Whether Corporate Governance is Another Factor to Stock Return?

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Abstract: More attention has been paid to corporate governance of listed companies, and the level of corporate governance can reflect the profitability of the firm well. However, few scholars add corporate governance index into asset pricing model in previous studies. In this paper, the question of whether combining corporate governance index and Fama-French three factor model can better interpret the excess return of the stock portfolios is interpreted and which portfolio is the most sensitive to corporate governance level is explored. Data are selected from all NYSE, AMEX, and NASDAQ stocks with complete corporate governance information from 2011 to 2020. Principal component analysis is used to construct corporate governance index by measuring the board of directors, audit committee, and compensation and nomination committee. The empirical results indicate that the extended model's R-squared is better than the original Fama-French three-factor model. It is found that the regression coefficient of the corporate governance factor is positive and significant in medium book-to-market value portfolios. In addition, big size portfolios are more sensitive to corporate governance level than small size. Based on this, this paper analyzes the reason for this and discuss the information disclosure, and provides a better method to predict excess return.

1. Introduction

To explore what is relevant to stock returns, some previous research has shown that size and book-to-market ratio are related to stock returns. Banz argues that size affects the stock returns, and on small size stocks, there is a return premium [1]. After two years, the size effect is confirmed by Blume & Stambaugh using US data [2]. For the book-to-market effect, the stocks with high book-to-market value have a return premium [3]. Also, serval years later, this kind of effect was confirmed by Capual et al. [4]. Fama & French point out the excess return on the market, the size factor, and the book-to-market factor are significant in explaining the variation of stock returns [5-7]. CAPM model cannot explain the relationship between risk and return well, and the Fama-French three-factor model is an accepted model to replace it.

The emergence of scandals at big companies, such as Enron in the early 2000s, did serious damage to the US and the world seriously, broking the confidence of investors. And the US, regarded as a model of corporate governance structures for a long time, is also beginning to be seriously questioned. The vulnerability of the law and the defects of the governance are revealed [8]. Thus, US President George W. Bush signed the Sarbanes-Oxley Act, passed by Congress, on July 30, 2002, which strictly governs the listed companies. After this, corporate governance becomes particularly important. It strengthens the supervision consciousness of the investment to the firm, constructs the internal and external constraint mechanism of corporate governance and improves the information disclosure obligation of listed companies. In this paper, the board of directors and committees are focused to measure the corporate governance index.

In order to improve the explanatory ability of Fama-French three-factor model to excess returns, the proposal of corporate governance factor is conducive to the improvement of asset pricing model. An extended model with a corporate governance index is considered. Since in big size firms, the level of corporate governance is higher, we will explore whether the corporate governance index has a greater effect on excess returns in big-sized firms' portfolios. For the medium book-to-market value

firms, the level of corporate governance is not very high, the governance provisions are not perfect and the composition of committee has problems. And whether changes in excess returns in medium book-to-market value portfolios are more sensitive to corporate governance index is discussed.

Principal component analysis method is used to construct corporate governance index of firms that are listed on all NYSE, AMEX, and NASDAQ with complete corporate governance data from 2011 to 2020. And different characteristics are considered to calculate the total index for corporate governance, board of directors, audit committee, and compensation and nomination committee. It is found that more firms have improved their corporate governance level in decades and board of directors and audit committees is an important part of corporate governance. Khanchel also found that in US firms for the period of 1994-2003 [9]. The Fama-French three-factor model and the extended model with CGI factor are further examined and compared. From the results of t-test and regression analysis, it can be found that CGI is sensitive to book-to-market value portfolios and has a positive relationship with it. The p-value of coefficient of CGI is much smaller than 0.01. In both high and low book-to-market value portfolios, whether big size or small size, the coefficients of CGI is not significant.

Although CGI has limited ability to explain the excess return of many portfolios, for medium B/M portfolios or in a specific period, corporate governance is strongly correlated with excess returns [10]. The coefficients of principal component analysis result show that compensation meetings or audit meetings are important to the corporate governance index and positively correlate.

