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A Contribution to Factor Model: A Firm Behavior Perspective

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Abstract

This paper proposes a neglected factor determining the stock returns from the perspective of firm behavior, i.e. the volatility of the asset of corresponding firms and thus contributes to the factor model. To this end, we model the wealth accumulation path of the firms and derive the relationship between risk premium and asset volatility. We document robust evidence that one standard deviation rise in volatility requires an increase of risk premium by 21.1%. Besides, we find that listed firms in China are more risk averse and required a higher return by investors than those in United States, and phenomena are more pronounced in non-state-owned enterprises and firms in competitive industries. These findings suggest that capital market in China is immature and too speculative, corresponding policy implications are thus derived.

Keywords: volatility factor; relative risk aversion coefficient; internal rate of return

INTRODUCTION AND LITERATURE REVIEW

The determinants of stock returns or risk premium are still mysterious even after the seminal work by Fama and French (1993) which argue that the risk premium of the expected return on a portfolio is explained by the sensitivity of its return to three factors: (1) the market premium; (2) the size premium, computed by the difference between the return on a portfolio of small stocks and the return on a portfolio of large stocks (SMB, small minus big); and (3) the book-to-market premium, calculated by the difference between the return on a portfolio of high-book-to-market stocks and the return on a portfolio of low-book-to-market stocks (HML, high minus low). These factors affect the stock returns and invoke quite a few followers in search of the determinants of stock return or asset price, like the persistence of fund's performance discovered by Carhart (1997) and thus develops the factor of momentum. Meanwhile, researchers strive to find out the additional factors that influence the stock return or asset price, which Fama and French (1996) denote as the ”multi-factor model”. The studies on multi-factor model haven't died down, but even revitalized instead: the number of the papers on such topics published in the three most prestigious journals of finance (The

Journal of Finance, Journal of Financial Economics and The Review of Financial Studies) keeps a speed of ten per annum in recent years, like what Cochrane (2011) metaphors, there have been a ”zoo of factors”. The importance of the issue is still growing, which is highlighted by the presidential address of American Finance Association in Cochrane (2011). Cochrane (2011) thinks the factors are still deserve studying with the combination of macroeconomic theory and its approaches. Moreover, Cochrane (2011) emphasizes the previously omitted but important factor that affects stock return, the volatility (see also in Maio and SantaClara (2012)). Maio and Santa-Clara (2012) argue that the volatility factor is indispensable, the conclusion is lent strength by Cochrane (2011) in his survey of quite a few papers. However, among these arguments on verifying the additional factors of risk premium, no theoretical work concretely deals with the relationship between volatility and stock returns.

Moreover, both Bakshi and Chen (1996) and Hilary and Hui (2009) indicate that the risk aversion rate measures the sensitivity of risk premium to the volatility, in the sense of stock returns, the additional factor in determining the stock return is scaled by the firm's level of risk aversion. The more risk averse, the higher returns, but still they haven't theoretically demonstrate the association. Kollmann (1996) summarizes previous works and makes great contributions to estimate the relative risk aversion coefficients in United States, their estimates show that the value is around 2 and these seminal researches revitalize some important topics like consumption decisions, risk premium puzzles and so on. However, the risk averse coefficient of firms, especially that in China is still remained untouched to our limited knowledge, despite its importance in corporate strategies (see, e.g., Hilary and Hui (2009) for a systematic argument on this). Moreover, Cochrane (2011) stresses the internal rate of return of the firms, or in other words, the firms' discounting rate, as they vitally affect the financing strategies and accounting principles while on the other hand might reflect more crucial facts of the firms and investors according to his thorough survey.

In this paper, we model the firms' asset accumulation path like what was done by Maio and Santa-Clara (2012) and solve it by dynamic programming. The derivation of the corresponding volatility factor omitted by previous studies which impacts the stock returns lays the theoretical background of the such determinant. We then empirically investigate the theoretical predictions while controlling for the commonly used the three factors with stock data in China and find that the factor significantly affects the stock return. The results suggest that the factor is present and shouldn't be omitted, while the coefficient estimates on such factor exhibit the level of risk aversion of the firms in China. We further discuss the relative risk aversion coefficient obtained in regressions as well as the implied internal rate of return and compare them with those derived in mature equity market like United States by Kollmann (1996) and Dodonova and Khoroshilov (2007): we discover that firms in China are more risk averse than those in United States and they are imposed with a higher internal required of return, the phenomena are more pronounced in non-state-owned enterprises and firms in competitive industries. The phenomena suggest that China is still on its way towards market economy: the capital market is immature so that Chinese firms are less tolerant to the risk, like what Paler (2005) and Wang and Qian (2011) argues, and speculative in that firms are required to have the high internal rates.

