HONG KONG MONETARY AUTHORITY

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ASSESSING THE RISKS OF FORCED PROPERTY LIQUIDATIONS AND CREDIT DOWNGRADES OF REAL ESTATE INVESTMENT TRUSTS IN A COMMERCIAL PROPERTY MARKET DOWNTURN: A STRESS-TESTING APPROACH

Key points:

- *The values of global commercial real estate (CRE) have faced pressures amid high interest rates and structural changes such as shifts towards remote working and e-commerce, raising concerns about the financial implications for CRE investors. One key concern is the impact on real estate investment trusts (REITs), as their assets accounted for around a quarter of the global CRE held by institutional investors as of 2023.*

- *REITs could also potentially amplify the downturn of the CRE market, as they are typically subject to leverage limits (usually at or below 60% of total assets) as required by debt covenants or credit rating agencies. As the market downturn has continued to drive up their leverage ratios, REITs could be forced to deleverage by selling their CRE assets at steep discounts to avoid triggering the leverage limits. Such deleveraging, if realised on a large scale, could deepen the CRE market downturn, with ramifications for the wider financial system.*

- *To assess this issue, we conducted a stress test for global REITs by estimating the impacts on their property sales volume and credit ratings if CRE asset values were to fall by 10% (mild scenario) to 40% (severe scenario) from the end of 2023. Our estimations show that REITs would face elevated leverage and significant risks of forced property liquidations and credit downgrades:*

    - *Leverage risks: The median debt-to-asset ratio of REITs was estimated to increase significantly, ranging from 44% to 67% under the scenarios, compared to 40% at the end of 2023. The share of REITs whose leverage exceeds the 60% threshold would increase from 8% at the end of 2023 to 13% - 55% under the scenarios.*

- *Risks of forced property liquidations: Given the elevated leverage, it is estimated that REITs would additionally liquidate their property portfolios under the severe scenario, with the incremental sales amounting to around 13% of the global CRE transaction volume observed in 2023; a majority of the incremental sales would be contributed by those whose leverage exceeds 60%.*

- *Risks of credit downgrades: The elevated leverage would lead to around 5% to 16% of REITs losing their investment-grade status under the mild and severe scenarios, respectively.*

- *Our assessments also point to significant regional and sectoral variations, with Americas-listed REITs, and retail and office REITs being more vulnerable to leverage breaches, forced property liquidations, and credit downgrades compared to Asia-Pacific (APAC)-listed REITs and industrial REITs.*

- *In the near future, the global CRE market may continue to face challenges given uncertain interest rate paths and weak demand for office and retail spaces. From a financial stability perspective, it is crucial to closely monitor CRE investors' responses to the development of the CRE market, particularly their potential amplification of pressure on the CRE market due to deleveraging. The spillover risks to the broader financial system, including banks, should also be assessed, especially for the relatively vulnerable REIT segments identified in this stress-testing exercise.*

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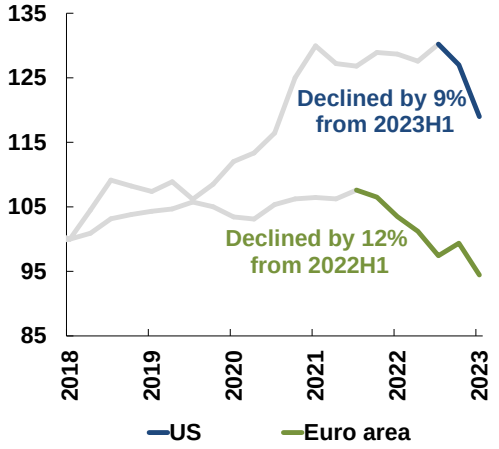
1. INTRODUCTION

The values of global commercial real estate (CRE) have faced pressures (Chart 1) amid high interest rates and structural changes such as shifts towards remote working and e-commerce, especially in office and retail spaces (Chart 2). This has raised concerns about the financial implications for CRE investors. One key concern is the impact on real estate investment trusts (REITs), as their assets accounted for around a quarter of the global CRE held by institutional investors at the end of 2023.

