

ESTIMATING THE EQUITY RISK PREMIUM: THE CASE OF GREATER CHINA

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ABSTRACT

The expected equity risk premium is a key input in various financial applications. Different methods exist for estimating the risk premium. This paper applies two approaches to estimate it in the markets of Greater China. More specifically, the historical average and relative estimation are carefully examined. The first approach is applied to estimate the equity risk premium when the markets are recovering from a trough. Then the relative estimation approach is applied to justify those findings, taking into consideration the lower rate of return required of Chinese investors due to a lack of investment opportunities. After these adjustments, the risk premium in Mainland China is found to be close to those in Hong Kong and Taiwan. All of these markets have a higher risk premium than in the US market. The risk premiums for the Shanghai and Shenzhen markets are about 8% and 10%, respectively. The risk premiums for the Hong Kong and Taiwan markets are 8% and 9% compared to a long-term forward-looking risk premium of about 4% for the US market.

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I. INTRODUCTION

The equity risk premium is an important input used by investors (i.e., in estimating required returns on stocks), corporate managers (i.e., in determining a project's discount rate), and fund managers (i.e., in evaluating a portfolio's performance). However, empirical estimates of this critical number, the ex ante equity risk premium, are quite uncertain. Furthermore, most studies on this topic have focused on the US market, paying relatively little attention to other major equity markets. In the past decade, China has become the world's second largest economy, and its equity market has come to play an important global role. Due to culture similarity and geographic proximity, the equity markets in Hong Kong and Taiwan have become integrated with the market of Mainland China. Although the Greater China market (i.e., Mainland China, Hong Kong, and Taiwan) has been attracting increasing investments from the United States and other developed countries, little research has been conducted to empirically estimate its equity risk premium.

This paper attempts to fill this gap by providing empirical evidence on estimating the equity risk premium (*ERP*) in Greater China's stock markets using the methodology suggested by Damodaran (1999) and Dimson et al. (2003). As will be shown, there exist different methods of estimating the risk premium. This paper also aims to provide estimates from different methods, thus providing improved estimates of the equity risk premium based on different market conditions.

First, the equity risk premium is estimated from realized historical stock returns and Treasury bond yields, assuming that the ex post risk premium can promptly reflect the forward-looking expected risk premium. The key issue here is that we assume that the historical data covers a sufficiently long period to remove any abnormal fluctuations. However, the markets in Greater China, especially Mainland China, have a relatively short period compared to the US market. Another problem is that there may not be any reliable market-based data on long-term government bonds due to the underdevelopment of the bond market in China. Therefore, this paper slightly revises the standard method of using historical data; that is, it estimates the equity risk premium for all markets as they are rising from a trough. By applying this method, we implicitly allow the risk premiums estimated for all markets to reflect the market price of risk required by investors when the markets are recovering from a trough. In other words, we control for the business cycles for all markets and thus guarantee that the equity risk premiums are estimated under similar market conditions.

However, although we control for business cycle risk, the estimates from historical data might still not be reliable, because of the relatively short period for stock markets in China. This paper therefore uses another method to estimate the risk premium. This method is suggested by Damodaran (1999) and can be called a relative estimation approach. The idea is to first select a benchmark market and estimate its risk premium; then the risk premiums for other markets can be estimated by comparing their relevant risk levels to the benchmark market. This method assumes that the per unit price of risk is roughly the same for all markets. To make the estimation more precise, we make two adjustments. First, when estimating the risk premium for the benchmark market, we exclude factors that could bias the estimation, thus obtaining an unbiased forward-looking risk premium. Second, since China's investors have lower investment opportunities

compared to their foreign counterparts, they could require a lower rate of return. This factor is also taken into consideration in estimation.

In a comparison of the two approaches, the historical approach is found to provide a consistent and reasonable estimate only if the sample size is sufficiently large, a condition that might not be satisfied by most emerging markets, including China. On the other hand, the relative estimation approach can overcome this shortage and thus provides a reliable estimate.

The remainder of the paper is organized as follows: Section II provides the methodology for estimating the risk premium from historical data and the relative estimation. Section III discusses the data and reports the empirical findings. Section IV concludes the paper.

II. METHODOLOGY

The main difficulty in estimating the equity risk premium is that the expected stock return is unobservable. Empirical studies have to make certain assumptions when estimating the equity risk premium. A natural way to obtain the market risk premium is to estimate it directly from historical data. This is the realized market risk premium. A strand of literature focuses on applying different approaches to extract expected returns from realized returns. Not surprisingly, these studies show quite different results, depending on various methods and samples. In addition, most previous studies focus on the US market. This paper aims to provide empirical evidence on the Greater China markets by applying different estimation approaches, thus contributing to the literature by providing empirical evidence on the world's second largest economy, based on improved methods.

If we assume that the distribution of stock returns will remain unchanged over time, then the realized market risk premium provides a consistent estimation of the expected risk premium in the future. This assumption requires that we make estimations based on a relatively long period of historical data, as suggested by Dimson (2003). The approach is summarized as follows.

