

Policy Shock and the Evolution of Risk Pricing: An Empirical Analysis of Mainland Chinese Real Estate Stocks under the “Three Red Lines”

Hongjia Mi

*Faculty of Business, The Hong Kong Polytechnic University, Hong Kong, China
mihongjia.mi@connect.polyu.hk*

Abstract. This paper examines the impact of China’s 2020 “Three Red Lines” policy on the risk pricing and return dynamics of real estate companies listed in Hong Kong, using an event study framework and Capital Asset Pricing Model (CAPM) regression. The policy, which imposed borrowing limits to curb excessive corporate leverage, marked a pivotal shift in regulatory stance and triggered significant volatility within the real estate sector. To isolate the policy’s effects, the study compares a treatment group of 15 mainland developers with high leverage against a control group of 15 firms from related but unaffected sectors. Results from the short-term event analysis reveal a marked deterioration in adjusted returns for the treatment group immediately following the policy announcement, while the control group exhibited resilience. Long-term CAPM regressions indicate a decline in the explanatory power of market beta for real estate stocks post-policy, underscoring a structural change in risk premium formation. Moreover, subgroup analyses based on firm size demonstrate that both large-cap and small-cap developers experienced intensified systemic risk and declining abnormal returns. In contrast, control group displayed stable or improving performance metrics. These findings suggest that the Three Red Lines policy not only constrained real estate firms’ financial flexibility but also reshaped investor risk perceptions and traditional asset pricing mechanisms in China’s equity markets.

Keywords: Mainland Chinese real estate stock, three red lines policy, CAPM

1. Introduction

The real estate sector in China has historically been a crucial component of national economic growth, powered by quick urbanization and a debt-driven expansion model. For many years, developers worked in a regulatory climate that implicitly supported large leverage, which allowed them to buy land and build aggressively. But this way of growing made the economy more vulnerable to financial problems because companies relied more and more on short-term loans to pay for long-term investments. The average debt-to-equity ratio of China’s top 50 publicly traded developers was more than 80% in 2018. Sina finance made regulators and market watchers pay more attention [1]. Ng stressed that relying on debt like this was a big systemic risk that may lead to bigger financial problems if nothing was done about it [2].

In August 2020, Chinese officials came up with the "Three Red Lines" regulation, which was a major step to stop people from borrowing too much money and get their finances back on track. The policy placed severe limits on three financial metrics: the liability-to-asset ratio (not counting advance receipts) could not be higher than 70%, the net gearing ratio could not be higher than 100%, and the cash-to-short-term debt ratio had to be at least 1.0 [3]. Developers who broke all three rules were not allowed to take on more debt with interest, while those who broke one or two were only allowed to do so in a limited way. This was a clear change from the prior friendly attitude toward real estate financing, which led to a new era of stricter rules.

The program was meant to promote long-term stability, but its short-term impacts caused a lot of problems. Developers with a lot of debt had very little cash on hand, which led to defaults, credit downgrades, and big drops in stock prices. Research has demonstrated that policy uncertainty can increase risk premiums and exacerbate market volatility, especially during times of regulatory transition [4]. International studies also show how shocks to home wealth affect how people act and make investment choices. For example, Lovenheim and Mumford discovered that fluctuations in housing wealth have a substantial impact on fertility and spending decisions in the U.S., indicating that asset revaluation can alter long-term expectations [5]. Atalay et al. similarly showed that changes in property wealth in Australia change how households feel about risk and how much they spend, especially when they are heavily leveraged [6]. The China Land Surveying and Planning Institute also talked about how policy tools are becoming more important in reducing systemic risks, especially in politically sensitive and highly leveraged areas like real estate [7]. Du demonstrated that in situations characterized by stringent regulation, investors prioritize firms' financial resilience and compliance capabilities, which directly affect market valuation [8].