The remainder of this paper is organized as follows. Section 2 describes the data used in models, followed by characteristics of corporate governance and construction of CGI in Section 3. Section 4 shows Fama-French three-factor model and the extended model. Section 5 and Section 6 present the empirical results and robustness test respectively. And Section 7 summarizes, concludes.

2. Data

The data comes from Kenneth French's web site at Dartmouth, and the portfolios include all NYSE, AMEX, and NASDAQ stocks from July 2011 to June 2020. Figure 1 below shows the NASDAQ composite index from 2011 to 2020. The overall trend is increasing in a decade.

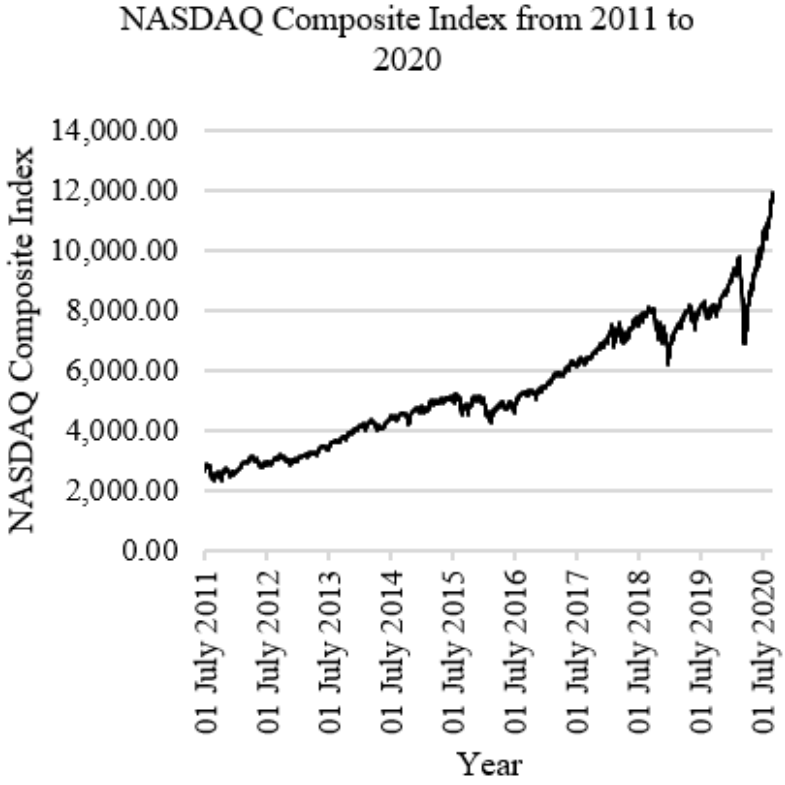

Fig 1. Price trend of NASDAQ Composite Index.

In this paper, Fama-French three-factor model is mainly used to analyze the returns of portfolios. However, the explanatory ability of the traditional Fama-French three-factor model is deficient and defective in market premium. It is considered that adding the corporate governance index could be considered for improvement.

3. Construction Of CGI

Corporate governance index has been more often referred to measure the return of a company recently. Corporate governance level is significantly and positively related to firm valuation, profits and cash dividends paid by shareholders [11]. And, corporate governance is strongly correlated with stock returns [10]. Therefore, in this study, we add the corporate governance index into the Fama French stock pricing model innovatively. We construct my own measures of corporate governance index, using sub-indices to group both internal and external elements followed by Gillan et al. [12]. We choose subindex of the board of directors, the sub-index of the board committees and subindex of the audit committee. These measures of corporate governance can indicate the strength accurately of the corporate governance quality at a firm [9].

To measure each sub-index, we selected nine characteristics to evaluate the performance of corporate governance and paid attention to the board structure, audit system and the situation of committee. Table I provides a list of the variables.

Table I. List of governance variables.

Variables	Interpretation
Board size	Total number of directors
Independent Directors	The proportion of independent directors
Board meetings	Number of the board meetings
Audit Committee meetings	Meetings of the audit committee
Audit Committee size	Size of the audit meetings
Independent Dir on Audit Cmte	The number of independent directors on the audit committee
Non Exec Dir on Comp Cmte	The number of executive directors who are not a member of the compensation committee
Comp Committee meetings	Number of the compensation committee
Nom Cmte meetings	Number of the nominating committee

3.1 Board size

Board size has a significant impact on corporate governance. The advantage of larger board size is that the board has more collective information then leading to greater performance, and has stronger monitor ability [13]. However, in the earlier studies, some researchers find that board size has a strong negative impact on profitability [14]. It becomes more difficult to hold board meetings and taking more time to decision-making [15].