The paper contributes to the existing literature in several significant ways. First, we for the first time lay the theoretical underpinnings of the risk factor in the multi-factor model and empirically identify its presence. Concretely, we solve for the asset accumulation path of firms and delineate the relationship between dividend paying outs and amount of asset theoretically, which enriches the argument made by Chay and Suh (2009). Second, our theoretical and empirical findings show that the volatility factor is indispensable, which has been as argued by Hilary and Hui (2009), Cochrane (2011) and Maio and Santa-Clara (2012) but not theoretically proved. Third, we obtain both the relative risk aversion coefficients and the the implied internal rate of returns of the firms in China, and the magnitude of relative risk aversion coefficient and implied internal rate of return imply that China is still on its way towards market economy. On account of the immature capital market filled with speculations, the firms are more risk averse and required higher returns by the investors than mature stock markets like United States'. The phenomena are more pronounced in non-state-owned enterprises and firms in competitive industries out of institutional and historical reasons. We propose some policy suggestions correspondingly.

The remainder of the paper proceeds as follows. Section 2 lays the theoretical background of the additional factor that affects the stock returns. Section 3 describes the data, variables and

model we employed. Section 4 exhibits the empirical results and further discussions on firms' risk aversion and internal rate of return.
Section 5 concludes and derives policy implications of the paper.

THE THEORETICAL UNDERPINNING: THE WEALTH PATH OF FIRMS

We follow the similar setting as developed by Bakshi and Chen (1996) to construct the wealth accumulation path of the firms, the method is frequently used as is seen in Maio and Santa-Clara (2012). The method is derive from the macroeconomic analysis and is now given full consideration by financial economists as argued by Cochrane (2011).

We also consider two kinds of assets the firms hold, the risk free asset with return Rb and risky one with return Rs. We assume the returns process as the follows:

$$dRb = rdt, \qquad dRs = adt + \sigma dWt$$

Where s is the return of the risk free asset with its counterpart a being the risky ones'. σ is the volatility of the risky asset return and Wt follows a standard Brownian motion.

Let D be the firms' dividend distribution and we assume that firms' utility function demonstrates the Constant Relative Risk Aversion (CRRA), i.e., $u(D_t) = \frac{D_t^{1-\gamma}}{1-\gamma}$ and thus γ captures the level of risk aversion.

The assumptions and solution in macroeconomic fashion are widely seen in literature like Bakshi and Chen (1996), Kollmann (1996) and so on. Note that our assumption is little bit different from that in Bakshi and Chen (1996) in that we don't include the wealth (asset) in the utility function (the utility function becomes $u(D_t) = \frac{D_t^{1-\gamma}}{1-\gamma}A^{-\lambda}$ if we follow Bakshi and Chen (1996) rigorously). Since stockholders are the owner of company and the value of the stock should be ultimately defined on its dividend, our assumption is reasonable. We assume that the firm invest a portion x of its total asset A in risk free asset and let β be the discounting factor. We further assume that time is continuous and then the firms' problem becomes:

$$\max_{D,x} E \int_0^\infty u(D_t)e^{-\beta t}dt$$

$$s.t. \quad dA_t = [rxA_t + (1-x)aA_t - D_t]dt + (1-x)A_t\sigma dW_t \qquad (1)$$

$$and \quad A(0) = A_0, D_t \le A_t \forall t \in (0,+\infty)$$

We solve the problem by defining the value function $J(s, A_s) = \int_s^{+\infty} f(t, A_t, D_t)dt, \; \forall\, s \in (0, +\infty)$.

$$J(s,A_s) = \max_{D,t\in(s,+\infty)} E_s\left[\int_s^{s+\Delta s} f(t,A_t,D_t)dt + \int_{s+\Delta s}^{+\infty} f(t,A_t,D_t)dt\right]$$

$$= \max_{D,t\in(s,+\infty)} E_s\left[\int_s^{s+\Delta s} f(t,A_t,D_t)dt + \max_{D,t\in(s,+\infty)} E_{s+\Delta s}\int_{s+\Delta s}^{+\infty} f(t,A_t,D_t)dt\right] \quad (\because E_s(E_{s+\Delta s}) = E_s)$$

$$= \max_{D,t\in(s,+\infty)} E_s\left[\int_s^{s+\Delta s} f(t,A_t,D_t)dt + J(s+\Delta s, A_s + \Delta A_s)\right]$$

$$= \max_{D,t\in(s,+\infty)} E_s\left[f(s,A_s,D_s)\Delta s + o(\Delta s) + J(s+\Delta s, A_s+\Delta A_s)\right](Taylor\ expansion) \quad (2)$$

We rewrite the last term of right hand side of the equation (2) according to Itˆo's formula:

$$J(s+\Delta s, A_s+\Delta A_s) = J(s,A_s) + J_s(s,A_s)\Delta s + J_A(s,A_s)\Delta A_s + \frac{1}{2}J_{AA}\sigma^2\Delta s \quad (3)$$

where J_i denotes the partial derivatives with respect to i, $i \in \{s, A_s\}$.
Combine the equation (2) with (3), we have:

$$J(s,A_s) = \max_{D,t\in(s,+\infty)} \mathbb{E}_s\left[f(s,A_s,D_s)\Delta s + J(s,A_s) + J_s(s,A_s)\Delta s + J_A(s,A_s)\Delta A_s + \frac{1}{2}J_{AA}\sigma^2\Delta s\right]$$