First we define the daily log return as $r_t = \ln(S_t/S_{t-1})$, where S_t is the close price of the stock on day t and r_t includes both the dividend yield and capital gains:

$$r_t = \ln(D_t / S_{t-1} + GS_t) \quad (1)$$

After obtaining the stock return, we subtract the risk-free rate to obtain the risk premium, as follows:

$$ERP_t = r_t - r_{ft} \quad (2)$$

This risk premium is actually the risk premium in real terms, since the inflation rate embedded in both the market return and the risk-free rate cancels out.

The risk-free rate is defined as the yield of a Treasury bond of a given maturity. The yields to maturity for three-month, one-year, five-year, and 10-year Treasury bonds were obtained daily. If valuation is based on a long-term analysis, then the

long-term risk-free rate is applied. The estimated results of short-term risk-free rates are also presented for comparison. Then the excess return or risk premium is defined as $r_t - r_{ft}$ based on a daily frequency. This measure is converted into the annualized risk premium by multiplication by the number of trading days in a year. Here, the analysis assumes 252 trading days in one year. The estimated risk premium is also adjusted for possible bias arising from the difference between the arithmetic and geometric means (for further discussion, see Blume, 1974; Cooper, 1996).

The limitation of estimating the equity risk premium from historical data, however, is also obvious. In their seminal paper, Mehra and Prescott (1985) show that the estimated equity risk premium from historical data is too high to be consistent with any reasonable assumption about risk aversion. Furthermore, the whole idea of using realized historical data to forecast the required risk premium depends on the stability of the data; however, we often observe that the data series fluctuates quite a lot. It is also reasonable to expect the required risk premium to be time varying. Finally, various factors influence stock prices, and some of them do not repeat themselves, and these must be taken into account when we use historical data to estimate the required risk premium.

One possible solution to alleviate these concerns is to estimate the risk premium based on similar market conditions for all markets. We thus make the estimated risk premium comparable for all markets. This paper estimates the risk premium from the so-called bottom point for all markets; that is, the estimation period starts at the beginning of the recovery for all markets. We can control for special market conditions and allow the risk premium to be estimated based on similar market conditions. There is plenty of evidence that markets covary strongly in bearish situations. For example, Erb et al. (1994) document that monthly cross-equity correlations between developed economies are strongest when any two economies are in a common recession, and they also show that the correlations are much higher in bear markets. This result could be due to factors that affect all markets in a bearish situation (for studies on this topic, see Campbell et al., 2002; Ang and Bekaert, 2004; Patton, 2004; Poon et al., 2006). By estimating the risk premium from the bottom point, we can take the impact of these factors into consideration and make sure that the risk premium is estimated under similar conditions for all markets.

Although the above-mentioned method alleviates the impact of some factors on the estimation of the risk premium when using historical data, the results could still suffer from the short period available for estimation, especially for emerging markets such as China (for further discussion, see Damodaran, 2008). Thus, another method is adopted to estimate the risk premium, namely, the relative estimation approach. The idea is first to choose a benchmark market and estimate its risk premium and then to calculate the risk premiums for other markets by comparing their risk levels to that of the benchmark. The key issue for this method is to choose a benchmark with a long data history and to correctly estimate the forward-looking risk premium from the historical risk premium for the benchmark, excluding all factors that could bias the estimation from historical data.

Following Dimson et al. (2003), the historical risk premium includes two factors whose effects must be separated out to correctly estimate the required risk

premium from historical data. These two factors are unexpected dividend growth and a fall in the required risk premium, the latter due to diminished business and investment risk. These two factors distort the estimation of the true risk premium from historical data, since they are based on investors' expectations and do not reflect a real change in the risk premium. We must therefore extract both from the actual historical data.

To estimate unexpected dividend growth, we assume that investors use the long-term real dividend growth rate to make a projections of future real growth. More specifically, at the beginning of year i , investors use the long-term real dividend growth rate up to year $i - 1$ to project the dividend growth rate in year i . At the end of year i , the investors observe the realized dividend growth rate that year. The unexpected dividend growth rate for year i is calculated as the difference between the projected dividend growth rate and the realized dividend growth, as in the following expression:

$$g_{ui} = \frac{1}{t-1} \sum_{i=1}^{t-1} g_i - g_t \quad (3)$$

where g_{ui} is the unexpected dividend growth rate for year t , g_i is the realized dividend growth up to year $t - 1$, and g_t is the realized dividend growth rate for year t . This procedure is repeated for each year, and the averaged unexpected dividend growth is subtracted from the historical equity risk premium:

$$\text{Unexpected dividend growth} = \frac{1}{T} \sum_{i=1}^T g_{ui} \quad (4)$$