3.2 Independent Directors

Proportion independent directors are defined as the number of independent directors divided by the total number of directors on the board. Previous studies have shown the importance of the monitoring role of independent directors in corporate governance. Boards comprising a higher proportion of independent directors are associated with reduced levels of earnings management [16].

3.3 Board meetings

Board meeting frequency is a significant element of board operations and it is related to corporate governance and ownership characteristics [17]. In addition, Pamburai et al. suggest that a positive association between the frequency of board meetings and corporate performance [18].

3.4 Audit Committee meetings

The frequency of audit committee meetings has an effect on corporate governance. Similar to board meetings, Xie et al. have concluded that audit committee meeting frequency is associated with reduced levels of discretionary current accruals [19].

3.5 Audit Committee size

The size of the audit committee is also related to the discretionary current accruals [19]. Governance enhancing audit committee characteristics positively impact firm performance [20]. Their research reveals the smaller size of the audit committees with financial expertise is more likely to be associated with positive performance in the market.

3.6 Independent Dir on Audit Cmte

For the number of independent directors on audit committee, Chan has shown the presence of independent in the audit committee enhances firm value [21]. And in the study by Siagian et al., after the firm acquires independent directors on audit committee, earnings response and discretionary accruals are improved significantly [22].

3.7 Non Exec Dir on Comp Cmte

In many countries' corporate governance, non-executive director is not clearly identified by determining factors, and the relevant cases are limited. Zattoni & Cuomo hold a conviction that increasing the number of non-executive directors on compensation committee could have an advantageous impact on board practice [23].

3.8 Comp Committee meetings

Not enough evidence or research indicates that compensation committee meeting has a specific relationship with corporate value and profitability. When compensation committee quality is high, CEO cash compensation is more positively associated with accounting earnings [24]. Under the influence of compensation committee meetings, the association is less.

3.9 Nom Cmte meetings

The nomination committee is part of the board of directors and has the responsibility to ensure the right talent, the skilled person appointed to make the strategic decision of the firm [25]. And his evidence shows that nomination committee meetings are associated with poor performance.

In order to build the corporate governance index, most researches usually consider principal component analysis [26]. The principal component analysis of the original index system is carried out to reduce the dimension [27]. The data contains all NYSE, AMEX, and NASDAQ stocks from proxy statements from 2011 to 2020. However, not every firm reveals all detailed characteristics. To avoid the adverse effects of data loss, we select sample firms with complete corporate governance data for every characteristic each year.

Table II provides descriptive statistics for three panels. Panel A is the board of directors, and it indicates the structure of the firms' board. Board size ranges from seven to eleven directors for most firms; the average board size (9.213) is close to the median (9). The percentage of independent directors of the firms is a little more than three quarters (79.741%), and the proportion of more than half firms over 83.333%. However, the minimum is only 9% for some firms compared to most firms. Therefore, the standard is a little large. The board meetings are held about 8 times annually, and a firm even holds up to 57 meetings a year, which is far above the 75th percentile (10).

Table II. Descriptive Statistics of Governance Variables, 2011-2020.

	Mean	Minimum	Maximum	Median	25th percentile	75th percentile	SD
Panel A: Board of directors							
Board size	9.213	0	33	9	7	11	2.782
%Independent Directors	79.741	9	100	83.333	72.727	88.889	11.300
Board meetings	8.353	0	57	7	6	10	4.052
Panel B: Auditing system							
Audit Committee meetings	7.242	0	64	7	5	9	3.061
Audit Committee Size	3.945	2	14	4	3	5	1.160
Independent Dir on Audit Cmte	3.942	1	14	4	3	5	1.162
Panel C: compensation and Nominating Committees							
Non Exec Dir on Comp Cmte	3.834	0	10	4	3	4	1.111
Comp Committee meetings	5.392	0	40	5	4	7	2.612
Nom Cmte meetings	3.790	0	14	4	2	5	2.018

Panel B shows that seven meetings are held by the audit committee annually, approximately. For most firms, the audit committee consists of three to five members. The average audit size of a firm (3.945) is approximately equal to the median of the sample (4). In addition, nearly all members of the audit committee are independent directors since the average number (3.942) is very close to the size.