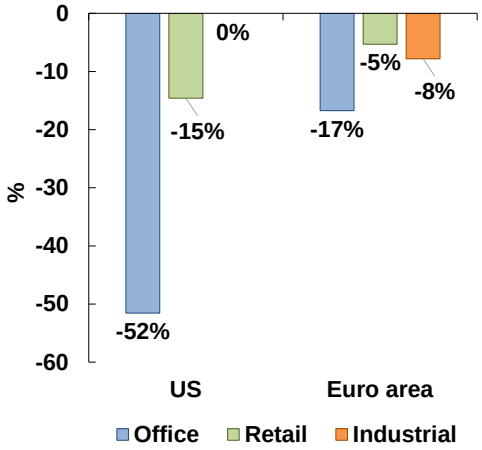
Chart 1: Average CRE asset values, by region (Levels at end-2018 = 100)



Notes:
1. Each curve represents the level of average CRE asset values against the level at the end of 2018 (= 100) in the given region from 2018 to 2023, with the solid coloured portion indicating the declining trend from the most recent peak;
2. The text indicates the average percentage decline in CRE asset values to the end of 2023 from the most recent peak in the given region; and
3. The chart covers the United States (US) and the euro area. As for Asia-Pacific (APAC), the International Monetary Fund (IMF) (2024) has indicated that CRE asset values in the region declined by around 3% in 2023.

Sources: Bank for International Settlements (BIS) (2024) and HKMA staff estimates.

Chart 2: Average percentage declines in CRE asset values from the most recent peak, by region and sector



Notes:
1. Each bar represents the average percentage decline in CRE asset values to the end of 2023 from the most recent peak in a given region and a given sector, with the colour indicating the respective sector;
2. The zero value means that the level of CRE asset value peaked at the end of 2023; and
3. This chart covers the US and the euro area. As for APAC, the IMF (2024) indicates that the asset values of office and retail properties in the region decreased by around 6% and 2% in 2023, while industrial buildings increased by about 1% in the same year.

Sources: IMF (2024), Leahy (2024) of MSCI, MSCI (2024) and HKMA staff estimates.

REITs could also potentially amplify the downturn of the CRE market, as they are typically subject to leverage limits (usually at or below 60% of total assets) as required by debt covenants or credit rating agencies. As the market downturn has continued to drive up their leverage ratios, REITs could be forced to deleverage by selling their CRE assets at steep discounts to avoid triggering the leverage limits. Such deleveraging, if realised on a large scale, could deepen the CRE market downturn, with ramifications for the wider financial system.

To assess this issue, we conducted a stress test for global REITs by estimating the impacts on their property sales volume and credit ratings if CRE market values were to fall by 10% (mild scenario) to 40% (severe scenario) from the end of 2023. Our estimations show that REITs would face elevated leverage and significant risks of forced property liquidations and credit downgrades. They also point to significant regional and sectoral variations, with Americas-listed REITs, and retail and office REITs being more vulnerable to leverage breaches, forced liquidations, and credit downgrades compared to APAC-listed REITs and industrial REITs.

The stress-testing exercise is structured as follows. *Section 2* describes our motivation, sample selection, data and stress-testing framework. *Section 3* presents the stress-testing results. *Section 4* concludes and discusses policy implications based on these results.

2. MOTIVATION, SAMPLE SELECTION, DATA AND STRESS-TESTING FRAMEWORK

This section lays out the foundation by describing our motivation (*Section 2.1*), sample selection (*Section 2.2*), data (*Section 2.3*), and stress-testing framework for the risks of forced property liquidations and credit downgrades facing REITs (*Section 2.4*).

2.1. Motivation

The current CRE market downturn has posed significant financial challenges to CRE investors, with possible implications on the financial system. To better understand the financial stability implications, this assessment focuses on REITs for two reasons:

1) First, REITs are key investors in the global CRE market. Specifically:

   - In terms of asset holdings, their combined asset value was estimated at US$3.3 trillion as of the end of 2023[1] (red curve, Chart 3), equivalent to around 25% of the US$13.2 trillion in CRE assets managed by global institutional investors in the same year (MSCI, 2024).