Another factor we need to exclude from the historical data is the change in the valuation basis for equity markets due to diminished business and investment risk. The diminished business risk is attributable to technological innovation, productivity and efficiency growth, and improvements in management and corporate governance, and so forth. The diminished investment risk can be attributed to diversified benefits, decreases in transaction costs, and so on. All these factors can cause a fall in the required rate of return in the long term. For example, the price-to-dividend ratio at the start of 1900 was 23 for the United States, and it increased to 81 by 2002 (Fama and French, 2001). This change must partly reflect the fall in the required rate of return for investors. We have to exclude that factor when estimating the expected equity risk premium too. To keep things simple, we assume that the increase in the price-to-dividend ratio is attributed solely to the long-term fall in the required rate of return, as assumed by Dimson et al. (2003). Then the fall in the required rate of return is estimated as follows:

$$\text{Fall in required rate of return} = \sqrt[T]{\frac{(P/E)_T}{(P/E)_0}} - 1 \quad (5)$$

where $(P/E)_T$ and $(P/E)_0$ are the pricing–earnings ratios at the end and the beginning of the sample period, respectively, and T is the number of years for the sample period.

After obtaining the forward-looking projection of the equity risk premium for the US market, we can derive the equity risk premium for China from US estimates. Following Damodaran (1999), one simple approach is to assume that the market price of risk is relatively constant for all markets. Thus, if we know the equity risk premium for the benchmark market and the risks (as proxied by volatility) for the benchmark and other markets, we can estimate the equity risk premium for the other markets as follows:

$$ERP_i = \frac{\sigma_i}{\sigma_{US}} ERP_{US} \quad (6)$$

where σ_i and σ_{US} are the volatility of market i and the volatility of the US market, respectively.

The relative estimation approach appears attractive. It avoids the problem of the unreliable estimation of historical data due to a lack of long-term data for markets such as Mainland China. It also fits markets such as Taiwan, since it performed poorly for the estimation period, and the estimated risk premium could be close to zero or even negative, which does not make any sense for valuation. In that case, the relative estimation approach becomes a promising alternative to pure historical estimation.

We can even go a little further, especially for the case of Mainland China. Several studies show that the Chinese stock market is relatively segmented from the rest of the world. For example, Fernald and Rogers (2002) argue that domestic investors in China have fewer investment opportunities than their foreign counterparts due to strict capital control and other regulations. Yang (2003) concludes that the Chinese stock market has low correlations with other markets (for further discussion, see Bailey, 1994; Chen et al., 2001; Sun and Tong, 2000).

If domestic investors in Mainland China face fewer investment opportunities, they could require a lower rate of return, since they have few alternative options. However, the risk premium estimated from equation (6) is based on the assumption that investors assign the same value per unit of risk in all markets. Thus, it might not correctly reflect the risk premium in a segmented market such as China's. We need to make an adjustment to the value obtained from equation (6). The question that remains is how to quantify the adjustment or the difference in the required rate of return due to market segmentation. A ready proxy for such a spread is the average B- and H-share price discount.¹ According to Gordon's (1962) model, the current stock price can be expressed as

¹ B shares are shares issued by Chinese companies listed in the Shanghai and Shenzhen stock markets, which are also available to foreign investors, and H shares are issued by Mainland Chinese companies and are listed in the Hong Kong stock market. Some of these companies also issue A shares in the Shanghai or Shenzhen stock markets. The corresponding B or H shares enjoy the same dividend policies and voting rights. They are virtually equivalent to A shares for valuation purposes. However, B and H shares are usually priced lower than their A-share counterparts, which is referred to as the B- and H-share discount.

$$P_0 = \frac{D_1}{r - g} \tag{7}$$

where P_0 is the current stock price, D_1 is the dividend expected next year, r is the investor's required rate of return, and g is the dividend growth rate.

For A shares and corresponding B or H shares, equation (7) implies that

$$P = \frac{D_1}{(ERP + r_f) - g} \tag{8}$$

and

$$P' = \frac{D_1}{(ERP' + r'_f) - g} \tag{9}$$

where P and P' are the prices for domestic A shares and corresponding B or H shares, respectively; ERP and ERP' are the equity risk premiums for A shares and B or H shares, respectively; and r_f and r'_f are the corresponding risk-free rates for China and its counterpart, respectively. Since A shares and B or H shares are issued by the same company, they have the same dividend D_1 and the same dividend growth rate g .

Rearranging equations (8) and (9) yields the following equation for ERP :

$$ERP = \frac{P'}{P} [(ERP' + r'_f) - g] + g - r_f \tag{10}$$

Now assume that the risk premium for the proxy ERP' equals the risk premium we obtain from equation (6). As long as we know the proxy discount $\frac{P'}{P}$, the risk-free rate r_f and r'_f for China and its foreign counterpart, respectively, and the dividend growth rate g , we can estimate ERP by equation (10). For example, if $\frac{P'}{P} = 0.6$ (i.e., B or H shares are 40% cheaper than the corresponding A shares), $r'_f = 5\%$, $r_f = 3\%$, $ERP' = 11\%$, and $g = 2\%$; given these values, according to equation (10), $ERP = 7.4\%$. Thus, there is a 3.6% spread for the adjustment. We will apply this method for the adjustment in our empirical studies, which are covered in the next section.