According to the compensation and nominating committees of the firm, the results we can find in Panel C. Almost four members on compensation committees are not executive directors of the firms, the standard deviation is only 1.111 and both of the median and 75th percentile numbers are four that confirms it. Compensation committees hold between four and seven for most firms each year, and the average is five meetings. However, compared to compensation meetings, nomination committees hold fewer meetings annually. Most of them hold two to five in a year.

Before carrying principal component analysis, we should do the KMO test first, to judge whether the data is adequate for principal component analysis. From Table III, we find that the overall KMO values are greater than 0.7, which means the data are suited well for principal component analysis.

Table III. Kaiser-Meyer-Olkin Factor Adequacy.

Variables	KMO
Board size	0.91
%Independent Directors	0.76
Board meetings	0.78
Audit Committee meetings	0.78
Audit Committee Size	0.62
Independent Dir on Audit Cmte	0.62
Non Exec Dir on Comp Cmte	0.95
Comp Committee meetings	0.64
Nom Cmte meetings	0.69

Table IV. Principal Component Analysis Coefficient Matrix for 2011.

Variables	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Board Size	0.0481405	-0.2144685	0.4821455	0.7465808	0.1650314	0.3621869	-0.0581901	0.0060317	-0.0011576
%Independent Directors	0.9955417	0.0695271	-0.0581984	-0.0138010	-0.0090257	0.0193895	0.0026837	-0.0044726	0.0007252
# Board Meetings	0.0343314	-0.8805818	-0.4680015	0.0214187	0.0489597	0.0273059	-0.0219436	-0.0169857	-0.0000196
Audit Committee Meetings	0.0458923	-0.3408089	0.5549666	-0.2949474	-0.6946275	-0.0118393	0.0639114	-0.0053849	-0.0002407
Size of Audit Committee	0.0195349	-0.0553887	0.0890606	0.1883378	0.0556589	-0.5163120	0.2709493	-0.3257746	0.7098793
# Independent Dir on Audit Cmte	0.0204673	-0.0548095	0.0883387	0.1876790	0.0557030	-0.5182115	0.2705635	-0.3356564	-0.7042977
# Non Exec Dir on Comp Cmte	0.0215362	-0.0604322	0.0620009	0.1360128	0.0380286	-0.4072743	0.1638260	0.8828076	-0.0057697
# Comp Committee Meetings	0.0293438	-0.1809467	0.3775270	-0.4900939	0.6334213	0.1706266	0.3913137	0.0147016	-0.0004382
# Nom Cmte Meetings	0.0341912	-0.1229978	0.2739143	-0.1599619	0.2809076	-0.3707450	-0.8157553	-0.0355970	0.0008850
Standard deviation	12.1018	4.29075	3.29792	2.64048	2.48301	1.62999	1.52667	0.7638	0.05464
Proportion of variance	0.7532	0.09468	0.05593	0.03586	0.03171	0.01366	0.01199	0.0030	0.00002
Cumulative proportion	0.7532	0.84784	0.90377	0.93963	0.97133	0.98500	0.99698	1.0000	1.00000

Table IV shows the results of the principal component analysis for 2011. The first two eigenvalues are greater than 1, which means PCA is feasible here. Although, in most situations, it is preferable to use PCA based on the correlation matrix. In this circumstance, the variables measuring similar entities and sample variances are not too different so that we use PCA based on the covariance matrix here. The result is much better and appropriate than that based on correlation. We only need to retain 2 PCs (based on covariance) rather than 6 PCs (based on correlation). From the cumulative proportion of all PCs, the first two could explain 85% total variation. For interpretation of the first PC, it gives positive, roughly equal (around 0.03) except for the percentage of independent directors, weight to eight kinds of variables and thus represents the 'average' performance. For example, a firm has a high PC1 score, which means it has a larger board size and holds more committee meetings every year so that it has a good corporate governance condition.

