# Capital Structure, Turnover, and Stock Return: The Case of the Firms in the Nikkei 225

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**Abstract**

This paper investigates the risk and return relations of the turnover ratio of trading and capital structure based portfolios, which include the Nikkei 225 firms in Japan. The findings derived from our investigations are summarized as follows. First, portfolio risk is statistically significantly reduced in our lowest debt ratio and lowest turnover portfolio; second, portfolio risk statistically significantly increases in our highest debt ratio and highest turnover portfolio. Third, although risks of portfolios change in accordance with the levels of debt ratios and turnover ratios, these risks are not rewarded with higher returns as Sharpe ratios are not statistically different in our different risk portfolios. Finally, from the viewpoint of time-series analysis, time-varying risk of each portfolio is not clearly priced in stock markets, either.

**Keywords:** capital structure, GARCH-in-mean model, Sharpe ratio, stock return, turnover ratio

## 1. Introduction

Portfolio risk measured by the standard deviation, namely, the volatility of portfolio should be rewarded in the world of standard finance. This paper focuses on two risk sources that may raise the volatility of portfolio; the first is the firm's capital structure. Modigliani and Miller (1958) insisted in their famous paper that firms which have higher debt ratios are generally required higher stock returns. In addition, they expressed the firm's debt ratio as the financial risk of the firm, thus higher debt ratio portfolios should have higher volatility according to their theory. In addition to the debt ratio, we also focus on the firm's turnover ratio of trading in this paper. Generally, higher turnover stocks shall have higher market impacts from larger trading volumes. Hence it is natural to consider that higher turnover ratio portfolios have higher volatility. However, are these risks of higher volatility priced in stock markets?

As for the studies investigated the risk-return tradeoff of stocks, there are many US researches such as Campbell and Hentschel (1992), Lundblad (2007), Nelson (1991), and Glosten et al. (1993). However, as far as we know, there exists little empirical study that tested the risk-return tradeoff of stock portfolios by focusing on these two factors of capital structure and turnover ratio simultaneously by using the Japanese data.

Based on these research backgrounds, the objective of this paper is to empirically test whether risks associated with corporate capital structures and turnover ratios are rewarded with higher returns for the firms in the Nikkei 225 stock index in Japan. The contributions of this study are as follows. First, we find that 1) portfolio risk is reduced in our lowest debt ratio and lowest turnover portfolio. Second, we also find that 2) portfolio risk increases in our highest debt ratio and highest turnover portfolio. Third, our investigations reveal that 3) although risks change gradually as the levels of debt ratios and turnover ratios of portfolios increase, these risks are not rewarded with higher returns. This is understood from the evidence that the Sharpe ratios are not statistically different in our different portfolios sorted by debt ratios and turnover ratios. Fourth, 4) from the viewpoint of time-series analysis, again, risks of our various portfolios are not clearly priced in stock markets. The rest of the paper is organized as follows. Section 2 describes our data and research design, Sections 3 to 5 explain our empirical results, and Section 6 summarizes the paper.

## 2. Data and Research Design

First is regarding our data. We utilize the data of the firms included in the Nikkei 225 stock index in Japan. All data are supplied by the Quick Corp. More specifically, we are interested in all firms in the Nikkei 225; however,

the data of the characteristic information of turnover ratios and capital structure, which are needed for our portfolio constructions, are not obtained for all 225 firms. Thus our full sample data are 172 firms in cross-section, 26 years in time-series, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. More exactly, the sample period is from the fiscal year of 1986 to 2011.

Next is regarding our portfolio construction procedures: using the data explained above, we constructed four kinds of turnover and capital structure sorting portfolios by following procedures. To construct our first six portfolios, 1) we first divided our full sample into two turnover groups, namely, low and high turnover firms. We then divided these two portfolios into three capital structure portfolios, namely, low, middle, and high debt ratio portfolios, respectively. We repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios. We note that 'capital structure' here denotes the corporate debt ratios, which are measured by total book-value debt divided by total book-value assets, and 'turnover' here means the corporate turnover ratios of trading, which are measured by the (yen) trading volumes during the final month of the fiscal year divided by the (yen) corporate market values at the end of the fiscal year.

Next, to construct our second six portfolios, 2) we first divided our full sample into two capital structure groups, namely, low and high debt ratio firms. We then divided these two portfolios into three turnover portfolios, namely, low, middle, and high turnover portfolios, respectively. We repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios.

Further, for our third six portfolios, 3) we divided our full sample into six turnover groups, namely, the lowest turnover firms, the second lowest turnover firms, and so on. We repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios.

Moreover, for our final six portfolios, 4) we divided our full sample into six capital structure groups, namely, the lowest debt ratio firms, the second lowest debt ratio firms, and so on. We repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios.

In order to survey the data characteristics of our full sample, we display the time-series and descriptive statistics for three variables: capital structure, turnover ratio, and one-year future return as to the Nikkei 225 firms in Table 1. We note that regarding our full sample, historical average of returns is 6.7672 and the standard deviation of historical returns is 25.4727.

As for the next step, we test the equality of returns and variances of our four kinds of six portfolios and those of our full sample data. After that, we examine the equality of the Sharp ratios of our four kinds of six portfolios and that of our full sample data. Finally, from the time-series viewpoint, using the GARCH-in-mean model, we test whether volatilities of our four kinds of six portfolios are priced or not in equity markets.

## 3. Risk and Return Characteristics

This section examines the equality of the risks and returns of our various portfolios and those of our full sample data. Table 2 firstly shows the equally-weighted averages of the one-year future stock returns of the firms in the six portfolios sorted firstly by the firms' turnovers and secondly by their capital structures. In this table, Welch's $t$ denotes the $t$-statistic for the Welch's test and its null hypothesis is that the average return of each portfolio equals to that of our full sample, 6.7672 (displayed in Table 1). While the alternative hypothesis is that the average return of each portfolio does not equal to that of our full sample. According to the $t$-statistics for our Welch's tests in Table 2, we understand that the returns of all six portfolios are not statistically significantly different from the full sample's return.