III. DATA AND EMPIRICAL RESULTS

Data are collected from several markets in Greater China, including Shanghai, Shenzhen, Hong Kong, and Taiwan. For historical reasons, the stock markets in Hong Kong and Taiwan were opened much earlier than those in Shanghai and Shenzhen, the latter two were launched in the early 1990s. The Shanghai Composite Index (SHCI), the Shenzhen Composite Index (SZCI), the Hong Kong Hang Seng Index (HSI), and the Taiwan Weighted Index (TWII) are adopted as representative indexes for these four markets.

The SHCI is compiled and published by the Shanghai Stock Exchange. It is a weighted index that includes all stocks listed in Shanghai and total market capitalization is used as the weight for each stock. The publishing date for the SHCI is July 15, 1991, using December 19, 1990, as the basis date and 100 as the starting value. The construction of the SZCI is similar to that of the SHCI: it includes all shares listed in the Shenzhen stock market and uses total market capitalization as the weight for each stock. The HSI is one of the best-known indexes in Asia and is widely used by fund managers as their performance benchmark. It is a market capitalization-weighted index of representative stocks listed in the Hong Kong stock market. The TWII is also a market capitalization-weighted index similar to the HSI. Finally, for the US market, the Standard & Poor's (S&P) 500 index is chosen. It is the most representative index for overall market performance and is widely used for both academic and practical purposes.

Since the equity risk premium must be estimated from the bottom point, that is, the date when the markets start to recover from the bottom, the start date of such an event varies for different markets. For the US market, the start date of October 20, 1987, is chosen, the date following Black Monday in 1987 and when the stock market began to recover. For the Hong Kong market, June 6, 1989, is chosen, the date when the market started to rebound from the previous crash and then rapidly developed. For Taiwan, the start date is October 2, 1990, the date when the market started to recover from the bursting of the market bubble. For the two markets in Mainland China, that is, the Shanghai and Shenzhen stock markets, the estimation period from July 1, 1996, is chosen, since no significant crisis occurred due to fundamental changes since the establishment of the markets. Note that data for an earlier period were discarded, because of abnormal fluctuations in these markets. The ending date is fixed for all the markets as the last trading day in the year 2018.

The data are from Yahoo Finance and the Center for Research on Security Prices (CRSP). The risk-free rate for the US market is the yield to maturity of US Treasury bills with different maturities, ranging from three months to 10 years. The three-month Hong Kong Interbank Offered Rate is used as the risk-free rate for Hong Kong. Due to data limitations, the three-month deposit rate and the average deposit rate are selected as proxies for the risk-free rate for Mainland China and Taiwan, respectively.

Table 1.
Summary Statistics for Market Indices

SHCI, SZCI, HSI, TWII and S&P 500 refer to Shanghai Composite Index, Shenzhen Component Index, Hang Seng Index, Taiwan Weighted Index and S&P 500 Index, respectively. The data are collected from Yahoo!Finance and the CRSP data service. It is adjusted for dividends and splits. We assume that there are 252 trading days per year. In the following tables, without specified indication, all reported returns are in nominal terms.

Markets	SHCI	SZCI	HSI	TWII	S&P 500
Sample period	1996/7/1- 2018/12/28	1996/7/1- 2018/12/28	1989/6/6- 2018/12/31	1990/10/02- 2018/12/30	1987/10/20- 2018/12/30
Daily Observations	5433	5457	7313	7319	7863
Annualized Mean	5.25%	9.19%	8.66%	4.56%	11.0%
Annualized Stand Dev.	26.3%	29.3%	24.9%	23.7%	17.3%
Skewness	-0.431	-0.620	-0.010	-0.119	-0.200
Kurtosis	8.14	3.79	9.60	3.23	9.35

Table 1 reports the summary statistics for these indexes. We observe that the S&P 500 index has the most daily observations and the SHCI and SZCI have the least. The annualized mean is about 5% and 9% for the SHCI and SZCI, respectively, 9% for the HSI, 11% for the S&P 500, and less than 5% for the TWII. However, volatility is much higher for the SHCI and SZCI than for the S&P 500 index. This result is consistent with many other studies: emerging markets provide higher returns but are accompanied by higher risk, compared to developed markets. The annualized volatilities for the HSI and TWII are close and range between those of the SHCI, SZCI, and S&P 500. The skewness and kurtosis values indicate that the distributions of these return series are not far from normal.

Table 2.
Correlations between Different Markets for the Period 1996/7/1-2018/12/31

SHCI, SZCI, HSI, TWII and S&P 500 refer to Shanghai Composite Index, Shenzhen Component Index, Hang Seng Index, Taiwan Weighted Index and S&P 500 Index respectively. The data are collected from Yahoo!Finance and the CRSP data service. It is adjusted for dividends and splits. Total Observations total 5457. Finally, * and * indicate significance level at 1% and 5%, respectively.