   - In terms of transaction volume, their combined property transaction volume was estimated to have reached at least US$116 billion in 2023[2]

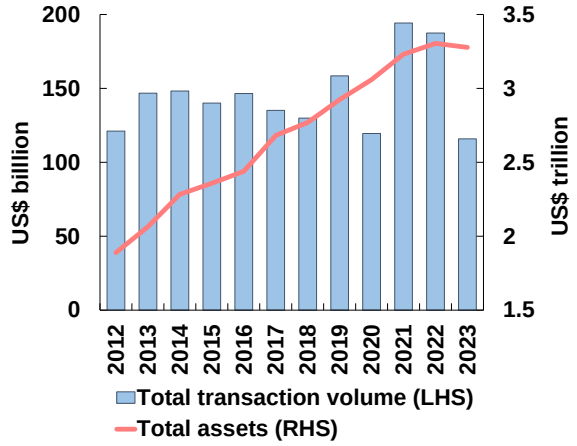
[1] This figure based on our sample is highly comparable to the global universe, of which total assets were estimated at US$3.2 trillion at the end of 2022 (FSB, 2023).

[2] This figure may underestimate the aggregate property transaction volume of REITs, since it is calculated solely based on their net property purchases or sales. For each REIT whose property sales exceeded property purchase in 2023, its transaction volume would be underestimated by the sum of its property sales and purchases, minus the difference between the two. This is equivalent to twice the

(blue bars, Chart 3), amounting to around 18% of the US$647 billion market aggregate in the same year (CBRE, 2024).

2) Second, REITs could potentially amplify the downturn of the CRE market as they are typically subject to leverage limits (usually at or below 60% of total assets) required by debt covenants or credit rating agencies (Lai, 2023; Frankel, 2014; Olazabal et al., 2012).[3] If CRE asset values continued to decline and drove up their leverage ratios, REITs could be forced to deleverage by selling their CRE assets at steep discounts to avoid triggering the leverage limits. This could set off a further downward spiral in CRE prices, with significant implications on financial stability.[4]

Chart 3: Total property transaction volume and total assets of REITs



Notes:
1. Each bar represents the total transaction volume of global REITs in the given year; and
2. The curve represents the total assets of global REITs over the years.

Sources: S&P Capital IQ and HKMA staff estimates.

2.2. Sample selection

Retrieved from S&P Capital IQ and Bloomberg, our sample encompasses 600 global REITs specialising in the office, retail, industrial or diversified sectors, which are at the epicentre of the ongoing CRE market downturn as illustrated in Chart 2. Other REIT sectors, including residential REITs, hospitality REITs, specialised REITs and healthcare REITs, are excluded. The combined asset value of the sampled REITs has totalled US$2.4 trillion at the end of 2023, accounting for about 76% of the global REIT universe.

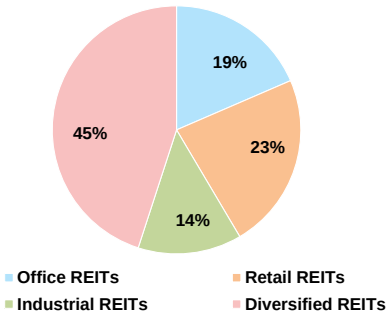
amount of its property purchases. Conversely, for each REIT whose property purchases exceeded property sales, the transaction volume would be underestimated by twice the amount of its property sales.

[3] For a detailed discussion, please refer to *Step 3*, *Section 2.4*.

[4] Apart from both of the reasons, the mandatory disclosure by REITs also enables us to have sight of their balance sheet and property transaction cash flows, while such an information may not be available for other CRE investors.

The sample offers a broad and balanced coverage of investment sectors and listing regions. In terms of investment sectors, around 45% of them were diversified REITs at the end of 2023. This was followed by retail REITs at 23%, office REITs at 19% and industrial REITs at 14% (Chart 4). By listing region, REITs listed in the APAC region held the largest share at 35%, followed by those listed in the Europe, Middle East and Africa (EMEA) region at 34%, and those listed in the Americas at 31% (Chart 5).

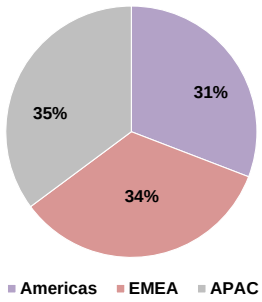
Chart 4: Breakdown of REITs, by investment sector



Note: This pie chart represents the share of the sampled office, retail, industrial and diversified REITs at the end of 2023, expressed as a percentage of the number of the sampled REITs.

Sources: S&P Capital IQ and HKMA staff estimates

Chart 5: Breakdown of REITs, by listing region



Note: This pie chart represents the share of the sampled REITs listed in the Americas, EMEA and APAC regions at the end of 2023, expressed as a percentage of the number of the sampled REITs.

Sources: S&P Capital IQ and HKMA staff estimates.