Then we replace ΔA_t by equation (1) and use the fact that $E[\sigma dW_t] = 0$. We derive the recursive equation by further letting $\Delta s \to 0$:

$$0 = \max_{D,t\in(s,+\infty)} \mathbb{E}_s\left\{f(s,A_s,D_s) + J_s(s,A_s) + J_A(s,A_s)[rxA_s + (1-x)aA_s - D_s] + \frac{1}{2}J_{AA}[\sigma(1-x)A_s]^2\right\} \quad (4)$$

We solve the recursive equation (4) by taking first order conditions with respect to D and x:

$$\begin{cases} J_A(s,A_s) = \frac{\partial f(s,A_s,D_s)}{\partial D_s} \\ J_A(s,A_s)(r-a)A_s + J_{AA}\sigma^2 A_s^2(x-1) = 0 \end{cases} \quad (5)$$

Since the utility function of the firm takes the form of CRRA, we guess the value function by $J(s,A_s) = B\frac{A^{1-\gamma}}{1-\gamma}e^{-\beta s}$, and B is to be determined. We adopt it to equation (5), and get:

$$\hat{D}_t = B^{-\frac{1}{\gamma}}A_t, \hat{x} = 1 - \frac{a-r}{\gamma\sigma^2} \quad (6)$$

It is easy to find that if we adopt Bakshi and Chen (1996)'s utility function, then $\hat{x} = 1 - \frac{a-r}{(\gamma+\lambda)\sigma^2}$, a slight difference from what we obtained. If we use rigorously the assumptions by Bakshi and Chen (1996), then the subsequent analysis on testing the relative risk aversion coefficient yields $\gamma+\lambda$, we could then define such combination as the "composite relative risk aversion coefficient" as the sum captures the agent's total level of risk aversion. In this case, our assumption won't be affected due to our different assumption from Bakshi and Chen (1996).

We finally plug the optimal D and x from the equation (6) into (4) and get Hamilton-Jacobi-Bellman equation (7).

$$0 = \max_{t\in(s,+\infty)} \mathbb{E}_s\left\{f(s,A_s,\hat{D}_s) + J_s(s,A_s) + J_A(s,A_s)[r\hat{x}A_t + (1-\hat{x})aA_t - \hat{D}_t] + \frac{1}{2}J_{AA}[\sigma(1-\hat{x})A_t]^2\right\} \quad (7)$$

The parameter to be determined, B is then derived and final solutions are obtained:

$$\begin{aligned} B &= \left[\frac{\beta - (1-\gamma)\left[r + \frac{(a-r)^2}{2\gamma\sigma^2}\right]}{\gamma}\right]^{-\gamma} \\ D_t &= \frac{\beta - (1-\gamma)\left[r + \frac{(a-r)^2}{2\gamma\sigma^2}\right]}{\gamma}A_t \\ dA_t &= \frac{1}{\gamma}\left[\frac{(1+\gamma)(a-r)^2}{2\gamma\sigma^2} - \beta + r\right]A_t dt + \frac{(a-r)^2}{\gamma\sigma}A_t dW_t \end{aligned}$$

The equation (8) suggests that our guess is correct while the equation (9) tells us that dividend pay outs should be proportionate to firms total asset which indicates that the discounting factor β can be then obtained by the realized values of relative risk aversion coefficient γ and other parameters like dividend asset ratio as well as volatility. Moreover, the wealth path of the firm is given by equation (10) together with its growth rate $\mathbb{E}(\frac{dA_t}{A_t}) = \frac{(1+\gamma)(a-r)^2}{2\gamma\sigma^2} - \beta + r$, which also solves the problem in Maio and Santa-Clara (2012).

Most importantly, from equation (6) we know that $a-r = \gamma(1-\hat{x})\sigma^2$, indicating that the risk premium is also related to the firms' asset volatility weighed by their asset allocation, the $(1-\hat{x})\sigma^2$. According to Chay and Suh (2009), the statistical properties of volatilities of asset, cash flow and stock return are so similar that they are mutually substitutable, and it makes sense that volatility requires extra returns. The volatility is never taken into consideration in CAPM or Fama-French three-factor model. In the present paper, we append this factor into the original Fama-French three factor model as it is most reliable in predicting the stock returns argued by Fama and French (1996) and Maio and Santa-Clara (2012). The coefficient on such variable is also meaningful; it captures the level of risk aversion of each listed firm.

THE DATA, VARIABLES AND THE MODEL

The Data

The CSMAR Database is specially designed to meet the demands of Chinese financial institutions, and is acknowledged by the academia. Recent empirical works like Wang and Qian (2011) who employs the data set to investigate the corporate philanthropic behavior. Specifically, we include the observations that contain valid information on risk premium, volatility, market premium, size premium, book-to-market premium, dividends, asset, return on asset, revenue and cash flows. Our data start from 1992 to 2011, since the very beginning years (1990 and 1991) contains too few observations.