Even with these insights, there is still not enough thorough empirical study on how the "Three Red Lines" legislation changed how investors act and how they price risk in equity markets, especially for mainland developers listed in Hong Kong. This study seeks to fill that void by conducting a bifurcated analysis of 30 equities, categorized into a treatment group and a control group. The first part employs an event study methodology to assess short-term market reactions within a five-day window surrounding the policy announcement. The second part extends the analysis to a ten-year horizon, examining changes in return dynamics, risk premia, and the explanatory power of market beta before and after the policy's implementation.

2. Method

2.1. Dataset preparation

This study employs a contrastive approach to categorize two groups of firms: Firstly, there is a Treatment group that is directly affected by the "Three Red Lines" policy. Secondly, a control group that holds the same features as the treatment group but is not subject to policy intervention. This approach aims to assess the policy's impact on the treatment group via comparative analysis.

The Treatment group includes real estate companies that are listed on the securities exchange of Hong Kong and primarily operate in Mainland China shown in Table 1. Due to high debt levels and elevated leverage ratios, these firms faced the constraints of the "Three Red Lines." The selection of particular companies is derived from the official financial reports published by the companies. The control group functions as a comparative benchmark. Certain companies exhibit comparable traits in terms of industry, region, or leverage, yet are not affected by the policy. These include Hong Kong-based real estate firms operating outside Mainland China, building materials companies within the

broader building value chain, and hospitality firms that, despite maintaining high leverage, function in a separate industry and are exempt from this policy.

Table 1. Selected companies in treatment and control groups

Treatment Group	Ticker	Control Group	Ticker
Shimao Group Holdings Limited	0813.H K	CK Asset Holdings Limited	1113.H K
Country Garden Holdings Company Limited	2007.H K	Sun Hung Kai Properties Limited	0016.H K
Logan Group Company Limited	3380.H K	Henderson Land Development Company Limited	0012.H K
Guangzhou R&F Properties Co., Ltd	2777.H K	New World Development Company Limited	0017.H K
Kaisa Group Holdings Ltd.	1638.H K	Sino Land Company Limited	0083.H K
China Aoyuan Group Limited	3883.H K	Hongkong and Shanghai Hotels Ltd	0045.H K
Agile Group Holdings Limited	3383.H K	Huastar Holdings Limited	8237.H K
CIFI Holdings (Group) Co. Ltd.	0884.H K	Shangri-La Asia Limited	0069.H K
China Evergrande Group	3333.H K	Langham Hospitality Investments	1270.H K
Greentown China Holdings Limited	3900.H K	Regal Hotels International Holdings Limited	0078.H K
Joy City Property Limited	0207.H K	China Lesso Group Holdings Limited	2128.H K
China Jinmao Holdings Group Limited	0817.H K	Xinyi Glass Holdings Limited	0868.H K
China Vanke Co., Ltd.	2202.H K	China Resources Cement Holdings Limited	1313.H K
Longfor Group Holdings Limited	0960.H K	Anhui Conch Environment Protection Holdings Company Ltd.	0586.H K
China Resources Land Limited	1109.H K	China National Building Material Company Limited	3323.H K

2.2. Algorithms for analysis

2.2.1. Computation methods for adjusted return

In short-term analysis, the use of adjusted return as a research parameter aims to eliminate the influence of market fluctuations on individual stock returns. The specific calculation formula is as follows: Adjusted return = stock return – market (HS Index) return.

2.2.2. CAPM regression (for long-term analysis)

The Capital Asset Pricing Model (CAPM) regression is a foundational tool in asset pricing [9], used to estimate the relationship between an asset's excess return and the market's excess return. It posits that expected returns are linearly related to systematic risk, measured by beta. As Kenton notes, CAPM remains widely used for pricing risky securities and estimating expected returns based on market risk. Furthermore, this model facilitates the evaluation of risk-adjusted performance and the identification of abnormal returns.

$$R_i - R_f = \alpha_i + \beta_i (R_m - R_f) + \varepsilon_i \quad (1)$$

$$\beta_i = \frac{Cov(R_i - R_f, R_m - R_f)}{Var(R_m - R_f)} \quad (2)$$

In the CAPM regression framework, R_i denotes the return of the individual stock, while R_f represents the risk-free rate, typically proxied by the yield on government bonds. R_m refers to the market return, which in this study is measured by the Hang Seng Index. The coefficient α_i captures the asset's excess return unexplained by market movements, and β_i reflects the asset's sensitivity to market fluctuations, commonly known as market beta.