Further, $F$-statistic in Table 2 is for testing the null hypothesis that the variance of each portfolio and that of our full sample (648.8584 (squared value of 25.4727 in Table 1)) are equal. While the alternative hypothesis is that the variance of each portfolio and that of our full sample are not equal. In this test, the variance of our low turnover and low debt ratio portfolio is statistically significantly lower than that of our full sample and the variance of our high turnover and high debt ratio portfolio is statistically significantly higher than that of our full sample.

Next, Table 3 is regarding our six portfolios sorted firstly by the firms' capital structures and secondly by their turnovers. This table shows the similar results of the same analyses as those in Table 2. According to the results in Table 3, all six portfolio returns are not statistically significantly different from our full sample's return. While the variance of the low debt ratio and low turnover portfolio is statistically significantly lower than that of our full sample. In addition, the variance of the high debt ratio and high turnover portfolio is statistically significantly higher than that of our full sample. Based on the results in Table 2, this evidence is considered to be natural.

Table 1. Full sample characteristics of capital structures, turnover ratios, and one-year future stock returns as to the firms included in the Nikkei 225 stock index in Japan: time-series values and descriptive statistics for the fiscal year from 1986 to 2011

| Panel A. Yearly sample averages | | | |
|---|---|---|---|
| Fiscal year | Capital structure | Turnover | One-year future return |
| 1986 | 0.6722 | 0.1405 | 28.2225 |
| 1987 | 0.6660 | 0.1081 | 39.5953 |
| 1988 | 0.6557 | 0.0940 | −2.1454 |
| 1989 | 0.6484 | 0.0501 | −13.2853 |
| 1990 | 0.6505 | 0.0499 | −20.4727 |
| 1991 | 0.6496 | 0.0278 | −1.7181 |
| 1992 | 0.6435 | 0.0449 | 9.4120 |
| 1993 | 0.6339 | 0.0390 | −9.9241 |
| 1994 | 0.6324 | 0.0286 | 31.5409 |
| 1995 | 0.6284 | 0.0417 | −10.0540 |
| 1996 | 0.6205 | 0.0324 | −10.9642 |
| 1997 | 0.6125 | 0.0350 | 1.7901 |
| 1998 | 0.6102 | 0.0495 | 20.0913 |
| 1999 | 0.6038 | 0.0647 | 6.5887 |
| 2000 | 0.5966 | 0.0644 | −9.1343 |
| 2001 | 0.5945 | 0.0772 | −17.0925 |
| 2002 | 0.5943 | 0.0704 | 66.1699 |
| 2003 | 0.5741 | 0.1199 | 8.2657 |
| 2004 | 0.5614 | 0.1146 | 60.4492 |
| 2005 | 0.5430 | 0.1283 | 8.5032 |
| 2006 | 0.5406 | 0.1730 | −26.2258 |
| 2007 | 0.5408 | 0.1756 | −35.6423 |
| 2008 | 0.5613 | 0.1581 | 41.0961 |
| 2009 | 0.5585 | 0.1273 | −6.6016 |
| 2010 | 0.5536 | 0.2213 | −1.2304 |
| 2011 | 0.5686 | 0.1505 | 18.7141 |
| Panel B. Descriptive statistics | | | |
| Hist. Avg. | 0.6044 | 0.0918 | 6.7672 |
| Std. Dev. | 0.0419 | 0.0546 | 25.4727 |
| Max. | 0.6722 | 0.2213 | 66.1699 |
| Min. | 0.5406 | 0.0278 | −35.6423 |
| Skewness | −0.0732 | 0.6207 | 0.7205 |
| Kurtosis | 1.7019 | 2.3404 | 2.9417 |
| Obs. (TS) | 26 | 26 | 26 |
| Obs. (CS) | 172 | 172 | 172 |
| Obs. (Total) | 4472 | 4472 | 4472 |

*Notes*: This table shows the time-series sample average values and the descriptive statistics for the variables as to the firms included in the Nikkei 225 stock index in Japan. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover ratio and capital structure is not obtained for all 225 firms. Thus our full sample is 26 years in time-series, 172 firms in cross-section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. In Panel A, 'Capital structure' denotes the sample averages of corporate capital structures, which are measured by total book-value debt divided by total book-value assets, and 'Turnover' means the sample averages of corporate turnover ratios, which are measured by the (yen) trading volumes during the final month of the fiscal year divided by the (yen) corporate market values at the end of the fiscal year. In addition, 'One-year future return' denotes the averages of the next fiscal year's stock returns. Moreover, 'Hist. Avg.' denotes the historical average values and 'Std. Dev.' denotes the standard deviations. Further, 'Max.' and 'Min.' denote the maximum values and minimum values, respectively. Furthermore, 'Obs. (TS)', 'Obs. (CS)', and 'Obs. (Total)' are the number of time-series observations, the number of cross-sectional observations, and the number of total observations, respectively.

Table 2. Equally-weighted firm averages of the one-year future stock returns with regard to six portfolios constructed by turnover and capital structure: the time-series and the test results of the portfolio returns of the firms in the Nikkei 225 for the fiscal year from 1986 to 2011

