032	0.01 ***	0.030	0.01 ***	0.030	0.01 ***
degree of dependence on borrowings	-0.004	0.00 ***	-0.030	0.00 ***	-0.003	0.00 ***	-0.030	0.00 ***
pseudo-R2	0.35				0.35			

***, **, * and † indicate significance at the 0.1%, 1%, 5%, 10% levels

6. Interpretation of analysis results and conclusions

The graphs and estimation results in this report suggest that HR-shortage bankrupt companies have different characteristics from other companies in terms of labor cost burdens and operational efficiency. First, the labor cost burden of HR-shortage bankrupt companies gradually became heavier as they approached bankruptcy, as indicated by the change in the labor costs over net sales ratio. The change in the labor cost over net sales ratio is driven by a decrease in sales per worker and an

increase in labor costs per worker. There are two possible reasons for the decrease in sales per worker. The first is the quality of human resources, such as the fact that newly hired personnel are not sufficiently productive, even though they have been hired to solve the human resource shortage. The second factor is the inability to hire new workers despite the shortage, which has led to a decline in the utilization ratio. In addition to wage increases, the increase in labor costs per worker may also be an indication of a move to secure human resources by offering high compensation. However, in light of the fact that the company ultimately went bankrupt, it is possible that even if such measures to secure human resources were taken, the aforementioned factors may have prevented the company from securing sufficient sales.

The low labor equipment ratio and high tangible fixed asset turnover of the HR-shortage bankrupt companies may have resulted from a relatively immature automation and inadequate improvement in operational efficiency. In addition, given the fact that HR-shortage bankrupt companies tend to be highly dependent on borrowings even prior to their bankruptcy, it is possible that they have not been able to make investment to improve operational efficiency due to cash flow challenges.

In interpreting this analysis, some points should be noted. The sample size of HR-shortage bankrupt companies is very limited, making it difficult to conduct a detailed analysis by industry, by the nature of the personnel shortage, or by region. In the estimation equation, it is possible that there are factors other than the variables used in this study, such as the quality of management and the number of years in business that affect the human resource shortage bankruptcies, and further refinement of the model equation remains an issue for future study.

IV. Conclusion

In this paper, an analysis to understand the financial characteristics of firms that went bankrupt due to a lack of human resources are conducted, given that the labor situation in Japan has changed significantly. By continuing the analysis using a wide range of data, including trends in corporate finances, the FSA will continue to monitor, in a forward-looking manner, the impact of changes in the macro environment on the financial system, such as whether the changing labor situation leads to an increase in credit risk for financial institutions.