The Variables

The variables in this paper are simple and commonly seen in the literature discussing the factors that influence the returns of the stock.

Data from CSMAR. The variables for the further discussions, i.e., div, asset, roa, revenue and cashflow are winsorized in case that our results are driven by these outliers. Actually we employ the level terms of these variables as equation (9) indicates.

We select the premia of the firms as our dependent variable, denoted as premium, which is calculated by taking off the annual risk free rate from the annual return of the stock. There are two measures of the annual returns of the stock, one that takes the reinvestment of dividends into account and the other doesn't. We check interchangeably with the two calculation methods in order to be free from measurement error, and denote them as premiumr and premiumnr respectively. The dependent variable for further discussion in section 4.3.2 on the internal rate of returns of the firms is the total dividends paid out div, measured by its paying out period times the total shares then, and summed to annual level.

Table 1: Summary Statistics

Variable	definition	Obs	Mean	Std. Dev.	Min	Max
$premium^r$	Reinvested premium (%)	19085	2.84	2.1	-11.673	19.276
$premium^{nr}$	Nonreinvested premium (%)	19085	2.84	2.102	-11.673	19.276
vol_{tot}	volatility (net profit)	20478	0.045	0.08	0	0.067
vol_{net}	volatility (total profit)	20475	0.041	0.07	0	0.062
mkt_{trd}	market premium (trading volume)	21182	0.009	0.045	-0.075	0.093
mkt_{tot}	market premium (total volume)	21182	0.008	0.042	-0.078	0.078
smb_{trd}	*smb* (trading volume)	21182	0.008	0.015	-0.019	0.075
smb_{tot}	*smb* (total volume)	21182	0.009	0.015	-0.022	0.045
hml_{trd}	*hml* (trading volume)	21182	0.001	0.011	-0.058	0.022
hml_{tot}	*hml* (total volume)	21182	0.005	0.014	-0.022	0.069
div	total dividends in million	21280	216.150	331.617	0	1018.434
asset	total asset in million	19431	2332.204	2136.552	438.237	7162.206
roa_{tot}	return on asset (total profit)	19429	0.062	0.045	0.006	0.134
roa_{net}	return on asset (net profit)	19216	0.050	0.037	0.004	0.109
revenue	total revenue in million	21243	1178.25	1063.569	185.223	3149.708
cashflow	total cash flow in million	20940	42.375	115.510	-99.462	248.674

The independent variable is the newly proposed factor influencing the risk premium of the stock, namely, the weighted volatility vol, corresponds to σ2(1 − xˆ) in equation (6). The σ2 is the volatility of firms' risk asset return, which is calculated as the variance of return of asset. x is measured by their risk free assets, the cash and deposits, the actual risk free rate is thus adjusted by three the comparative weights of these risk free assets. Since the returns are also calculated in two alternative ways, one by the total profit (voltot) while the other by net profit (volnet), we use the two computations of volatility in case of the measurement error. As for the further discussion in section 4.3.2, we use firms' total asset asset to determine the internal rate of return of the firms in China, which is captured by the estimated coefficient on it.

The control variables are the common three factors in Fama-French, the market premium (mkt), the size premium (smb) and the book-to-market premium (hml). Since in China, the market value of of firms take on two different measures, the total market value and the genuinely traded market values since some of the stocks couldn't be sold out due to political, historical and economical reasons, we use superscript tot and trd to denote the difference. We have further control variables in section 4.3.2, and select commonly recognized controls like profitability (return on equity), revenue and cash flow (see, e.g., Denis and Osobov (2008) and Chay and Suh (2009)).

Table 1 reports the descriptive statistics of the variables involved in our paper. We see that interchangeable measures of premia, volatility and return on asset don't differ from each other much, and no obvious abnormal values are found after we winsorize the outliers for dividend, asset, return on asset, revenue and cash flow. Besides, we find that the risk premium of stocks in China is 2.84%, and the market premium is only 0.9%, suggesting that single stock might be somehow profitable but stock market is not as a whole compared to the risk free rate.

The Estimation technique

We are interested in the volatility measure we proposed in Section 2 and control for the common three factors on account of their reliability and stability in stock returns forecast as argued in Fama and French (1996) and Maio and Santa-Clara (2012). We run the time series regressions first to get the coefficients on the premia (size, value and market), i.e. the β's. Then we run the cross sectional regressions of estimated β's, size, market to book ratio and the proposed weighted volatility. Then taking out the coefficient estimate on the weighted volatility, one can conduct hypothesis testing and calculate the (average) risk aversion coefficient: the statistical significance tells us whether the weighted volatility should be an additional factor influencing the return of the stock and its magnitude measures the level of risk aversion of listed firms.