| | Portfolios | | | | | |
| | Low turnover | | | High turnover | | |
| Fiscal year | Low CS | Middle CS | High CS | Low CS | Middle CS | High CS |
|---|---|---|---|---|---|---|
| 1986 | 38.7149 | 32.3931 | 35.7722 | 15.8642 | 17.9349 | 28.4448 |
| 1987 | 11.4473 | 27.0016 | 52.2811 | 18.4570 | 43.1534 | 84.9198 |
| 1988 | 17.3078 | 4.3790 | 2.3237 | −9.9186 | −11.4327 | −15.6271 |
| 1989 | −14.6831 | −14.1847 | −8.4739 | −12.7422 | −16.7588 | −13.0198 |
| 1990 | −12.6386 | −17.5995 | −18.5340 | −20.2994 | −28.0634 | −25.8639 |
| 1991 | −1.3256 | 1.2058 | −5.6117 | −5.0533 | 2.2181 | −1.50529 |
| 1992 | 17.1026 | 19.4128 | 6.9266 | 9.4481 | 3.9916 | −0.2519 |
| 1993 | −4.7171 | −5.5654 | −8.9029 | −15.0309 | −12.5747 | −12.6951 |
| 1994 | 27.1036 | 21.4799 | 30.3798 | 34.8179 | 36.3987 | 38.8861 |
| 1995 | 3.2399 | −16.2686 | −19.0068 | 5.5056 | −19.7102 | −14.6311 |
| 1996 | −1.2842 | −18.9621 | −20.8522 | 2.9921 | −8.1778 | −19.6806 |
| 1997 | 11.7532 | 11.6694 | −10.2564 | 6.3004 | −1.2705 | −7.2201 |
| 1998 | 15.9198 | 3.6937 | −0.9144 | 51.3867 | 23.3147 | 26.6931 |
| 1999 | −0.5852 | 26.3094 | 23.3075 | −5.6210 | 2.8307 | −6.1589 |
| 2000 | −8.7683 | −7.1923 | −3.3908 | −7.6129 | −15.2906 | −12.6962 |
| 2001 | −13.8685 | −3.9531 | −11.2428 | −27.5132 | −24.6692 | −21.1166 |
| 2002 | 33.9315 | 51.5932 | 76.7525 | 47.1916 | 65.9064 | 121.1325 |
| 2003 | 10.0792 | 8.6202 | 12.6234 | 0.1127 | 8.2943 | 9.8777 |
| 2004 | 43.4486 | 51.5083 | 52.8977 | 58.1113 | 71.3222 | 85.4736 |
| 2005 | 9.3543 | 5.5651 | 9.5788 | 13.1352 | 11.3319 | 2.0502 |
| 2006 | −20.1962 | −23.0021 | −25.3256 | −27.2093 | −27.8117 | −33.7530 |
| 2007 | −25.9112 | −39.8531 | −27.9123 | −38.4090 | −41.6864 | −40.4354 |
| 2008 | 26.3476 | 41.8766 | 23.8964 | 52.8429 | 52.5502 | 49.4849 |
| 2009 | −7.3608 | −8.1322 | −6.8192 | −13.0636 | −4.2142 | 0.0100 |
| 2010 | 2.1232 | 4.1356 | −3.9502 | −6.7870 | −5.0008 | 2.1519 |
| 2011 | 29.6147 | 24.5980 | 15.9290 | −0.6776 | 14.9610 | 27.9327 |
| Average | 7.1596 | 6.9511 | 6.5952 | 4.8549 | 5.2903 | 9.7078 |
| Welch's $t$ | 0.0635 | 0.0272 | 0.0240 | 0.2684 | 0.1947 | 0.3207 |
| $p$-value | 0.9497 | 0.9784 | 0.9810 | 0.7895 | 0.8464 | 0.7500 |
| Std. Dev. | 18.5837 | 23.1828 | 26.2414 | 25.9022 | 29.1048 | 39.2062 |
| $F$-statistic | 0.5322* | 0.8283 | 0.9423 | 0.9671 | 0.7660 | 0.4221** |
| $p$-value | 0.0608 | 0.3206 | 0.4415 | 0.4670 | 0.2550 | 0.0177 |

*Notes*: This table shows the equally-weighted averages and test results of the one-year future stock returns with regard to six portfolios constructed by the turnover ratios and capital structure of the firms included in the Nikkei 225 stock index in Japan. The sample period is from the fiscal year of 1986 to 2011. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover and capital structure is not obtained for all 225 firms. Thus our full sample data are 26 years in time-series, 172 firms in cross-section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. With regard to the portfolio constructions, we first divided our samples into two turnover groups, namely, low turnover and high turnover firms. We then divided these two portfolios into three capital structure portfolios, namely, low, middle, and high debt ratio portfolios. We repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios. In the table, 'CS' means debt ratios. In addition, Welch's $t$ denotes the $t$-statistic for the Welch's test whose null hypothesis is that the average return of each portfolio equals to that of our full sample, 6.7672 (displayed in Table 1), while the alternative hypothesis is that the average return of each portfolio does not equal to that of the full sample. Similarly, $F$-statistic displayed in the table is for testing the null hypothesis of equal variance of each portfolio and that of the full sample, 648.8584 (squared values of 25.4727 in Table 1). Alternative hypothesis here is that the variance of each portfolio and that of the full sample are not equal. Finally, ** denotes the statistical significance at the 5% level and * denotes the statistical significance at the 10% level, respectively.

Table 3. Equally-weighted firm averages of the one-year future stock returns with regard to six portfolios constructed by capital structure and turnover: the time-series and the test results of the portfolio returns of the firms in the Nikkei 225 for the fiscal year from 1986 to 2011