Markets	SHCI	SZCI	HSI	TWII	Lagged S&P 500
SHCI	1	0.922**	0.258**	0.130	0.109**
SZCI	-	1	0.279**	0.152*	0.125**
HSI	-	-	1	0.345**	0.489**
TWII	-	-	-	1	0.219**
S&P 500	-	-	-	-	1

Table 2. (Cont.)
Correlations between Different Markets for the Period 2002/7/1 – 2018/12/31

SHCI, SZCI, HSI, TWII and S&P 500 refer to Shanghai Composite Index, Shenzhen Component Index, Hang Seng Index, Taiwan Weighted Index and S&P 500 Index respectively. The data are collected from Yahoo!Finance and CRSP data service. It is adjusted for dividends and splits. Total Observations total 3988. Finally, * and * indicate significance level at 1% and 5%, respectively.

Markets	SHCI	SZCI	HSI	TWII	Lagged S&P 500
SHCI	1	0.945**	0.397**	0.195**	0.215**
SZCI	-	1	0.352**	0.214**	0.234**
HSI	-	-	1	0.416**	0.508**
TWII	-	-	-	1	0.265**
S&P 500	-	-	-	-	1

Table 2 reports the Pearson correlation coefficient estimates for the period from July 1, 1996, to December 31, 2018. Considering the time difference and leading effects of the US market, we use the lagged S&P 500 index (which is lagged by one day) instead of the S&P 500 index on the same day to calculate its correlation with other indexes. It is obvious from the table that the two stock markets in Mainland China have much lower correlations with the S&P 500 index than the HSI and the TWII. However, there is strong evidence of a highly positive correlation between the SHCI and the SZCI. This result indicates that the stock markets in Mainland China are still relatively segmented from the other markets in the world. The HSI and TWII have higher correlations with the S&P 500 index, although the correlation between the HSI and the S&P 500 is almost doubled that between the TWII and the S&P 500. Considering the acceleration in openness of China's capital markets in recent years, the estimation results for the correlation coefficient from

July 1, 2002, to December 31, 2018, are also presented. The results are shown in the second panel of Table 2. It is interesting to see from the table that the correlation between the SHCI and SZCI and the S&P 500, respectively, increase to 0.215 and 0.234 from 0.109 and 0.125, respectively, for the full period, although these values are still lower than the correlations between the HSI and TWII and the S&P 500. In addition, the correlation between the HSI and TWII and the S&P 500 index doesn't increase much further. However, the correlation between the HSI and the two mainland stock markets is almost doubled. This result indicates that, in recent years, the Hong Kong stock market has become more integrated with the two mainland stock markets, and we believe the trend would continue in the future, considering the increasingly closer economic relations between these markets.

Table 3.
Estimation Results of Ex Post Market Risk Premium for S&P 500 Index Using Historical Data

This table reports the real equity risk premium for Shanghai, Shenzhen, Hong Kong, Taiwan market indices as well as S&P 500, which stands as a benchmark. The risk-free rate is denoted as r_f . It refers to the 3-month deposit rate for Shanghai and Shenzhen, the 3-month HIBOR for Hong Kong, the 3-month average deposit rate for Taiwan and yield on 3-month treasury note for S&P 500. The index return v is the total return which includes dividend yield and capital gain. The real ERP = $r - r_f$, since inflation is embedded in both nominal terms, r and r_f , and thus cancelled out. σ is the standard deviation and all variables are annualized.

Maturity for treasury bonds	3-month	1-year	5-year	10-year
Estimation Period	1954/1/4- 2007/12/31	1959/7/15- 2001/08/24	1962/1/2- 2007/12/31	1962/1/2- 2007/12/31
Total Observations	13439	10480	11448	11448
Averaged Daily ERP	0.0242%	0.0186%	0.0136%	0.0127%
Averaged Yearly ERP	6.10%	4.67%	3.42%	3.20%
Yearly Standard Err.	14.3%	14.3%	14.8%	14.8%

For comparison reasons, we next estimate the risk premium for the S&P 500 index against Treasury yields with different maturities for a long period of nearly 50 years. The results are presented in Table 3. We see that, for different risk-free rates, the risk premium ranges from 3.20% to 6.10%. These results are similar to those of previous studies (i.e., Fama and French, 2002; Goetzmann and Ibbotson, 2005).

Table 4.
Equity Risk Premium for Different Sectors in Shanghai Stock Market

This table reports the real equity risk premium for industry sectors of Manufacturing, Real Estate and finance in Shanghai stock market. The risk-free rate is denoted as r_f . It refers to the 3-month deposit rate. The index return r is the total return which includes dividend yield and capital gain. The Real ERP = $r - r_f$, since inflation is embedded in both nominal terms, r and r_f , and thus cancelled out. σ is the standard deviation and all variables are annualized. The Sharpe Ratio is defined in the usual way as Real ERP/ σ .