THE EMPIRICAL RESULTS

Basic Results

Table 2 presents the baseline results. Maio and Santa-Clara (2012) argue that the stock return should be estimate based on the relative risk aversion. In our regressions, the coefficient estimates on the volatility measure captures the relative risk aversion coefficient according to equation (6).

In all of the eight regressions, we find that the weighted volatility positively and significantly affect the premium at 1% level, regardless of how the premium is calculated (consider the reinvestment of dividends or not) or the way volatility is measured (using total profit or net profit to derive return on asset and then calculate the volatility). One point increase in the volatility measure requires around 7.5 point premium compensation, therefore the volatility influences premium not only in statistical sense, but economically. Alternatively, as the volatility increases by one standard deviation (0.008), the premium rises by 0.6% in absolute value or 21.1% in its total value (2.84%). Therefore, the previous studies that neglect such important factor might lead to biased estimates, as warned by Cochrane (2011). Moreover, the coefficient estimates mean that the relative risk aversion coefficient of firms in China is about 7.5, intuitively different from 0. In terms of the magnitude of the results, we find that in each of the each regression exhibits similar estimate, which implies that our results are robust to different measures of premium or volatility, and the concern of measurement error is nonexisting, or at least in higher order indefinite small.

Moreover, we see from Table 2 that the controls generally demonstrate similar results as did in previous studies like Fama and French (1993), Fama and French (1996) and so on. Both market premium (mkt) and size premium (smb) positively affect the stock premium, while the book-to-market premium (hml) negatively influences the stock premium; all of these factors are significant at 1% level and their economical significance is large: one deviation increase in market premium, size premium and book-to-market premium result in 7.2%, 1.76% and -2.25% change in absolute stock premium, or 253%, 62.2% and -79.2% percentage variation in the stock premium. The estimates on these controls are also stable and robust as the different model specifications give similar estimates in magnitude.

Besides, our model possesses a strong explanatory power, the factors included in our model can explain over 26% of the variation in stock risk premium, the increase is large when adding the volatility measure, since the examination of the original three factor model yields 11% as the parameter of determination R2.

The Robustness across the Sample

People might worry that our estimates could be the results might not hold for some firms fall into some certain groups, and we investigate the possibility on subsamples according to the market status, i.e., their ownership and monopolistic degree of the industry, following Fligstein, Zhang, and Qiao (2012). It is commonly held view that the industry characteristics and structure affect the firms' performance, as is seen in Denis and Osobov (2008) and Fligstein, Zhang, and Qiao (2012).

Table2:BasicResults

VARIABLES	(1)(2)(3)(4)(5)(6)(7)(8)
	$premium^r$ $premium^r$ $premium^r$ $premium^r$ $premium^{nr}$ $premium^{nr}$ $premium^{nr}$ $premium^{nr}$
vol^{tot}	7.491***7.130***7.577***7.062***
	(1.695)(1.472)(1.704)(1.479)
vol^{net}	7.858***7.476***7.634***7.254***
	(1.594)(1.985)(2.614)(2.000)
mkt^{trd}	1.617***1.685***1.560***1.627***
	(0.263)(0.282)(0.264)(0.282)
smb^{trd}	1.615***1.632**1.904***1.623***
	(0.213)(0.292)(0.216)(0.295)
hml^{trd}	-1.946***-1.909***-1.950***-1.913***
	(0.492)(0.599)(0.496)(0.602)
mkt^{tot}	1.587***1.438***1.549***1.400***
	(0.263)(0.280)(0.263)(0.280)
smb^{tot}	1.626***1.791***1.935***1.102***
	(0.320)(0.373)(0.322)(0.374)
hml^{tot}	-1.711***-1.553***-1.004***-1.843***
	(0.396)(0.353)(0.338)(0.355)
Constant	-2.403***-2.149***-2.881***-2.527***-2.402***-2.147***-2.881***-2.526***
	(0.017)(0.016)(0.019)(0.017)(0.017)(0.016)(0.019)(0.017)
Observations	18,81918,81918,81718,81718,81918,81918,81718,817
R^2 squared	0.2750.2650.2650.2800.2730.2640.2640.279

DatafromCSMAR.

Estimatesarebasedonequation(??).

Standarderrorsinparentheses.***p < 0.01 ,**p < 0.05 ,*p < 0.1

We divide the sample according to a seminal work in Fligstein, Zhang, and Qiao (2012) that summarizes it as the impact of institutional logics. Specifically, we distinguish state-owned enterprises from non-stateowned ones suggesting the impact of the institutions (see Fligstein, Zhang, and Qiao (2012)). We also exploits the share (investment, asset, sales or number of employees) of state-owned-enterprises to that of total industry and derive the monopolistic degrees. Finally in our sample the monopolistic industries include those whose monopolistic degrees exceed thirty like B (Mining and Quarrying Industry), D (Electricity, Gas and Water Production and Supply Industry), I (Finance and Insurance Industry) and those under thirty are defined as competitive ones like A (Agriculture Industry), E (Construction Industry), H (Wholesale and Retail Trade Industry) following Fligstein, Zhang, and Qiao (2012). Codes are from China Securities Regulatory Commission and concrete details are found in Appendix A. The monopolistic degrees of the industry where they operate might also indicate a difference as argued by Fligstein, Zhang, and Qiao (2012) to indicate the influence of institution.