3. Result and discussion

3.1. Short-term analysis procedure

The short-term analysis aims to examine the effects of the “Three Red Lines” policy application on the short-term returns of the selected stocks in the two groups. Focusing on a five-day window—from two days prior to the policy's release on 20 August 2020 to two days afterward, the study seeks to capture the market's immediate response to this significant regulatory change.

3.2. Short-term analysis result

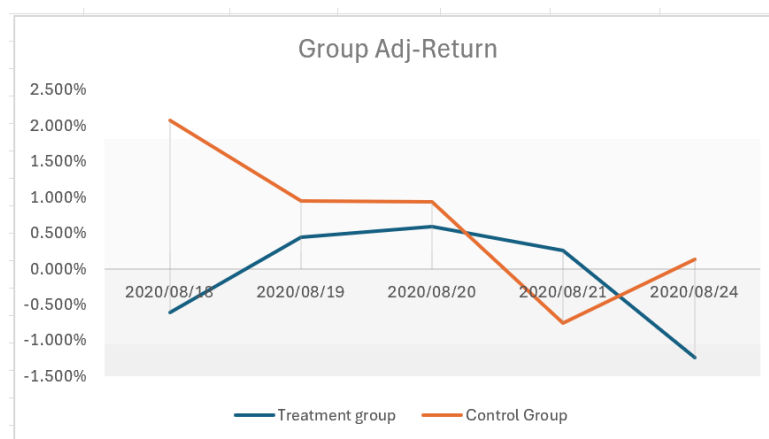


Figure 1. Average adjusted stock returns of treatment group and control group (picture credit : original)

Over the observation period from August 18 to August 24, 2020, shown in Fig. 1, the control group demonstrated more stable and favorable adjusted returns compared to the treatment group,

which exhibited a volatile and downward-sloping performance trajectory. Initially, the treatment group started with a negative return of -0.604% , while the control group recorded a strong positive return of approximately 2.086% , indicating an early performance gap of 2.7 percentage points. The Adj-return from the two groups intersected for the first time between August 20 and August 21, marking a pivotal shift in performance trends. Following this crossover, the treatment group's performance deteriorated sharply, reaching -1.238% by August 24, while the control group maintained a modest but positive return of 0.142% .

Throughout the series, the control group's returns decreased gradually but only a single day's result exhibited a negative return, suggesting relative resilience. In contrast, the treatment group experienced brief mid-period improvement followed by a pronounced decline right after August 20, ultimately ending with significantly lower returns. These diverging trends imply systematic stability in the control group's reaction to this event and suggest that the Treatment group may be associated with greater variability and risk exposure.

3.3. Long-term analysis procedure

The assessment of long-term influences resulting from the policy implementation involves dividing the processing period into two 5-year phases: the first policy period (Aug 2015 to Aug 2020) and the second policy period (Sept 2020 to the present).

The analysis calculates the average return and beta coefficient for each stock across both phases. Monthly return data for each stock is utilized in the calculations of group average return during the specified period, while the beta coefficient is estimated through a regression based on the Capital Asset Pricing Model (CAPM). Using the Hang Seng Index as the market benchmark, the excess return of each stock—calculated as the stock return minus the risk-free rate—is regressed against the market's excess return, with the resulting coefficient representing the stock's beta. The risk-free rate is based on the average government bond yield during the period. Market index average returns are also computed for both intervals for comparison. Finally, a cross-sectional regression is performed in each period, analyzing the relationship between the average return and Beta coefficient across all 30 stocks. This allows for a comparison of Beta's explanatory power for average returns before and after the policy implementation, shedding light on how the policy has affected market structure and the return-risk premium relationship.