| Fiscal year | Portfolios | | | | | |
| | Low capital structure | | | High capital structure | | |
| | Low TO | Middle TO | High TO | Low TO | Middle TO | High TO |
|---|---|---|---|---|---|---|
| 1986 | 39.6877 | 31.3856 | 15.8642 | 35.7722 | 25.9534 | 20.7029 |
| 1987 | 21.6735 | 18.8938 | 14.3308 | 49.5991 | 47.4873 | 85.1456 |
| 1988 | 17.6328 | 3.7356 | −8.3152 | 2.9658 | −10.0717 | −18.8903 |
| 1989 | −17.8958 | −4.8953 | −20.0315 | −10.6997 | −10.9904 | −14.8304 |
| 1990 | −10.0824 | −19.6116 | −21.8489 | −18.4757 | −25.6075 | −27.3575 |
| 1991 | −4.9501 | 0.0986 | −3.1560 | −2.9378 | 0.1133 | 0.6493 |
| 1992 | 18.8571 | 12.9030 | 8.9967 | 12.2238 | 1.5964 | 1.7457 |
| 1993 | −4.2350 | −10.8100 | −16.4597 | −5.1009 | −11.3936 | −11.6270 |
| 1994 | 27.4349 | 32.2759 | 36.1948 | 23.4180 | 29.2223 | 40.6450 |
| 1995 | −0.9466 | −6.0412 | 1.1716 | −19.6786 | −17.2564 | −17.6827 |
| 1996 | −4.1427 | −13.8289 | 8.7827 | −16.1825 | −25.0691 | −15.9297 |
| 1997 | 9.9883 | 8.4070 | 3.0499 | −0.1455 | −9.5797 | −1.1431 |
| 1998 | 11.2027 | 15.4209 | 52.4728 | −1.9111 | 8.6850 | 34.1232 |
| 1999 | −3.8299 | −3.2919 | 0.4855 | 24.9320 | 27.5778 | −5.9584 |
| 2000 | −6.5992 | −10.5079 | −10.6457 | −0.3892 | −14.0849 | −12.7970 |
| 2001 | −8.2959 | −20.9256 | −27.9171 | −10.9968 | −13.2775 | −21.1428 |
| 2002 | 41.3525 | 35.7308 | 60.9193 | 69.7951 | 74.2723 | 114.1791 |
| 2003 | 10.4902 | 8.9288 | 0.5014 | 15.0116 | 5.7275 | 8.8701 |
| 2004 | 43.8057 | 47.2084 | 59.7313 | 49.6905 | 61.6707 | 100.1740 |
| 2005 | 8.5212 | 5.4183 | 12.9825 | 8.8283 | 4.6097 | 10.4186 |
| 2006 | −20.8541 | −21.2680 | −27.7441 | −24.0757 | −26.1483 | −37.0908 |
| 2007 | −28.5978 | −31.7981 | −42.2629 | −29.1874 | −41.1205 | −40.9436 |
| 2008 | 24.2180 | 45.0395 | 53.4019 | 26.3207 | 43.7340 | 54.0896 |
| 2009 | −6.7610 | −5.5959 | −15.6213 | −8.1231 | −4.8080 | 1.3962 |
| 2010 | 2.4098 | 3.7948 | −7.2554 | −3.3582 | −2.5534 | −0.2923 |
| 2011 | 31.7964 | 18.0660 | 3.9785 | 21.1054 | 14.2981 | 22.8654 |
| Average | 7.3800 | 5.3359 | 5.0618 | 7.2462 | 5.1149 | 10.3584 |
| Welch's $t$ | 0.0972 | 0.2215 | 0.2307 | 0.0688 | 0.2206 | 0.3856 |
| $p$-value | 0.9230 | 0.8257 | 0.8185 | 0.9454 | 0.8263 | 0.7017 |
| Std. Dev. | 19.5919 | 20.9029 | 27.7940 | 24.7046 | 28.4510 | 40.0722 |
| $F$-statistic | 0.5916* | 0.6734 | 0.8399 | 0.9406 | 0.8016 | 0.4041** |
| $p$-value | 0.0982 | 0.1646 | 0.3331 | 0.4398 | 0.2922 | 0.0137 |

*Notes*: This table shows the equally-weighted averages and test results of the one-year future stock returns with regard to six portfolios constructed by the turnover ratios and capital structure of the firms included in the Nikkei 225 stock index in Japan. The sample period is from the fiscal year of 1986 to 2011. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover and capital structure is not obtained for all 225 firms. Thus our full sample data are 26 years in time-series, 172 firms in cross-section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. With regard to the portfolio constructions, we first divided our samples into two capital structure groups, namely, low debt ratio and high debt ratio firms. We then divided these two portfolios into three turnover portfolios, namely, low, middle, and high turnover portfolios. We repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios. In the table, 'TO' denotes the turnover ratio. In addition, Welch's $t$ denotes the $t$-statistic for the Welch's test whose null hypothesis is that the average return of each portfolio equals to that of our full sample, 6.7672 (displayed in Table 1), while the alternative hypothesis is that the average return of each portfolio does not equal to that of the full sample. Similarly, $F$-statistic displayed in the table is for testing the null hypothesis of equal variance of each portfolio and that of the full sample, 648.8584 (squared values of 25.4727 in Table 1). Alternative hypothesis here is that the variance of each portfolio and that of the full sample are not equal. Finally, ** denotes the statistical significance at the 5% level and * denotes the statistical significance at the 10% level, respectively.

Table 4. Equally-weighted firm average of the one-year future stock returns with regard to six portfolios constructed by turnover: the time-series and the test results regarding the portfolio returns of the firms in the Nikkei 225 for the fiscal year from 1986 to 2011

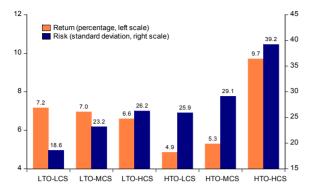| Fiscal year | Portfolios constructed by turnover | | | | | |
|---|---|---|---|---|---|---|
| | Level of turnover | | | | | |
| | Lowest | 2 | 3 | 4 | 5 | Highest |
| 1986 | 47.2189 | 32.8810 | 26.7972 | 23.9465 | 23.2121 | 15.2674 |
| 1987 | 34.5618 | 25.6225 | 30.4983 | 42.7974 | 32.9939 | 70.3886 |
| 1988 | 17.9557 | 5.7282 | 0.3732 | −5.0492 | −12.5740 | −19.3945 |
| 1989 | −16.6396 | −13.1600 | −7.5068 | −8.4160 | −17.7435 | −16.3951 |
| 1990 | −12.0053 | −13.3658 | −23.2550 | −24.0858 | −26.6461 | −23.4459 |
| 1991 | −3.0288 | −4.7256 | 1.8183 | −2.3901 | −1.5236 | −0.5559 |
| 1992 | 16.7714 | 14.7142 | 11.7944 | 1.8903 | 10.3945 | 1.1238 |
| 1993 | −1.7784 | −9.2443 | −8.2895 | −10.0881 | −14.3141 | −15.9584 |
| 1994 | 21.3907 | 28.3239 | 29.4847 | 35.2461 | 28.8634 | 45.7334 |
| 1995 | −7.8788 | −14.0477 | −10.0324 | −11.1847 | −6.7994 | −10.4065 |
| 1996 | −14.6904 | −7.9585 | −18.0702 | −19.4076 | −7.8835 | 2.4350 |
| 1997 | 2.1801 | 6.3422 | 4.4602 | −2.0086 | 7.1968 | −7.0865 |
| 1998 | 0.7742 | 4.7313 | 13.2293 | 13.8858 | 25.4937 | 62.0902 |
| 1999 | 13.9572 | 13.3158 | 21.3106 | −3.2683 | 0.1862 | −5.9583 |
| 2000 | −7.0211 | 0.5365 | −12.6004 | −9.5828 | −11.8046 | −14.0920 |
| 2001 | −5.9406 | −14.2506 | −9.2282 | −22.1909 | −21.4212 | −29.5748 |
| 2002 | 45.1298 | 66.6680 | 50.9991 | 60.6902 | 72.0710 | 101.6818 |
| 2003 | 10.0731 | 14.8147 | 6.6486 | 2.8408 | 8.1709 | 7.2689 |
| 2004 | 43.1815 | 45.1610 | 59.2932 | 52.6139 | 74.4917 | 87.9107 |
| 2005 | 12.2843 | 8.4144 | 3.8979 | −0.6136 | 7.0280 | 19.9545 |
| 2006 | −23.2622 | −21.5179 | −23.6927 | −19.3929 | −33.1230 | −36.4413 |
| 2007 | −26.3477 | −32.1362 | −34.9267 | −35.7711 | −42.0488 | −42.7234 |
| 2008 | 15.0199 | 32.3378 | 44.4339 | 46.9933 | 55.2877 | 52.6914 |
| 2009 | −12.8993 | −6.2435 | −3.1043 | −6.5142 | −4.3077 | −6.4491 |
| 2010 | −1.8322 | 5.4456 | −1.2595 | −7.1978 | 2.6623 | −4.8362 |
| 2011 | 30.3703 | 25.1713 | 14.6199 | 11.7312 | 22.1417 | 8.5909 |
| Average | 6.8286 | 7.4446 | 6.4497 | 4.0567 | 6.5386 | 9.3007 |
| Welch's $t$ | 0.0095 | 0.1019 | 0.0468 | 0.3858 | 0.0300 | 0.2821 |
| $p$-value | 0.9925 | 0.9193 | 0.9629 | 0.7013 | 0.9762 | 0.7792 |
| Std. Dev. | 20.9530 | 22.3875 | 23.4274 | 25.1844 | 29.3617 | 38.0507 |
| $F$-statistic | 0.6766 | 0.7724 | 0.8459 | 0.9775 | 0.7526 | 0.4482** |
| $p$-value | 0.1675 | 0.2617 | 0.3394 | 0.4775 | 0.2413 | 0.0249 |