We report only the estimates on voltot and volnet and are willing to provide the estimates on controls upon request. The estimates on controls are omitted since they are almost identical to what we report in Table 2 and of less importance compared to our independent variable. Table 3 illustrates the subsample results. We see that in each regression, however the variables of interest (the premium and volatility) are defined or the sample are divided, similar results to the baseline regression as reported in Table 2 are found: each estimate on the volatility is significant at 1% level and the magnitude don't deviate from that of the baseline one much, allowing for some relatively small fluctuations in their own subsamples. It is clear that non-state-owned enterprises are more risk averse: the estimated coefficients on the volatility are around 8 while those for state-owned enterprises are about 6.5, about 20% lower. Besides, companies belong to competitive industries own a higher level of risk aversion, the estimates are around 9 while those for their counterparts in monopolistic industries are 6.5, the difference is even larger, about 28%.

Overall, the subsample results confirm the existence of the volatility factor developed in Section 2: these estimates are both statistically and economically significant. Meanwhile, we find non-state-owned firms and firms in competitive industries are more risk averse, this might reflect that non-government backup companies and competitive companies are more sensitive to the institutions and immature capital market in China in facing of the fierce competition (see, e.g., Paler (2005), Wang and Qian (2011) and Fligstein, Zhang, and Qiao (2012)).

Table3:SubsampleResults

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	$premium^r$	$premium^r$	$premium^r$	$premium^r$	$premium^{nr}$	$premium^{nr}$	$premium^{nr}$	$premium^{nr}$
	Non-State-Owned							
vol^{tot}	7.533***	8.663***	7.575***	8.521***				
	(1.604)	(1.318)	(1.614)	(1.325)				
vol^{net}					8.161***	8.363***	9.195***	9.424***
					(1.562)	(1.661)	(1.582)	(1.673)
	State-OwnedEnterprise							
vol^{tot}	6.930***	6.670***	6.120***	6.805***				
	(1.836)	(1.575)	(1.867)	(1.604)				
vol^{net}					7.748***	7.203***	7.904***	7.336***
					(1.009)	(1.444)	(1.072)	(1.502)
	TheFirmsinCompetitiveIndustry							
vol^{tot}	9.373***	9.908***	9.431***	9.795***				
	(1.307)	(1.023)	(1.319)	(1.033)				
vol^{net}					8.785***	8.825***	8.541***	8.578***
					(1.010)	(1.249)	(1.036)	(1.267)
	TheFirmsinMonopolisticIndustry							
vol^{tot}	6.136***	6.249***	6.296***	6.343***				
	(1.440)	(1.127)	(1.453)	(1.137)				
vol^{net}					6.487***	6.989***	6.400***	6.899***
					(1.386)	(1.502)	(1.413)	(1.523)

DatafromCSMAR.
Estimatesarebasedonequation(??).
Standarderrorsinparentheses.*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Further Discussions

The Risk Aversion of the Frims

We collect the estimates from the Table 2 and 3. The coefficient estimates on vol (α4) measures relative level of risk aversion γ of the firms. We see that the estimates are around 7.5 for the whole sample, meaning that in China firms are somehow more risk averse than United States, whose relative risk aversion coefficients lie in the range of zero to five according to Kollmann (1996) who summarizes the previous studies and derives two in his own study. Our estimates fall somehow out of the range provided by previous studies, and it is reasonable in that the existing works on relative risk aversion coefficients mainly study the situation in mature stock market like United States like Kollmann (1996) rather than China, as the legislative system in China is not complete compared to United States as argued by Paler (2005), and firms in China have to struggle to seek for political protection from the government (like Wang and Qian (2011) discover), the risk aversion coefficient in China should be higher.

Table 4: The Risk Aversion and Patience of the Firms

Panel A	The Risk Aversion of the Firms				
Group	Overall	non-state-owned enterprises	state-owned enterprises	firms in competitive industry	firms in monopolisitc industry
relative risk aversion coefficient	7.435	8.429	7.090	9.155	6.475
Panel B	The Patience of the Firms				
Group	Overall	non-state-owned enterprises	state-owned enterprises	firms in competitive industry	firms in monopolisitc industry
$\frac{D_t}{A_t}$	0.1089	0.1095	0.0965	0.1051	0.1083
internal rate of return	0.470	0.561	0.363	0.532	0.452

Data from CSMAR.

Numbers of Panel A come from Table 2 and 3.
Numbers of Panel B come from Panel A and are calculated with the data through equation (9).
We compare the estimates of whole sample in Table 2 with subsample ones in Table 3 to find more details regarding different types of firms characterized through our division principle of subsamples. We discover that: non-state-owned enterprises are more risk averse, and firms in competitive industry are more risk averse. This reflects the phenomenon that state owned firms might be less worried about the risk on account of its ownership, and government might pump money into these firms in case of danger. Moreover, the monopolistic firms might share high profit with little competition, and thus these firms are less risk averse.