3.4. Long-term analysis result

Analysis of beta's explanatory power for average return: The comparison study shown in Table 2, Table 3, Table 4 and Table 5 reveals that, in the group excluding the real estate sector, the correlation of beta coefficients remained reasonably consistent after the policy implementation, while the explaining capacity of the BETA coefficients for the real estate sector experienced a significant reduction. In terms of statistics, it can be found that the R^2 significantly decreased ($0.39-0.012$) and the beta coefficient for the real estate group changed from significant ($p\text{-value}=0.01<0.05$) to insignificant ($p\text{-value}=0.21>0.05$). However, even though R^2 decreased (from 0.65 to 0.50), the control group's BETA coefficients stayed significant in both periods, indicating that beta retains relatively reliable explanatory power.

Table 2. Regression results on beta and average return for the control group prior to the event

Regression Statistics				
Multiple R	0.808627656			
R Square	0.653878686			
Adjusted R Square	0.627253969			
Standard Error	0.00892422			
Observations	15			
	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.036336572	0.00506687	-7.1714	7.25E-06
X Variable 1	0.023416393	0.004725132	4.955712	0.000263

Table 3. Regression results on beta and average return for the control group after the event

Regression Statistics				
Multiple R	0.704595			
R Square	0.496454			
Adjusted R Square	0.45772			
Standard Error	0.099577			
Observations	15			
	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.18687	0.057711	-3.23809	0.006475
X Variable 1	0.188939	0.052775	3.580074	0.003357

Table 4. Regression results on beta and average return for the treatment group prior to event

Regression Statistics				
Multiple R	0.623839			
R Square	0.389175			
Adjusted R Square	0.342188			
Standard Error	0.009977			
Observations	15			
	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.03098	0.013676	-2.26512	0.041239
X Variable 1	0.025851	0.008983	2.877966	0.012944

Table 5. Regression results on beta and average return for the treatment group after the event

Regression Statistics				
Multiple R	0.346076			
R Square	0.119768			
Adjusted R Square	0.052058			
Standard Error	0.018103			
Observations	15			
	Coefficients	Standard Error	t Stat	P-value
Intercept	-0.06192	0.012466	-4.96726	0.000257
X Variable 1	0.008371	0.006294	1.329977	0.20639

Following the implementation of the policy, Mainland Chinese real estate enterprises, owing to their high-leverage practices, were compelled to restructure their economic frameworks and undertake a reassessment of their assets, accompanied by a shift in risk appetite. Consequently, high-beta real estate companies no longer generated superior returns—in fact, they often experienced declines in performance. This disparity between groups substantiates the causal effect of the policy shock. In contrast, the risk premium structure and market beta pricing were nevertheless partially held for the control group equities that were not directly subject to the program. This discrepancy demonstrates that, although the "Three Red Lines" regulation had less of an effect on equities from other industries, it reduced the predictive capacity of beta for the average returns of real estate stocks. Chu et al. arrived at a similar conclusion through analysis: following the implementation of the policy, the predictive power of the beta coefficient in the real estate sector weakened, and the stock price crash risk of highly leveraged firms increased significantly [10].

Table 6. Values of average return, beta, and alpha for the two groups

Portfolio	Five years before event			Five years after event		
	Average return	Average Beta	Average Alpha	Average return	Average Beta	Average Alpha
Control group	-1.40%	0.9550	-0.0020	-0.19%	0.9790	0.0270
Treatment group	0.77%	1.4953	0.0220	-4.66%	1.8362	0.0077

Analysis of changes in parameters before and after the event: After the event, the Treatment group experienced significant deterioration in performance indicators. The average return declined to -4.66% shown in Table 6, signifying a significant turnaround in profitability. Beta rose from 1.4953 to 1.8362, indicating higher market co-movement and elevated systemic risk. Alpha declined from 0.0220 to 0.0077, signaling reduced risk-adjusted returns amid higher risk-taking. Meanwhile, the study questions the practical significance of the beta value, as prior analysis indicates a marked decline in its explanatory power for the extent to which individual stocks are affected by systematic risk after the event. Overall, these changes suggest substantial operational pressure and financial stress imposed on the Treatment group by the event.