*Notes*: This table shows the equally-weighted averages and test results of the one-year future stock returns with regard to six portfolios constructed by the turnover ratios of the firms included in the Nikkei 225 stock index in Japan. The sample period is from the fiscal year of 1986 to 2011. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover and capital structure is not obtained for all 225 firms. Thus our full sample data are 26 years in time-series, 172 firms in cross-section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. With regard to the portfolio constructions, we first divided our samples into six turnover groups, namely, the lowest turnover to the highest turnover firms. We then repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios. In addition, Welch's $t$ denotes the $t$-statistic for the Welch's test whose null hypothesis is that the average return of each portfolio equals to that of our full sample, 6.7672 (displayed in Table 1), while the alternative hypothesis is that the average return of each portfolio does not equal to that of the full sample. Similarly, $F$-statistic displayed in the table is for testing the null hypothesis of equal variance of each portfolio and that of the full sample, 648.8584 (squared values of 25.4727 in Table 1). Alternative hypothesis here is that the variance of each portfolio and that of the full sample are not equal. Furthermore, ** denotes the statistical significance at the 5% level.
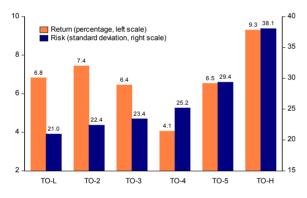
Table 5. Equally-weighted firm average of the one-year future stock returns with regard to six portfolios constructed by capital structure: the time-series and the test results regarding the portfolio returns of the firms in the Nikkei 225 for the fiscal year from 1986 to 2011

| Fiscal year | Portfolios constructed by capital structure | | | | | |
| | Level of capital structure | | | | | |
| | Lowest | 2 | 3 | 4 | 5 | Highest |
|---|---|---|---|---|---|---|
| 1986 | 33.2666 | 29.6907 | 23.9217 | 30.0007 | 21.6478 | 30.6314 |
| 1987 | 12.2603 | 22.0200 | 20.7256 | 36.1090 | 65.0710 | 81.6584 |
| 1988 | 16.8646 | −1.4997 | −2.4922 | 4.4437 | −15.4876 | −15.1391 |
| 1989 | −14.8772 | −13.0598 | −15.1671 | −13.7869 | −11.6603 | −11.0964 |
| 1990 | −14.9883 | −16.9361 | −19.5262 | −27.5400 | −21.0123 | −22.7299 |
| 1991 | −1.9252 | −4.1306 | −2.0975 | 4.0271 | −2.8916 | −3.4143 |
| 1992 | 13.0522 | 16.6853 | 11.1497 | 9.2865 | 5.5430 | 0.8725 |
| 1993 | −7.8545 | −12.6793 | −11.0353 | −11.6211 | −10.5048 | −5.9650 |
| 1994 | 31.5589 | 34.6790 | 29.7505 | 30.0143 | 28.8147 | 34.4423 |
| 1995 | 6.4278 | 1.5314 | −13.5143 | −20.6679 | −15.7431 | −18.1545 |
| 1996 | 2.5921 | −0.5746 | −10.7494 | −20.1015 | −17.9409 | −18.8931 |
| 1997 | 8.6805 | 8.4168 | 4.3483 | 8.6960 | −7.5937 | −11.9021 |
| 1998 | 48.2545 | 10.3711 | 20.2967 | 14.4611 | 36.2412 | −8.8549 |
| 1999 | −9.3013 | −0.3635 | 3.1295 | 22.9862 | 6.2452 | 16.5844 |
| 2000 | −6.8993 | −12.6925 | −8.2363 | −9.2075 | −12.9146 | −5.1087 |
| 2001 | −20.6692 | −22.7528 | −13.7796 | −13.8602 | −13.0109 | −18.5368 |
| 2002 | 40.4389 | 40.8344 | 56.9053 | 63.1989 | 90.2977 | 105.3026 |
| 2003 | 4.6171 | 7.5505 | 7.7053 | 4.8421 | 14.0558 | 10.9985 |
| 2004 | 37.7900 | 46.1845 | 66.7357 | 61.6034 | 74.5567 | 75.8194 |
| 2005 | 12.8424 | 8.4101 | 5.7727 | 17.0706 | −1.0865 | 7.6761 |
| 2006 | −22.3547 | −24.9677 | −22.6714 | −28.0635 | −29.5813 | −29.7883 |
| 2007 | −27.4590 | −34.5365 | −40.7577 | −40.1054 | −34.9853 | −35.9492 |
| 2008 | 34.1432 | 45.5276 | 43.0054 | 51.6274 | 36.9341 | 35.3483 |
| 2009 | −10.3340 | −9.5734 | −8.2079 | −6.1376 | 1.6523 | −6.8268 |
| 2010 | −2.5557 | −2.4495 | 3.7391 | −1.6036 | −8.9387 | 4.1183 |
| 2011 | 21.2597 | 16.0896 | 16.4234 | 18.2563 | 10.3800 | 29.4975 |
| Average | 7.1089 | 5.0683 | 5.5913 | 7.0742 | 7.2342 | 8.4843 |
| Welch's $t$ | 0.0527 | 0.2585 | 0.1694 | 0.0420 | 0.0586 | 0.2020 |
| $p$-value | 0.9582 | 0.7971 | 0.8662 | 0.9666 | 0.9535 | 0.8408 |
| Std. Dev. | 21.1214 | 21.7722 | 24.5755 | 27.1805 | 31.6353 | 35.0824 |
| $F$-statistic | 0.6875 | 0.7306 | 0.9308 | 0.8783 | 0.6483 | 0.5272* |
| $p$-value | 0.1776 | 0.2190 | 0.4296 | 0.3741 | 0.1427 | 0.0580 |