But what is the very origin of such phenomenon? We argue that government plays an important role in capital market; on one hand it rapidly established the capital market, while on the other hand still intervenes the market. The intensive participation of government impedes the functioning of market through its discrimination of private property right (like the unfavorable policies and state owned bank's reluctance to lend money) and administratively monopolizes some certain industries, as are seen in the policies, government documents, etc. Meanwhile, the ambiguity of the state ownership contributes to their insensitiveness to the potential risks, for instance, the 554 million dollars loss of China National Offshore Oil Corporation in 2004. And even worse, the state-owned enterprises are still expecting the bailouts by the government; the mind set further hinders the risk consciousness of the state-owned enterprises.

The Implied Internal Rate of Return of Firms in China

From the simple ratio of $\frac{D_t}{A_t}$ from the Panel B in Table 4, we see that the implied discounted cash flow rate of return in China is higher than that in United States which is calculated by Dodonova and Khoroshilov (2007).

Table 5: The Regression Analysis of the Firms' Patience

	(1)	(2)	(3)	(4)	(5)	(6)
	div	*div*	*div*	*div*	*div*	*div*
asset	0.1223***	0.1024***	0.1206***	0.1076***	0.1212***	0.1075***
	(0.017)	(0.011)	(0.014)	(0.010)	(0.014)	(0.010)
roa_{tot}			5.7597***	2.6321***		
			(0.7445)	(0.4166)		
roa_{net}					7.0745***	3.2285***
					(0.9156)	(0.5117)
revenue			0.0204***	0.0055***	0.0200***	0.0049**
			(0.0029)	(0.0019)	(0.0030)	(0.0019)
cashflow			0.0669**	0.0440***	0.0607**	0.0417***
			(0.0274)	(0.0147)	(0.0276)	(0.0147)
internal rate of return	0.566	0.431	560	0.400	0.562	0.399
Individual Dummy	No	Yes	No	Yes	No	Yes
Year Dummy	No	Yes	No	Yes	No	Yes
Observations	19,431	19,431	19,083	19,083	18,875	18,875
Pseudo-R^2	0.0105	0.0106	0.0243	0.0244	0.0243	0.0244

Data from CSMAR.

Estimates are based on equation (11).
Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We investigate further through the equation (9) to find out the magnitude of discounting factor β, which measures the internal rate of return.

We employ tobit model to estimate the association between dividends and asset since dividend censored at 0 which is not only commonly seen in China that firms pay little dividend to their stockholders but also in other part of world, even in United States as reported by Denis and Osobov (2008). Moreover, the unobserved variables might influence the corporate behavior, we further check the robustness of the model by applying panel setting to the tobit model. The empirical model is:

$$div_{i,t} = \alpha_0 + \alpha_1 asset_{i,t} + \alpha_2 roa_{i,t} + \alpha_3 revenue_{i,t} + \alpha_4 cashflow_{i,t} + u_{i,t} \quad u_{i,t} = \mu_i + \lambda_t + \epsilon_{i,t}$$

where the disturbance term ui,t now contains the individual fixed effect μi to denote the firms' specific characteristics invariant to time and time fixed effect λt to capture the common shock invariant to individual firms. The definitions of other variables have been given in Table 1. Although the subscripts contains {i,t}, we estimate the model with tobit model as well as the tobit model with dummy variables indicating individual and time fixed effects. Table 5 reports the corresponding results.

We don't include the price of stock as controls as the price has already been decomposed and reflected in the other controls, like asset, return on asset, revenue and cash flow as argued by Chay and Suh (2009). Moreover, Denis and Osobov (2008) maintain that the price should not enter the model for its insignificance in their studies. We actually examine the model with stock price and the estimates stay virtually unchanged.

The estimates on asset are similar within or without the fixed effects, but from the Panel B in Table 4, we see that the tobit model in panel setting yields more reliable results. The estimates are around 0.107, meaning that the association between dividend paying outs and asset are similar to the simple ratio measure in Panel B of Table 4. We then calculate the implied β, i.e., the internal rate of return and the results demonstrate that firms in China are required much higher returns than those in United States, whose requirement on return is only about 15% pre-tax according to Dodonova and Khoroshilov (2007). The phenomenon indicates that Chinese stockholders are speculative on the listed companies they invested rather than emphasize the value of investment in the long run. Similar to the level of risk aversion discussed in Section 4.3.1, nonstate-owned enterprises and firms in competitive industry are required higher returns; the non-state-owned enterprises have to compensate their investors with about 50% more than their counterparts, while the figure for firms in competitive industry is about 18%, the difference is apparent. Our results are consistent with Aivazian, Ge, and Qiu (2005), who argue that the state-owned-enterprises and government intervened firms (like those firms in monopolistic industries) bear more burden and are less profitable, in this way, investors place high expectations on non-state-owned enterprises and firms in competitive industries.