2.3. Data

We collected REIT-level annual data from S&P Capital IQ for 2013 - 2023, including debt-to-asset ratios (DARs), interest coverage ratios (ICRs), and property transaction cash flows. Each REIT's property transaction cash flows are reported as positive in a year if it sold more properties than it acquired, and vice versa. We measure each REIT's net property sales with this metric as a percentage of its total assets from the previous year.[5]

Additionally, we retrieved credit ratings from Bloomberg, which categorises REITs into 21 grades under three tiers: investment grade (IG), high yield (HY) and distressed (DS). We coded those grades numerically from 1 to 21, with the lowest number (1) indicating the least risky grade (IG1) and the highest number (21) signifying the most distressed grade (DS5) as outlined in Table 1 below.

We had considered three leading rating agencies: Bloomberg, S&P Global Ratings and Moody's Ratings. We chose Bloomberg because approximately 75% of

[5] We had considered the gross property sales rather than the net property sales, but the former is not available from our data providers. That said, in the stress-testing exercise we roughly estimate the gross property sales from the net property sales as detailed in *Step 4, Section 2.4*.

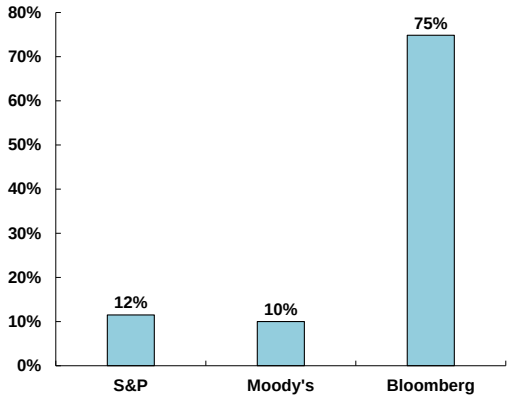
the sampled REITs had historical ratings from Bloomberg, compared to only 10% from the latter two (Chart 6).[6] However, the choice of credit rating agency does not appear to significantly influence our results, as all three of these agencies employ similar rating methodologies,[7] with about 93% - 94% of REITs rated as IG by S&P Global Ratings and Moody's Ratings also receiving IG ratings from Bloomberg at the end of 2023 (Chart 7).

Table 1: Bloomberg's credit rating scale and numeric values

	Credit ratings (Compiled by Bloomberg)	Corresponding numeric values (Coded by HKMA staff)
Investment Grade (IG)	IG1-IG10	1-10
High-yield Grade (HY)	HY1-6	11-16
Distressed Grade (DS)	DS1-5	17-21

Sources: Bondioli et al. (2021) of Bloomberg and HKMA staff estimates.

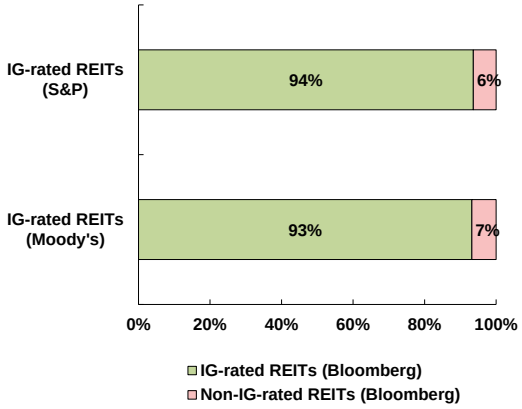
Chart 6: Proportion of REITs with credit ratings, by rating agency



Notes:
1. Each bar represents the share of the sampled REITs with historical credit ratings by the given rating agency at the end of 2023; and
2. The availability of the sampled REITs' historical credit ratings is based on our search in Bloomberg.

Sources: S&P Capital IQ, Bloomberg, and HKMA staff estimates.

Chart 7: REITs with IG ratings, by rating agency



Note:
Each bar represents the sampled REITs with IG ratings by the given rating agency, with the share of those with IG ratings from Bloomberg at the end of 2023 shaded in green.

Sources: S&P Capital IQ, Bloomberg, and HKMA staff estimates.

[6] This information is based on our search in Bloomberg. The historical credit ratings for additional REITs assigned by the other two credit rating agencies may be available in other databases to which we do not have access.