The second PC, meanwhile, represents a contrast between the percentage of independent directors and other variables left. For instance, a large positive value of PC2 implies the firm has a much large percentage of independent directors, and a large negative value implies the opposite.

Table 5 provides the descriptive statistics of total corporate governance score from 2011 to 2020. We calculate the total governance scores by:

$$CGI = \sum_{i=1}^{n} \left(\frac{s_i}{\sum_{i=1}^{n} s_i} \right) PC_i \quad (1)$$

Where s_i is the ith proportion of variance of PCs, PC_i is the ith PC scores of the principal component, n is the number of the principal component we selected, and the CGI is the total

governance scores. When carried out the principal component analysis, we centralize the data, so the mean of the total corporate governance score is zero. In addition, in order to add the data into the model for analysis conveniently, the value of CGI is translated.

Table V. Descriptive Statistics Of total Governance Score, 2011-2020.

Year	Sample size	Median	25th percentile	75th percentile	SD
2011	1291	51.6141	44.7187	57.5551	9.48
2012	1327	52.5624	44.3468	57.1703	9.38
2013	1394	52.7334	44.1384	57.5075	9.55
2014	1464	47.3954	42.5488	55.8922	9.54
2015	1494	47.5443	42.8902	55.2398	9.11
2016	1586	46.6670	40.8633	56.9419	11.81
2017	1671	46.2925	41.3359	56.5429	11.51
2018	1696	46.4059	41.5699	56.3185	11.41
2019	1485	53.0671	44.3468	57.7263	10.43
2020	391	46.9425	42.2445	54.2599	11.65

The Sample size of ten years is overall increasing except for 2020, since the year 2020 has not yet passed; thus, many firms have not released relative data. This trend indicates that more and more firms realize the importance to multiple characteristics of corporate governance. The median of the year 2011 is 51.6141, the 25th percentile is 44.7187 and 75th percentile is 57.5551. From 2011 to 2013, the median is increasing, but the firms at the 75% level have roughly the same scores. This indicates that most of the improvement is at the medium corporate governance level. From 2014 to 2019, although the trend of the median is slightly decreasing, which may due to growth in the sample size, more of the poorly-governed firms also count the corporate governance index. The 75th percentile is increasing in general, and this suggests that some of the better-governed firms have risen again in recent years. For the abnormal result of the year 2020, perhaps because some firms with high corporate governance index have yet to release information.

4. Economic Method

4.1 Original Fama-French model

The Fama-French Portfolios are constructed from the intersections of two portfolios formed on size, as measured by market equity (ME), and three portfolios using, as a proxy for value, the ratio of book equity to market equity (BE/ME). Returns from these portfolios are used to construct the Fama-French Factors [5]. These portfolios differ from the Fama-French Benchmark Portfolios, primarily because the latter include estimated transaction costs [28]. In addition, the portfolios incorporate any typically very small revisions in the underlying historical data.

The Fama-French three-factor model includes Market Equity, Book Equity and Book-to-Market.

4.1.1 ME (Market Equity)

Market equity (size) is price time's shares outstanding. Price is from CRSP, shares outstanding are from Compustat or CRSP.

4.1.2 BE (Book Equity)

Book equity is constructed from Compustat data. BE is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of the preferred stock. Depending on availability, redemption, liquidation, or par value (in that order) were used to estimate the book value of the preferred stock. Stockholders' equity is the value reported by

Compustat, if it is available. If not, stockholders' equity was measured by the book value of common equity plus the par value of the preferred stock, or the book value of assets minus total liabilities [29].

4.1.3 BE/ME (Book-to-Market)

The book-to-market ratio used to form portfolios in June of year t is book equity for the fiscal year ending in calendar year t-1, divided by market equity at the end of December of t-1.