It is no surprise that speculations in China stock market is serious. The incomplete capital market institution as we stated in Section 4.2 is a major contribution in that Chinese investors have only a few channels to invest, the quota system which was popular for years elevated the stock value for its scarcity although the profitability of Chinese listed firms is low as a certain proportion of firms' purpose of going public is to help them get out of trouble (like financial distress, see, e.g., Aivazian, Ge, and Qiu (2005)). The psychology might persist and speculation is prevalent. Besides, the lack of policy guidance to the investors worsen the situation and investors stick to their wrong belief in making money from stock investment.

CONCLUSION

In this paper, we study the existence of an unexplored factor that might affect the risk premium of the stock, the volatility of the asset of corresponding firms. We depict the wealth accumulation path as previous studies and for the first time lay the theoretical background of the additional factor to the classical FamaFrench three factor model. After that, we empirically investigate the model predictions with the data of listed firms in China and verify the existence of the factor. Besides, we discover that in China the listed firms are more risk averse and required higher internal rate of return than those in countries with mature stock market like United States. The phenomena imply that China is still on its way towards market economy, the stock market in China is immature and filled with speculative investors. Moreover, we find that non-stateowned enterprises and firms in competitive industries are more risk averse and required higher returns by the investors, out of institutional and historical reasons. These findings deepen our understanding of Chinese economy as well as shed light on the immaturity and the speculative property of China stock market.

In order to improve the capital market and prevent the speculation, we think that the government should do the followings. First of all, it is necessary for government to clarify its boundaries of administration and market, stop playing both athlete and referee, and establish the market-oriented mechanism for the capital market in order to guarantee the corporate interests institutionally. Second, government is required to continue the transformation of capital market and eliminate the radical obstacle of its development: the reform of the property right system through legislation to meet the requirements of market economy. As the political and historical considerations, a large proportion of state-owned enterprises couldn't be privatized, by this way could government fundamentally active the state-owned enterprises without privatizing the state-owned enterprises (see, e.g., Aivazian, Ge, and Qiu (2005)). Third, government should accelerate the deepening of capital market and establish more appropriate multi-layer market structure, like United States. The current stock market is far from an efficient one as the resources are monopolized by stateowned enterprises so that the benefits of other firms are few. Government might consider to create a fair environment to allow competition. Fourth, government might reform the banking system and fasten the privatization of the banks in order to release the power of finance into the economy. We might refer to the experience of Indian which loosened the control of banks and activated firms' development. Fifth, policy maker and regulators also need to increase the supply of stock, inventing more investment tools in order to eradicate the scarcity of financing products of Chinese investors so as to obstruct the speculation. Sixth, government should complete the legislative system and standardize the market, require firms to completely disclose their information so that investors wouldn't run into a maniac of stocks. Seventh, government should also consider offer education or training lessons to the investors, and help them establish correct investment philosophy.

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INDUSTRY TYPES

Table 6: Industry Types

Competitive Industries
agriculture industry (A); ferrous metals mining and dressing (B05); non-mental minerals mining and dressing (B09); other quarry industry (B49); agricultural products and by-products processing industry (C01); food industry (C03); beverage manufacturing industry (C05); textile industry (C11); textile clothing shoes and hats manufacturing industry (C13); leather and feather products industry (C14); wood processing industry (C21); furniture manufacturing industry (C25); paper making and paper products industry (C31); press industry (C35); cultural; educational and sports goods manufacturing industry (C37); chemical fiber manufacturing industry (C47); rubber manufacturing industry (C48); plastic product industry (C49); non-mental minerals products industry (C61); metal works industry (C69); general equipment manufacturing industry (C71); electronic appliances manufacturing industry (C76); instruments and cultural office machinery manufacturing (C78); medicine manufacturing industry (C81); construction industry (E); communication equipment manufacturing industry (G81); computer and related equipment manufacturing industry (G83); computer application services industry (G87); wholesale and retail trade industry (H); media and culture industry (L); Others (M)
Monopolistic Industries
coal mining and processing industry (B01); petroleum and natural gas extraction industry (B03) non-ferrous metals mining and dressing industry (B07); petroleum processing and coking industry (C41) chemical raw materials and chemical products manufacturing (C43); black metal smelting and rolling processing industry (C65); non-ferrous metal smelting and rolling processing industry (C67); special purpose equipment manufacturing industry (C73) transportation equipment manufacturing industry (C75) electricity; gas and water production and supply industry (D); transportation and warehousing industry (F); communication services industry (G85); finance and insurance industry (I); real estate industry (J); social service industry (K)

Codes are in parentheses, and they are from China Securities Regulatory Commission (CSRC).We calculated the administrative monopoly degrees with data from China Statistical Yearbooks of various years and measure in Fligstein, Zhang, and Qiao (2012).