Sectors	Manufacturing	Properties	Market	Finance	Market
Period	1997/1/1- 2018/12/28	1997/1/1- 2018/12/28	1997/1/1- 2018/12/28	2004/1/1- 2018/12/28	2004/1/1- 2018/12/28
r_f	2.15%	2.15%	2.15%	2.03%	2.03%
Real ERP	9.06%	2.62%	7.71%	25.3%	11.9%
σ	27.1%	35.1%	26.6%	35.0%	28.9%
Sharpe Ratio	0.334	0.0746	0.290	0.723	0.412

Table 5.
Equity Risk Premium for Different Sectors in Shenzhen Stock Market

This table reports the real equity risk premium for industry sectors of Manufacturing, Real Estate and finance in Shenzhen stock market. The risk-free rate is denoted as r_f . It refers to the 3-month deposit rate. The index return r is the total return which includes dividend yield and capital gain. The Real ERP = $r - r_f$, since inflation is embedded in both nominal terms, r and r_f , and thus cancelled out. σ is the standard deviation and all variables are annualized. The Sharpe Ratio is defined in the usual way as Real ERP/ σ .

Sectors	Manufacturing	Market	Properties	Finance	Market
Period	2001/3/1- 2018/12/28	2001/3/1- 2018/12/28	2002/2/2- 2018/12/28	2002/2/2- 2018/12/28	2002/2/26- 2018/12/28
r_f	1.95%	1.95%	1.94%	1.94%	1.94%
Real ERP	-6.73%	7.79%	15.8%	8.50%	16.50%
σ	42.9%	29.0%	36.4%	39.9%	29.70%
Sharpe Ratio	-	0.269	0.434	0.213	0.556

Table 6.
Equity Risk Premium for Different Sectors in Hong Kong Stock Market

This table reports the real equity risk premium for industry sectors of Commerce & Industry, Properties and finance in Hong Kong stock market. The risk-free rate is denoted as r_f . It refers to the 3-month HIBOR rate. The index return r is the total return which includes dividend yield and capital gain. The Real ERP = $r - r_f$, since inflation is embedded in both nominal terms, r and r_f , and thus cancelled out. σ is the standard deviation and all variables are annualized. The Sharpe Ratio is defined in the usual way as Real ERP/ σ .

Sectors	Commerce & Industry	Properties	Finance	Market
Period	1993/1/1-2018/12/31	1993/1/1- 2018/12/31	1993/1/01- 2018/12/31	1993/1/1- 2018/12/31
r_f	4.36%	4.36%	4.36%	4.36%
Real ERP	6.00%	5.31%	12.12%	7.61%
σ	31.5%	32.7%	25.6%	26.4%
Sharpe Ratio	0.190	0.162	0.473	0.288

Table 7.
Equity Risk Premium for Different Sectors in Taiwan Stock Market

This table reports the real equity risk premium for industry sectors of Electronic and finance in Hong Kong stock market. The riskfree rate is denoted as r_f . It refers to the 3-month deposit rate. The index return r is the total return which includes dividend yield and capital gain. The real ERP = $r - r_f$, since inflation is embedded in both nominal terms, r and r_f , and thus cancelled out. σ is the standard deviation and all variables are annualized. The Sharpe Ratio is defined in the usual way as Real ERP/ σ . The dividend yield is included in the total return. The average dividend for electronic and finance industry is 2.59% and 2.26% respectively.

Sectors	Electronic	Finance	Market
Period	2000/1/5-2018/12/28	2000/1/5-2018/12/28	2000/1/5-2018/12/28
r_f	2.25%	2.25%	2.25%
Real ERP	-5.22%	0.35%	-0.07%
σ	-	2.25%	-
Sharp ratio	-	0.0126	-

Table 8.
Equity Risk Premium for Different Sectors in US Stock Market

This table reports the nominal and real equity risk premium for industry sectors of Manufacturing, Real Estate and finance in Shenzhen stock market. The risk-free rate is denoted as r_f . It refers to the yield on 3-month treasury note for S&P 500. The index return r is the total return which includes dividend yield and capital gain. The real ERP = $r - r_f$ since inflation is embedded in both nominal terms r and r_f . σ is the standard deviation and all variables are annualized. The Sharpe Ratio is defined in the usual way as Real ERP/ σ .

Sectors	Industry	Bank	Nasdaq Composite	S&P 500
Period	1991/1/3- 2018/12/31	1991/1/3- 2018/12/31	1991/1/3-2018/12/31	1991/1/3- 2018/12/31
r_f	3.83%	3.83%	3.83%	3.83%
Real ERP	5.12%	7.97%	6.63%	7.15%
σ	22.1%	14.6%	23.8%	15.9%
Sharpe Ratio	0.232	0.546	0.279	0.450

Tables 4 to 8 report the estimated risk premium for representative sectors in the different markets. We select the manufacturing, real estate, and finance sectors for the Shanghai and Shenzhen stock markets, and the results are presented in Tables 4 and 5. Due to data availability, the estimation period is shorter compared to that in Table 3 and varies for the different sectors. For comparison, we also provide the estimation results for the market index, in addition to the sectors. In Table 4, we see that the manufacturing sector offers a slightly lower risk premium than the market, although the real estate sector offers a risk premium of less than 3%. The finance sector performs much better than the market and other sectors, which can be verified by its Sharpe ratio, which is the highest.