In contrast, the Control group showed relatively moderate shifts in performance. Average return improved from -1.40% to -0.19%, implying minimal impact. Beta remained almost unchanged (0.9550 → 0.9790), suggesting stable market sensitivity. Alpha rose from -0.0020 to +0.0270, likely due to passive downside risk control rather than active strategy shifts. In general, the Control group

remained stable due to its low-exposure industry composition and limited involvement in event-driven shocks.

Table 7. Sub-group analysis according to company size

Portfolio	Five years before event			Five years after event		
	Average return	Average Beta	Average Alpha	Average return	Average Beta	Average Alpha
Big&Treatment	0.61%	1.5206	0.0207	-5.23%	1.6926	-0.0023
Small&Treatment	0.87%	1.4784	0.0228	-4.28%	1.9320	0.0143
Big&Control	-0.14%	1.1830	0.0099	-3.67%	1.0170	-0.0067
Small&Control	-2.23%	0.6944	-0.0157	3.78%	0.9356	0.0654

Group Analysis Based on Market Size: Before the event, Treatment Groups outperformed Control Groups in both returns and risk-adjusted measures. Big Treatment posted +0.61% average returns shown in Table 7, with a Beta of 1.5206 and positive Alpha (0.0207), reflecting strong market alignment. Small Treatment excelled further (0.87% return, 0.0228 Alpha), likely due to their agility in high-exposure sectors. In contrast, Control Groups, particularly Small Control (-2.23% return, -0.0157 Alpha), showed weaker performance, constrained by limited exposure to systemic growth drivers and structural inefficiencies.

After the event, Treatment Groups experienced severe declines: The average return of Big Treatment group declined by -5.23%, with a heightened Beta of 1.6926 and a negative Alpha of -0.0023, whilst the Small Treatment group decreased by -4.28% with an even greater Beta of 1.9320. Control Groups fared better—Big Control showed moderate decline (-3.67% return), whereas Small Control rebounded impressively with 3.78% returns and 0.0654 Alpha, adapting effectively despite increased volatility. These outcomes underscore the decisive role of sectoral exposure over firm size in determining resilience and post-shock performance.

Overall, regardless of firm size within the treatment group, average returns declined significantly following the event, indicating that the event had a broadly negative impact on Treatment group. Furthermore, post-event beta values increased across the Treatment group, suggesting heightened exposure to systematic market risk. However, the simultaneous decline in returns despite rising beta reinforces the earlier conclusion that beta may have diminished explanatory power after the event. In terms of abnormal returns (alpha), the Big Treatment group experienced a shift from positive to negative alpha, implying underperformance relative to market expectations. Although the small-cap treatment group also saw a decline in overall returns, its alpha remained positive, indicating a degree of resilience or the presence of idiosyncratic gains. Finally, it's important to notice that the small-cap control group had a big change in performance, with returns going from negative to positive and alpha going up a lot. This means that performance will be better and exposure to systematic risk will be lower after the incident.

4. Conclusion

This research offers factual information regarding the consequences of China's "Three Red Lines" policy for real estate companies listed in Hong Kong, emphasizing both immediate and long-term market reactions. The analysis, which used event study technique and CAPM regression on both treatment and control groups, shows that the policy had a big effect on the risk-return dynamics in the real estate industry. The reduction in beta's explanatory power and the drop in abnormal returns signify a structural transformation in investor sentiment and asset pricing mechanisms. Additionally,

subgroup analysis indicates that firm size did not alleviate the negative impacts, as both large-cap and small-cap firms faced increased risk exposure and deteriorating performance. On the other hand, control firms stayed strong, showing that they were sensitive to policies that were special to their industry. These results show how important regulatory actions are for maintaining financial stability and how they can have important effects on asset prices in industries with a lot of debt.

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