*Notes*: This table shows the equally-weighted averages and test results of the one-year future stock returns with regard to six portfolios constructed by the capital structure of the firms included in the Nikkei 225 stock index in Japan. The sample period is from the fiscal year of 1986 to 2011. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover and capital structure is not obtained for all 225 firms. Thus our full sample data are 26 years in time-series, 172 firms in cross-section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. With regard to the portfolio constructions, we first divided our samples into six capital structure groups, namely, the lowest debt ratio to the highest debt ratio firms. We then repeated this procedure each year and recorded the next fiscal year's returns of these six portfolios. In addition, Welch's $t$ denotes the $t$-statistic for the Welch's test whose null hypothesis is that the average return of each portfolio equals to that of our full sample, 6.7672 (displayed in Table 1), while the alternative hypothesis is that the average return of each portfolio does not equal to that of the full sample. Similarly, $F$-statistic displayed in the table is for testing the null hypothesis of equal variance of each portfolio and that of the full sample, 648.8584 (squared values of 25.4727 in Table 1). Alternative hypothesis here is that the variance of each portfolio and that of the full sample are not equal. Furthermore, * denotes the statistical significance at the 10% level.
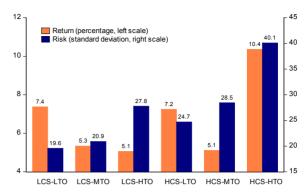
Panel A. Six portfolios of two levels of turnover and three levels of capital structure

Panel B. Six portfolios of two levels of capital structure and three levels of turnover

Panel C. Six portfolios constructed by sorting only by turnover

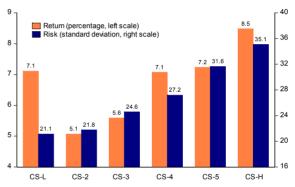Panel D. Six portfolios constructed by sorting only by capital structure



Figure 1. Risk and return relationship of the one-year future stock returns of four kinds of six portfolios constructed by turnover and capital structure: evidence from the firms included in the Nikkei 225 in Japan for the fiscal year from 1986 to 2011

Moreover, Table 4 displays the results of similar analyses for our only turnover sorting six portfolios. According to the results in Table 4, all portfolio returns are not statistically significantly different from our full sample's return. While as to the variance, in the highest turnover portfolio, it is statistically significantly higher than that of our full sample. In addition, Table 5 exhibits the results of similar analyses for our only debt ratio sorting six portfolios. The results in Table 5 demonstrate that again, the returns of all portfolios are not statistically significantly different from our full sample's return. While regarding the variance, in the highest debt ratio portfolio, it is statistically significantly higher than that of our full sample.

To sum up, in general, the risk is reduced in lower turnover and lower capital structure portfolios; while the risk increases in higher turnover and higher capital structure portfolios. However, the returns are not statistically significantly different even if the turnovers and capital structures in portfolios are altered.

Further, viewing the states of risk-return tradeoff in various portfolios is also interesting. Figure 1 displays the risk-return relationship of various portfolios in four graphs. First, Panels A and B of Figure 1 demonstrate that, although roughly, risks of portfolios gradually increase as the levels of turnovers and debt ratios in portfolios rise. However, returns of portfolios do not necessarily increase as the levels of turnover and debt ratio in portfolios go up. Furthermore, we can view the clearer tendency of risk characteristics of two kinds of portfolios shown in Panels C and D of Figure 1. More concretely, with regard to returns, not so clear tendency is observed again as before; however, the risks of the only turnover sorting portfolios clearly increase as the levels of turnover ratio rise (Panel C). Similarly, the risks of the only capital structure sorting portfolios clearly rise as the levels of debt ratios increase (Panel D).

As above, the clear positive connection between debt ratios and stock return volatilities and the clear positive linkage between turnover ratios and stock return volatilities can be recognized. However, as far as the firms in the Nikkei 225, higher volatilities associated with these two factors, debt ratio and turnover ratio, are not

statistically significantly rewarded with higher returns as seen in the results in Tables 2 to 5.