However, the result for the Shenzhen market is quite different. Table 5 shows that the manufacturing sector has the worst performance, and the real estate sector has the best. Note that the estimation period for Shanghai starts in 2001 instead of 1998. We can reasonably conclude that the real estate sector has developed quite positively in recent years, while the manufacturing sector did well in earlier years but has worsened since 2001. Table 6 reports the sector risk premium for Hong Kong. Again, the finance sector leads the market, and other sectors, such as the commerce and industry and the real estate sectors, provide similar but lower risk premiums. The results for Taiwan are presented in Table 7. Although the risk premiums are quite low or even negative, we still can see that the finance sector beats the market, and the risk premium for electronic sector is much lower than the market risk premium. The results in Table 8 for the US market are not much different. The industry sector is behind the market, and the finance sector is in the leading position compared to the market. From the above-mentioned tables, we can conclude that the finance sector performs positively against the market in almost all the markets, while the performance of the manufacturing sector seems to be behind the market.

Table 9.
Estimation Results of ex post Market Risk Premium for China's Indices for Selected Periods

Note: This table reports the estimation results of ex post Market Risk Premium of Greater China's stock markets for different subperiods. For Taiwan market, the first period is from 1998/01/01 –1999/01/01. The values in the parenthesis are standard errors in percentage.

Markets	SHCI	SZCI	HSI	TWII
1996	21.5% (33.8%)	79.1% (49.6%)	29.4% (14.5%)	-
1997	23.2% (34.5%)	23.0% (38.4%)	29.9% (39.7%)	-
1998	-6.93% (20.8%)	-37.7% (22.0%)	-14.9% (43.7%)	-28.1% (24.0%)
1999	15.3% (27.4%)	11.0% (32.1%)	46.2% (26.7%)	22.6% (26.9%)
2000	39.7% (21.2%)	32.4% (23.5%)	-17.8% (31.0%)	-62.0% (36.7%)
2001	-25.1% (21.4%)	-37.5% (22.4%)	-31.6% (27.3%)	11.6% (30.9%)
2002	-20.1% (23.7%)	-19.9% (24.7%)	-21.9% (19.1%)	-24.3% (27.7%)
2003	7.47% (17.4%)	21.0% (18.7%)	28.8% (16.8%)	26.4% (21.3%)
2004	-17.8% (20.6%)	-14.2% (21.7%)	11.8% (16.2%)	2.94% (23.5%)
2005	-11.0% (21.2%)	-8.02% (22.2%)	1.36% (11.3%)	5.13% (12.8%)
2006	81.7% (21.0%)	82.1% (23.8%)	25.0% (14.3%)	16.2% (16.2%)
2007	65.3% (34.7%)	95.6% (38.7%)	28.5% (25.9%)	6.75% (20.8%)
2008.6.30	-134% (45.1%)	-129% (49.7%)	-47.4% (38.5%)	-26.1% (26.2%)

Table 10.
Equity Risk Premium for Greater China's Indices, Using the US market as Benchmark

This table reports the estimated risk premium from relative estimation approach. The risk-free rate for U.S. is the average 10-year treasury bond yield for the sample period. The unexpected dividend growth rate is estimated according to (3) and (4). The fall in required rate of return is estimated according to (5). The relative ERP is estimated according to (6). The adjusted-ERP for Shanghai and Shenzhen is

Markets	SHCI	SZCI	HSI	TWII	S&P 500
Period	1996/7/1- 2018/12/31	1996/7/1- 2018/12/31	1989/6/6- 2018/12/31	1990/10/2- 2018/12/31	1926/1/1- 2018/12/31
r_f	2.25%	2.25%	4.52%	4.33%	5.22%
Real ERP	11.4%	12.4%	10.33%	2.69%	6.70%
Unexpected div _g	-	-	-	-	0.66%
Fall in r_g	-	-	-	-	1.60%
Relative ERP	11.23%	14.04%	8.19%	8.75%	4.44%
Adjusted ERP	7.98%	9.71%	-	-	-
σ	34.4%	43.0%	25.1%	26.8%	13.6%

As mentioned earlier, the estimates from historical data suffer from several weaknesses. The biggest problem is that the estimated risk premium can vary significantly from year to year. To obtain reliable estimates, we need a sufficiently long period of historical data to smooth out good and bad luck. However, it is difficult for emerging markets to meet this requirement, since these markets usually have a short history and often suffer from abnormal fluctuations. To check this, we estimate the realized risk premium for each year over the estimation period for all the markets in Greater China and present the results in Table 10. We see that these estimated risk premiums range widely from year to year, especially for the SHCI and SZCI. From Table 9, we can see that, for the period 1996–2008, the annual risk premium reaches as high as 81.8% for the SHCI and then changes by more than -100% (in the log return). The story is similar for the SZCI. Although the HSI and TWII are not as volatile as the SHCI and SZCI, they also face a similar problem of large deviations from the mean. Thus, the results cannot sufficiently justify estimating the risk premium by only using historical data.