In order to explain excess returns on stock portfolios, MKTRF, SMB and HML variables used by Fama & French are selected [5], and they showed that these three stock market factors (MKTRF, SMB, and HML) clarify a statistically significant fraction of the variation in stock returns.

$$R(t) - RF(t) = a + b \times MKTRF(t) + s \times SMB(t) + h \times HML(t) + e(t) \quad (2)$$

R (t) is the return on a stock portfolio. RF (t) is the risk-free return rate (e.g., one-month Treasury bill rate). R (t)-RF (t) is the excess return on the stock portfolio. MKTRF (t) is the excess return on the market. It is calculated as the value-weight return on all NYSE, AMEX, and NASDAQ stocks (from CRSP) minus the one-month Treasury bill rate (from Ibbotson Associates). SMB (t) (small minus big) is the difference between small-firms return and big-firms return. HML (t) (high minus low) is the difference between high book-to-market equity return and low book-to-market equity return.

4.2 CGI-Fama-French model

When considering the influence of corporate governance on asset pricing and firm value, I obtain the corporate governance index by principal component analysis method and add it into the Fama-French three-factor model.

$$R(t) - RF(t) = a + b \times MKTRF(t) + s \times SMB(t) + h \times HML(t) + c \times CGI(t) + e(t) \quad (3)$$

In this expression, the new variable, CGI, is calculated by using Principal Component Analysis on nine different characteristics of the firm. R (t)-RF (t), MKTRF (t), SMB, and HML are defined the same as before.

5. Results

After adding profitability factor RMW and investment factor CMA into the Fama-French three-factor model, the explanatory ability for an excess return of the model is stronger, but the variable HML becomes not significant [30]. Therefore, before to regression model, we should test whether the corporate governance factor CGI and other variables exist collinearity.

Table VI. Correlation between Factors.

	MKTRF	SMB	HML	CGI
MKTRF	1			
SMB	0.3774	1		
HML	0.2092	0.1495	1	
CGI	0.0915	0.0408	0.3408	1

Table VII. Collinearity Diagnostics.

Variables	VIF
MKTRF	1.2004
SMB	1.1737
HML	1.1815
CGI	1.1325

Table VI and Table VII show the result of correlation and VIF, respectively. The correlation coefficient between any two factors is greater than 0. For example, the correlation between SMB and MKTRF is 0.3774. There is a slightly positive correlation between each of these factors. It should be noted that the correlation between CGI and MKTRF, the correlation between CGI and SMB is 0.0915

and 0.0408, respectively, which means there is no obvious linear correlation exists. The results of Table VII show that all VIFs of these four factors are less than 2, which further verifies that there is no obvious collinearity among these four factors in our extended model.

Table VIII. Parameter Estimation Results of Fama-Fremch Three Factor Models.

Portfolio	Intercept	MKTRF	SMB	HML
S/L	-0.000 (-0.469)	1.082 *** (44.261)	1.116 *** (25.986)	-0.281 *** (-8.073)
S/M	0.000 (1.038)	0.984 *** (61.128)	0.846 *** (29.897)	0.323 *** (14.123)
S/H	0.000 (1.277)	0.979 *** (87.715)	0.913 *** (46.543)	0.681 *** (42.891)
B/L	0.001 * (2.537)	1.005 *** (88.138)	-0.140 *** (-6.958)	-0.275 *** (-16.942)
B/M	-0.000 (-0.584)	0.932 *** (42.179)	-0.050 (-1.284)	0.236 *** (7.502)
B/H	0.000 (0.140)	1.108 *** (46.063)	0.064 (1.514)	0.0763 *** (22.295)

t statistics in parentheses. * p<0.1, ** p<0.5, *** p<0.01.

Table VIII shows the result of parameter estimation of Fama-French three-factor models on different portfolios. These six portfolios are divided into small size and low book-to-market value (S/L), small size and medium book-to-market value (S/M), small size and high book-to-market value (S/H), big size and low book-to-market value (B/L), big size and medium book-to-market value (B/M) and big size and high book-to-market value (B/H).

By analyzing the regression results, it is found that the intercept terms of Fama-French three-factor model are not significant. This indicates that the remaining three factors (MKTRF, SMB and HML) can explain the excess return very well. In addition, in the B/M and B/H portfolio, the p-value of SMB factor is large, and we can conclude that the ability of SMB to explain the excess return of a big size portfolio (especially book-to-market value is medium and high) is relatively weak.