Table 6. Results of the Welch's tests for the time-varying Sharpe ratios of various portfolios constructed by turnover and capital structure: evidence from the firms included in the Nikkei 225 for the fiscal year from 1986 to 2011

| Panel A. Portfolios constructed by turnover and capital structure | | | | | | |
|---|---|---|---|---|---|---|
| | Turnover and capital structure levels of portfolios (two TO and three CS levels) | | | | | |
| | Low turnover | | | High turnover | | |
| | Low CS | Middle CS | High CS | Low CS | Middle CS | High CS |
| Sharpe ratio | 0.3820 | 0.3021 | 0.3382 | −0.0780 | 0.2036 | 1.9103 |
| Welch's *t* | 0.0007 | 0.2344 | 0.1209 | 1.3317 | 0.5249 | 0.8814 |
| *p*-value | 0.9994 | 0.8156 | 0.9043 | 0.1891 | 0.6021 | 0.3862 |
| Panel B. Portfolios constructed by capital structure and turnover | | | | | | |
| | Capital structure and turnover levels of portfolios (two CS and three TO levels) | | | | | |
| | Low capital structure | | | High capital structure | | |
| | Low TO | Middle TO | High TO | Low TO | Middle TO | High TO |
| Sharpe ratio | 0.4353 | 0.1755 | −0.0028 | 0.3606 | 0.2819 | 2.4537 |
| Welch's *t* | 0.1508 | 0.6332 | 1.1500 | 0.0607 | 0.2726 | 0.9237 |
| *p*-value | 0.8808 | 0.5297 | 0.2560 | 0.9518 | 0.7863 | 0.3641 |
| Panel C. Portfolios constructed by only turnover | | | | | | |
| | Turnover levels of portfolios | | | | | |
| | Lowest | 2 | 3 | 4 | 5 | Highest |
| Sharpe ratio | 0.2457 | 0.3056 | 0.4341 | 0.1337 | 0.2664 | 0.3991 |
| Welch's *t* | 0.4086 | 0.2278 | 0.1317 | 0.7525 | 0.3335 | 0.0444 |
| *p*-value | 0.6847 | 0.8207 | 0.8958 | 0.4555 | 0.7401 | 0.9648 |
| Panel D. Portfolios constructed by only capital structure | | | | | | |
| | Capital structure levels of portfolios | | | | | |
| | Lowest | 2 | 3 | 4 | 5 | Highest |
| Sharpe ratio | 0.2433 | 0.1252 | 0.1341 | 0.9687 | 0.2788 | 0.3231 |
| Welch's *t* | 0.4209 | 0.7722 | 0.7472 | 0.7532 | 0.2925 | 0.1652 |
| *p*-value | 0.6757 | 0.4438 | 0.4586 | 0.4570 | 0.7712 | 0.8695 |

*Notes*: This table shows the results of the Welch's tests for the time-varying Sharpe ratios of various portfolios constructed by the turnover ratio and capital structure (debt ratio). The sample firms are those included in the Nikkei 225 for the fiscal year from 1986 to 2011: our sample period spans from the fiscal year of 1986 to 2011. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover ratio and capital structure is not obtained for all 225 firms. Thus our full sample data are 26 years in time-series, 172 firms in cross-section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. In the table, 'CS' denotes the capital structures, which are measured by total book-value debt divided by total book-value assets, and 'TO' denotes the turnover ratios, which are measured by the (yen) trading volumes during the final month of the fiscal year divided by the (yen) corporate market values at the end of the fiscal year. Further, 'Sharpe ratio' in this table denotes the average of the time-varying Shape ratios derived by using the GARCH (1,1) model. Welch's *t* in this table denotes the *t*-statistic for the Welch's test, and whose null hypothesis is that the average of the time-varying Sharpe ratios of the portfolios equals to the average of the time-varying Sharpe ratios of our full sample. On the other hand, alternative hypothesis of the Welch's test is that the average of the time-varying Sharpe ratios of the portfolios does not equal to the average of the time-varying Sharpe ratios of the full sample. According to the *p*-values, it is understood that there is no portfolio Sharpe ratio that is statistically significantly different from the full sample's Sharp ratio.

Table 7. The risk-return tradeoff of various portfolios constructed by turnover and capital structure: the test results by using the GARCH-in-mean model for the firms included in the Nikkei 225 for the fiscal year from 1986 to 2011

Panel A. Portfolios constructed by turnover and capital structure

|  | Turnover and capital structure levels of portfolios | | | | | |
|  | Low turnover | | | High turnover | | |
|  | Low CS | Middle CS | High CS | Low CS | Middle CS | High CS |
|---|---|---|---|---|---|---|
| GARCH-in-mean | 22.8953 | 1.8003 | −0.5753* | 0.7104*** | 0.9171* | 0.5441*** |
| *p*-value | 0.4223 | 0.4603 | 0.0587 | 0.0100 | 0.0981 | 0.0000 |

Panel B. Portfolios constructed by capital structure and turnover

|  | Capital structure and turnover levels of portfolios | | | | | |
|  | Low capital structure | | | High capital structure | | |
|  | Low TO | Middle TO | High TO | Low TO | Middle TO | High TO |
|---|---|---|---|---|---|---|
| GARCH-in-mean | 17.2723 | 0.9358 | −0.2729 | −0.4573 | −3.5103*** | 0.1983 |
| *p*-value | 0.5882 | 0.6070 | 0.3838 | 0.1552 | 0.0000 | 0.2856 |

Panel C. Portfolios constructed by turnover

|  | Turnover levels of portfolios | | | | | |
|  | Lowest | 2 | 3 | 4 | 5 | Highest |
|---|---|---|---|---|---|---|
| GARCH-in-mean | 0.5351*** | −11.8449 | −0.0130 | 4.3920 | −0.0412 | −0.2164 |
| *p*-value | 0.0000 | 0.4123 | 0.9548 | 0.6260 | 0.8467 | 0.5321 |

Panel D. Portfolios constructed by capital structure

|  | Capital structure levels of portfolios | | | | | |
|  | Lowest | 2 | 3 | 4 | 5 | Highest |
|---|---|---|---|---|---|---|
| GARCH-in-mean | 0.6236 | −4.3405** | −0.3127 | 34.6290 | 0.4584 | 11.5243 |
| *p*-value | 0.2113 | 0.0121 | 0.3555 | 0.7394 | 0.1915 | 0.3200 |