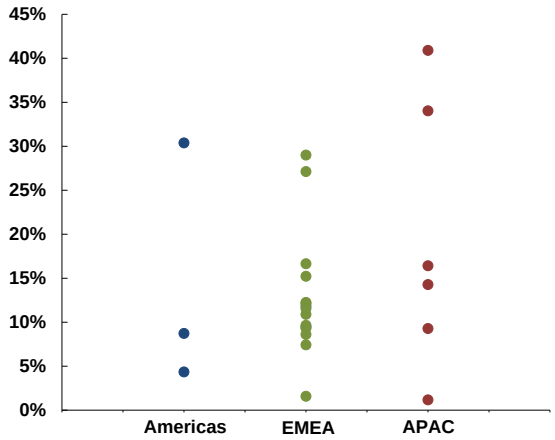
[7] Bloomberg's rating methodology is primarily data-driven by taking each REIT's DAR, ICR, return on assets, proportion of non-performing loans, distance to default, equity volatility and asset volatility into accounts (Bondioli et al., 2021). In contrast, the other two rating agencies consider a broader basket of factors, including not only financial data but also factors like country risk and the business strategy of each REIT.

2.4. Stress-testing framework

Step 1: Setting up the CRE market downturn scenarios

As a first step, we established the scenarios for sudden declines in CRE asset values at the end of 2023. We assumed a percentage decline ranging from 10% (mild scenario) to 40% (severe scenario). The decline was capped at 40% as this is close to the deepest annual decline (41%) observed among the reporting jurisdictions over the past three decades, according to BIS data on commercial property prices (BIS, 2024) (Chart 8).

Chart 8: The maximum annual declines in CRE asset values in the reporting jurisdictions



Notes:

1. Each dot represents the largest annual decline in CRE asset values in the respective reporting jurisdiction from 1993 to 2023, where data are available, with the colour indicating the jurisdiction's region; and
2. The reporting jurisdictions include Argentina, Brazil, Czechia, Denmark, France, Germany, Greece, Hong Kong, Iceland, Indonesia, Japan, Morocco, the Netherlands, the Philippines, Poland, Portugal, Saudi Arabia, Singapore, Slovenia, South Korea, Spain, Switzerland, Türkiye, the United Arab Emirates, the US and the euro area as a whole.

Sources: BIS (2024) and HKMA staff estimates.

Step 2: Projecting the change in DAR of each REIT under the scenarios

Under these scenarios, the total assets of each sampled REIT would be assumed to contract in tandem with CRE asset values by the same proportion.[8] The contraction would subsequently increase its DAR by 11% - 67%, assuming that its total debts remained constant (Table 2).

[8] This is a reasonable assumption as REITs are generally mandated to allocate a majority of their assets to, or/and generate most of their gross income from real estate assets in listing jurisdictions including Canada, the US, the United Kingdom, Germany, Italy, South Korea and Hong Kong (PwC, 2019). The total assets of REITs listed in these jurisdictions jointly accounted for 55% of the global aggregate at the end of 2023.

Table 2: Projected changes in REITs' DAR under the scenarios

Pre-scenario	Post-scenario	
	Mild scenario	Severe scenario
$DAR = \frac{Total\ debts}{Total\ assets}$	$DAR = \frac{Total\ debts}{Total\ assets \times (1-10\%)}$	$DAR = \frac{Total\ debts}{Total\ assets \times (1-40\%)}$
	$= 111\% \times \frac{Total\ debts}{Total\ assets}$	$= 167\% \times \frac{Total\ debts}{Total\ assets}$

Source: HKMA staff.

Step 3: Estimating the impacts of DAR on property sales and credit ratings

Next, we quantified the average effects of the changes in DAR on the changes in net property sales and credit rating over a year by using two fixed-effect regression models.[9] In our regression analyses, we not only considered a linear relationship but also explored the potential for a threshold effect, where a DAR above 60% could have more significant impacts as mentioned in *Section 1* and *Section 2.1*. The regression results confirm this conjecture and show that:

- For every percentage point (ppt) increase in DAR, each REIT was estimated to sell approximately 0.12% more of its assets (in net terms) on average in the subsequent year. If its DAR crossed the 60% threshold, it would additionally sell 3.9% of its assets, which seems to be considerable.[10]

- For every ppt increase in DAR, the credit rating of each REIT was estimated to be lowered by 0.04 grade (equivalent to increasing its numeric value by 0.04) on average in the subsequent year. If its DAR exceeded the 60% threshold, its credit rating would be additionally lowered by 0.89 grade (equivalent to increasing its numeric value by 0.89).[11]

[9] The regression models and results can be found in *Annex 1* and *Annex 2*.