Table IX. Parameter Estimation Results of Fama-French Three Factors + CGI Models.

Portfolio	Intercept	MKTRF	SMB	HML	CGI
S/L	-0.037 (-0.703)	1.082 *** (44.123)	1.117 *** (25.935)	-0.289 *** (-7.830)	0.065 (0.694)
S/M	-0.102** (-3.009)	0.982 *** (63.192)	0.847 *** (31.015)	0.300 *** (12.799)	0.181 ** (3.029)
S/H	-0.026 (-1.053)	0.979 *** (87.448)	0.913 *** (46.535)	0.675 *** (38.521	0.046 (1.076)
B/L	0.017 (0.687)	1.005 *** (87.892)	-0.140 *** (-6.951)	-0.271*** (-15.734)	-0.028 (-0.641)
B/M	-0.189 *** (-4.197)	0.930 *** (45.025)	-0.047 (-1.290)	0.193 *** (6.195)	0.332 *** (4.187)
B/H	0.005 (0.102)	1.108 *** (45.846)	0.064 (1.505)	0.764*** (20.980)	-0.010 (-0.099)

t statistics in parentheses. * p<0.1, ** p<0.5, *** p<0.01

Table IX presents the results of regressions of the extended Fama-French three factor model with the CGI variable. From the significance of estimator coefficients, the CGI in our extended model is not significant in S/L, S/H, B/L and B/H portfolios select in this paper. In the portfolio with medium book-to-market ratio, the regression coefficient of CGI is significant and positive, which indicates that CGI can has a positive relationship with the excess return of the portfolio with medium book-to-market ratio and explain it well. CGI performs better in big size portfolio since the coefficient of big size portfolio is greater than small size. In combination with the results of PCA before, this is may be caused by the level of corporate governance in big size firms is higher and more contributions to excess return. In addition, compared to other variables, the coefficient of CGI is small, which means the contribution of CGI to excess return is limited in 2011-2020.

For the R-squared of two models in 6 portfolios, Table X shows the comparison results. We can find that the R-squared of the original Fama-French three-factor model more than 95%, which illustrates that more than 95% of the excess return of the portfolios can be explained by MKTRF, SMB and HML. After adding the corporate governance factor CGI, the R-squared of each model was improved. However, the overall improvement was small, and the improvement was relatively large in the medium book-to-market portfolio only. In general, from the comparison of R-squared, the corporate governance index has a certain ability to explain excess return, but this ability is not outstanding.

For the firms that have relatively higher book-to-market value, most of them are poorly-governed firms rather than well-governed firms [31]. This indicates that in low book-to-market value firms, the corporate governance is well, corporate supervision and audit, compensation and nomination committee organizations are complete and performed well. Then the influence of the differences of the CGI in such firms are slight. Thus the CGI has little ability to explain the difference in an excess return of low book-to-market value portfolios. And for the medium book-to-market value portfolios, the governance provisions would be improved, and the corporate governance is low. In this case, if such firms increase the size of the board or improve the compensation and audit committees, the CGI could be increased, and the stock return has also risen significantly. Therefore, we can make a hypothesis that the excess return of medium book-to-market value firms is sensitive to the change of the CGI, and the CGI has a positive effect on such excess return. For high or low book-to-market value portfolios, due to the level of corporate governance, the characteristics of the board of directors, and the capital structure and value of the firm, the excess return is not sensitive to the CGI.

Table X. R-Squared Between the Fama-French Three Factors Models and the Fama-French Three Factors +CGI Models.

Portfolio	R-squared	
	FF-3 factors	FF-3 factors+CGI
S/L	0.9725	0.9727
S/M	0.9859	0.9870
S/H	0.9943	0.9944
B/L	0.9868	0.9869
B/M	0.9530	0.9594
B/H	0.9698	0.9700

6. Robustness Test

In order to verify the reliability and generality of our research results, we carry out the robustness test. Based on the robustness test method from Li et al., in this test [32], we divide the origin research time into three panels of different time periods (3 years, 5 years and 7 years), and each panel contains S/M and B/M portfolios, then do T-tests for each of these periods, and compare the significance of the coefficients of CGI in different panels to previous research.