*Notes*: This table shows the test results of the risk-return tradeoff of various portfolios constructed by turnover and capital structure. The test results are derived by using the GARCH-in-mean (1,1) model for the portfolios of firms included in the Nikkei 225 for the fiscal year from 1986 to 2011. More concretely, we are interested in all firms included in the Nikkei 225 index; however, characteristic information of corporate turnover and capital structure is not obtained for all 225 firms. Thus our full sample data are 26 years in time-series, 172 firms in cross section, and these firms are included in the Nikkei 225 at the end of the fiscal year of 2011. In the table, 'CS' denotes the capital structures, which are measured by total book-value debt divided by total book-value assets and 'TO' denotes the turnover ratios, which are measured by the (yen) trading volumes during the final month of the fiscal year divided by the (yen) corporate market values at the end of the fiscal year. Further, the values of the row of the 'GARCH-in-mean (1,1)' display the coefficient values estimated from the GARCH-in-mean (1,1) model. Our GARCH-in-mean (1,1) model in this analysis includes the conditional standard deviation in its return equation. Furthermore, the values of the row of the '*p*-value' under the 'GARCH-in-mean' display the *p*-values which show the statistical significance of the coefficients from the GARCH-in-mean (1,1) model. In our estimation, we used the heteroskedasticity consistent covariance by Bollerslev and Wooldridge (1992). Furthermore, *** denotes the statistical significance of the coefficients at the 1% level, ** denotes the statistical significance of the coefficients at the 5% level, and * denotes the statistical significance of the coefficients at the 10% level, respectively.

## 4. Testing the Time-Varying Sharpe Ratios

According to our results so far, although risks statistically significantly alter in the higher turnover and higher debt ratio portfolios or lower turnover and lower debt ratio portfolios, their returns are not statistically significantly different. How are then the risk-adjusted returns of our various portfolios? In order to explore this issue, we attempt to calculate the time-varying Sharpe ratios of our portfolios. For computing these time-varying Sharpe ratios, the time-varying standard deviations are needed; for this purpose, we use the following GARCH (1,1) model:

$$RET_{i,t+1} = \eta_i + \kappa_{i,t+1},$$
$$\sigma^2_{i,t+1} = \xi_{i,0} + \xi_{i,1}\sigma^2_{i,t} + \xi_{i,2}\kappa^2_{i,t}. \tag{1}$$

Where $RET_{i,t+1}$ denotes the return of portfolio $i$ at time $t+1$ and $\sigma_{i,t+1}$ denotes the return volatility of portfolio $i$ at time $t+1$. By using the time-varying standard deviations derived as above, we next compute the time-varying Sharp ratios as the following equation (2):

$$SR_{i,t} = [RET_{i,t} - r_{f,t}]/\hat{\sigma}_{i,t}. \tag{2}$$

Where $r_{f,t}$ is the risk-free rate at time $t$ and we use the short-term certificate of deposit (CD) rate in Japan for this variable. We then calculate the average of Sharpe ratios for various portfolios and test their differences by Welch's test as in Table 6. Namely, the null hypothesis of the Welch's test here is that the average of the time-varying Sharpe ratios of the portfolios equals to the average of the time-varying Sharpe ratios of our full sample. While the alternative hypothesis here is that the average of the time-varying Sharpe ratios of the portfolios does not equal to that of our full sample. According to the $p$-values in Table 6, we recognize that there is no portfolio Sharpe ratio that is statistically significantly different from our full sample's Sharp ratio. That is, we understand that even if the risk is adjusted, the risk-adjusted returns of various portfolios are not statistically significantly different from our full sample's risk-adjusted return. This means that, as far as the firms in the Nikkei 225, turnover and capital structure sorting portfolios cannot produce the statistically significantly higher risk-adjusted returns than that of our full sample.

## 5. Analyses of the Time-Varying Risk-Return Tradeoff

Finally, we examine the risk-return tradeoff from another angle. Namely, from the time-series viewpoint, we investigate whether the risk of each portfolio is rewarded or not. To implement this analysis, we use the following GARCH-in-mean (1,1) model:

$$RET_{i,t+1} = \eta_{i,0} + \eta_{i,1}\sigma_{i,t+1} + \kappa_{i,t+1},$$
$$\sigma^2_{i,t+1} = \xi_{i,0} + \xi_{i,1}\sigma^2_{i,t} + \xi_{i,2}\kappa^2_{i,t}. \tag{3}$$

Where $RET_{i,t+1}$ denotes the return of portfolio $i$ at time $t+1$ and $\sigma_{i,t+1}$ denotes the return volatility of portfolio $i$ at time $t+1$. Namely, our GARCH-in-mean (1,1) model in this analysis includes the conditional standard deviation in its return equation. In our estimation, we use the heteroskedasticity consistent covariance suggested by Bollerslev and Wooldridge (1992). The results are shown in Table 7. In this table, the values of the row of the '$p$-value' under the 'GARCH-in-mean' display the $p$-values that show the statistical significance of the coefficients of the time-varying standard deviations in the GARCH-in-mean (1,1) model.

As this table shows, in only four cases, risks are statistically significantly rewarded. Namely, those are 1) the case of the high turnover-low debt ratio portfolio (Panel A), 2) the case of the high turnover-middle debt ratio portfolio (Panel A), 3) the high turnover-high debt ratio portfolio (Panel A), and 4) the lowest turnover portfolio (Panel C). However, in overall, it is rather difficult to conclude that the time-varying risks of our capital structure and turnover sorting portfolios are clearly priced in equity markets in Japan.

## 6. Summary and Conclusions

This paper examined the risk and return relations of turnover and capital structure sorting portfolios of the Nikkei 225 firms in Japan. The findings from our empirical analyses are summarized as follows. 1) First, portfolio risk was reduced in our lowest debt ratio and lowest turnover portfolio. 2) Second, portfolio risk increased in our highest debt ratio and highest turnover portfolio. 3) Third, although risk changed in accordance with the levels of debt ratios and turnover ratios, these risks were not rewarded with higher returns. 4) Fourth, from the viewpoint of time-series, risk of each portfolio was not clearly priced in the Japanese stock markets, either.

We should note that the above evidence is as to the cases of the Nikkei 225 firms. However, from our analyses, one strong implication for the practice investments exists: for earning excess returns, it is useless to focus on the corporate capital structure and turnover differentials in the Nikkei 225 firms. Finally, we also recognize that this kind of research by using larger data set with adding some additional viewpoints shall be one of our future tasks.

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