To make sure that our estimated risk premium from the historical data is reliable, we use an alternative approach to obtain other estimates, namely, the relative estimation approach. As illustrated before, we first choose a benchmark market and estimate a reliable risk premium for it; then, the risk premium for other markets can be derived by comparing the relevant risk between the benchmark and target markets. The key is to estimate the forward-looking risk premium for the benchmark correctly. We exclude two factors from the estimation of the purely historical risk premium: unexpected dividend growth and the fall in the required rate of return. After calculating these two variables, we subtract both from the real risk premium and thus obtain the forward-looking risk premium for the benchmark. The risk premium for the other markets is estimated by comparing them against the benchmark.

Since we want to obtain a reliable risk premium for the benchmark, we need the history data to cover as long a period as possible. Thus, we estimate the risk premium for the S&P 500 index from January 1, 1926 (the start date of the CRSP data set), to December 31, 2018. Using the yield on a 10-year Treasury bond as a proxy for the risk-free rate, we estimate a real risk premium of 6.80%. The unexpected dividend growth rate is estimated as in equations (4) and (8). Using historical data on the S&P 500 index with dividends, we estimate the average unexpected dividend growth rate to be 0.66%. The fall in the required rate of return is estimated by simply assuming that it is solely responsible for the rise in the price-to-earnings ratio from 1926 to 2018; we thus obtain the value to be 1.6% annually.

After subtracting the unexpected dividend growth rate of 0.66% and the fall in the required rate of return of 1.6% from the historical risk premium, we obtain a forward-looking risk premium with a value of 4.44%. Then, we use equation (6) to calculate the risk premium for the Chinese stock markets. The results in Table 10 show that the risk premiums for the SHCI and SZCI are 11.23% and 14.04%, respectively, and the risk premiums for the HSI and TWII are 8.19% and 8.75%, respectively.

These numbers seem to be close to the risk premiums reported in Table 3, except for the case of Taiwan. However, we believe that this number for Taiwan

is more reliable, since the risk premium obtained from the historical data could be biased due to the market's extremely poor performance during the estimation period. A risk premium lower than 3%, as reported in Table 4, seems too low for any reasonable assumption.

The case of Mainland China is also interesting. As argued before, investors in Mainland China have few investment opportunities and, therefore, could require a lower rate of return, compared to other markets. Using equation (10), we can estimate the adjusted risk premium for the Shanghai and Shenzhen stock markets. The current average B- and H-shares discount is 0.62, and the risk-free rates for Hong Kong and for Shanghai and Shenzhen are 4.52% and 2.25%, respectively. We assume that the dividend growth rate equals the actual dividend growth rate of 1.2%. Using risk premiums of 11.23% for Shanghai and 14.04% for Shenzhen and plugging these numbers into equation (10), we obtain after-adjustment risk premiums of 7.98% and 9.71% for Shanghai and Shenzhen, respectively, as shown in the eighth row of Table 10. Therefore, taking into consideration the lower required rate of return due to the lack of investment opportunities, we find the adjusted risk premium to be roughly 3% lower than the estimates from the relative estimation approach. After the adjustment, the risk premiums for the Shanghai and Shenzhen markets are close to the risk premium applied to Hong Kong and Taiwan. These results are also consistent to those in previous studies.

IV. CONCLUSION

This paper estimates the equity risk premium in Greater China's stock markets. Two approaches are used for estimation of risk premium: the historical data approach and the relative estimation approach. Historical data are straightforward to estimate and the results show that the equity risk premiums for the Shanghai and Shenzhen markets are higher than the others, and the real risk premium for these two markets is about 11%. For comparison, the risk premiums for Hong Kong and the United States are about 10% and 7%, respectively. However, the risk premiums obtained from historical data might not be reliable, depending largely on the market performance for the estimation period. The case of Taiwan verifies this weakness. The historical risk premium for Taiwan is less than 3% due to unusually poor market performance.

To justify the results from the historical data, we apply the relative estimation approach as an alternative. The results show that the risk premium for the United States, adjusted for unexpected dividend growth and a fall in the required rate of return, is about 4%. From that number, we calculate the market risk premium for stock markets in Greater China. We also take into consideration the lower required rate of return due to the lack of investment opportunities for investors in Mainland China. Using the B- and H-share discount as a proxy for the difference in risk premiums, we show that the after-adjustment risk premiums for the Shanghai and Shenzhen markets are about 8% and 10%, respectively, close to the risk premiums for the Hong Kong and Taiwan markets obtained with the same approach.

This study also provides estimates of the risk premium for different industry sectors. It is interesting to find that, in recent years, the finance sector has provided higher returns than the overall market and other sectors in all the markets except

for Shenzhen; however, the manufacturing sector seems to lag behind all markets except for Shanghai.

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