Table XI. Robustness Test for S/M and B/M Portfolios.

Portfolios	Intercept	MKTRF	SMB	HML	CGI
Panel A: Robustness for three years (2018-2020)					
S/M	-0.226 ***	0.956 ***	0.806 ***	0.292 ***	0.402 ***
	(-3.769)	(35.380)	(13.735)	(6.461)	(3.794)
B/M	-0.268 **	0.894 ***	0.003	0.273 ***	0.475 **
	(-3.474)	(25.663)	(0.971)	(4.676)	(3.482)
Panel B: Robustness for five years (2016-2020)					
S/M	-0.220 ***	0.955 ***	0.857 ***	0.281 ***	0.390***
	(-4.324)	(43.992)	(21.085)	(9.187)	(4.337)
B/M	-0.300 ***	0.907 ***	-0.05	0.196 ***	0.527 ***
	(-4.730)	(33.582)	(-0.092)	(5.161)	(4.708)
Panel C: Robustness for seven years (2014-2020)					
S/M	-0.139 **	0.970 ***	0.833 ***	0.304 ***	0.249 **
	(-3.155)	(50.684)	(26.045)	(11.204)	(3.173)
B/M	-0.197 ***	0.929 ***	-0.054	0.211 ***	0.349 ***
	(-3.671)	(39.862)	(-1.399)	(6.381)	(3.651)

Table XI shows the robustness test for S/M and B/M portfolios in three different periods, which are three years robustness test from 2018 to 2020, five years robustness test from 2016 to 2020 and seven years robustness test from 2014 to 2020. From the results of the robustness test, the coefficients of CGI in different panels are all positive and significant. In addition, the CGI can explain more in big size portfolio than small size portfolio. These results are consistent with our previous results. Therefore, we can conclude the results of our research are reliable.

7. Conclusion

Recently, corporate governance has been paid more attention. However, few researchers have combined it with asset pricing models and they determine corporate governance index by using different characteristics. In this paper, we mainly use extend model with corporate governance index based on Fama-French three-factor model.

There are some characteristics we used to evaluate corporate governance, which includes board size, the proportion of independent directors, board meetings, size of audit committee, audit committee meetings, the proportion of independent directors on audit committee, non-executive director on compensation committee, compensation committee meetings and nomination committee meetings. Then, we use the principal component analysis method to construct the corporate governance index and use linear regression to investigate which factor can explain the excess return well. We also compared the results with the original Fama-French three-factor model in this article.

The results presented for principal component analysis coefficients show an overall positive relationship between every characteristic and corporate governance in total. For example, a large board size and a high proportion of independent directors may contribute to the high corporate governance index. In the last decades, we find that the CGI increased in the first three years, then dropped to a relatively low level in 2014. Then the corporate governance situation of most firms became better and more firms released corporate governance information.

We provide evidence that the corporate governance index is significant and has a positive relationship with an excess return in the model of medium book-to-market value portfolios. For other portfolios, the corporate governance index has not much improvement for the explanatory ability for the excess return of the model. We offer a hypothesis that corporate governance affects the excess

return by affecting the capital structure and value of the firm. In medium book-to-market value firms, this kind of effect is significant. However, due to CGI combines many characteristics of corporate governance, such translations weaken the contribution of factor CGI to excess return.

There are some limitations in our study. Although corporate governance has improved in nearly every firm, in our processing of data collection, some important characteristics of corporate governance are missing. As a result, according to the descriptive statistics of the corporate governance index in this paper, the corporate governance index is less differentiated, so the corporate premium is not obvious in different portfolios, and then the extended model has little effect on the improvement of the Fama-French three-factor model. When more firms reveal more information, the models could be improved. In addition, we only focus on nine characteristics of the firm, and due to an incomplete database, some important characteristics of the firm, especially related to the board of directors, could reflect more information about corporate governance. The research could be extended if using other characteristics of corporate governance, for example, shareholders' rights. In the future, we would consider more about shareholders of the firm and measure more characteristics based on more information disclosure. And then combine it to the model to predict the excess return.

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