[10] In the long run, the average effect of DAR would become milder. For every ppt increase in DAR, each REIT was estimated to sell around 0.06% more of its assets, and additionally 2.04% if its DAR crossed the 60% threshold. This may reflect the over-reaction of REITs to declines in CRE asset values in the short-term, which would be gradually corrected as the market reaches a more stable state over time.

[11] In the long run, the average impact of DAR would become milder. For every ppt increase in DAR, the credit rating of each REIT was estimated to be lowered by 0.02 grade, and additionally by 0.51 grade if its DAR exceeded the 60% threshold.

Step 4: Simulating the changes in property sales and credit rating of each REIT under the scenarios

By integrating the projected changes in DAR (*Step 2*) with the estimated effects of DAR on net property sales and credit ratings (*Step 3*), we computed the respective changes in net property sales and credit ratings of each REIT under the scenarios. Table 3 illustrates the whole simulation process under the mild scenario as an example.

Table 3: Estimating each REIT's net property sales and credit ratings under the mild scenario

Net property sales	Credit rating
Step 1: CRE asset values are assumed to decline by 10% (mild scenario).	
Step 2: The DAR of each REIT is projected to increase by 11%.	
Step 3: • If the REIT's DAR maintains at or below 60% under the scenario or had already been over 60% beforehand, its net property sales are simulated to increase by: = 11% × DAR_{2023} × 0.12 ppt[12] • If the REIT's DAR rises above 60% under the scenario, its net property sales are simulated to increase by: = 11% × DAR_{2023} × 0.12 ppt + 3.9 ppts[8] where DAR_{2023} denotes the REIT's DAR at the end of 2023.	Step 3: • If the REIT's DAR maintains at or below 60% under the scenario or had already been over 60% beforehand, its credit rating is simulated to be lowered by: = 11% × DAR_{2023} × 0.04 grade • If the REIT's DAR rises above 60% under the scenario, its credit rating is simulated to be lowered by: = 11% × DAR_{2023} × 0.04 grade + 0.89 grade where DAR_{2023} denotes the REIT's DAR at the end of 2023.

Source: HKMA staff.

However, the simulated net property sales could be difficult to interpret, as they could be negative if property acquisition is larger than sales in a given year. For easier interpretation, we have roughly estimated the increase in gross property sales by only considering the increase in positive values of net property sales, as detailed in Table 4 below. This approach allows us to estimate the lower bound of the increase in each REIT's gross property sales (i.e. a conservative estimate). These estimated gross property sales will be used in presenting our results for the rest of the paper.

[12] The simulated increase in each REIT's net property sales are bounded within that REIT's total assets at the end of 2023.

Table 4: Estimating the change in each REIT's gross property sales from the simulated change in its net property sales

If: (1) Actual net property sales in 2023	(2) Simulated net property sales in the coming year	Then: Simulated increase in gross property sales in the coming year
Positive (Sales > Acquisition)	More positive (Sales >> Acquisition)	(2) minus (1)
Negative (Acquisition > Sales)	Positive (Sales > Acquisition)	(2)
Negative (Acquisition > Sales)	Negative (Acquisition > Sales)	Zero

Source: HKMA staff.

3. STRESS-TESTING RESULTS

This section presented the estimates on the DAR (*Section 3.1*), property sales volume (*Section 3.2*) and credit ratings (*Section 3.3*) of the sampled REITs based on our stress-testing exercise.

3.1. To what extent would the DAR of REITs increase under the scenarios?

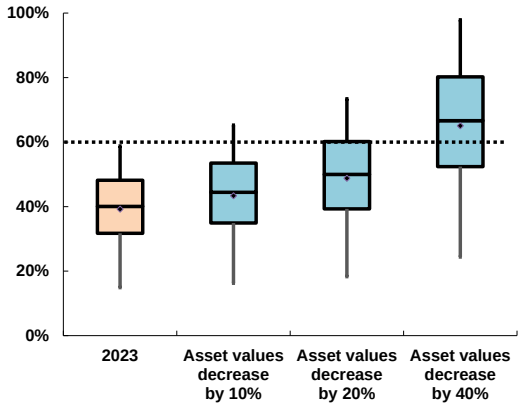
The stress-testing results revealed that the DAR of the sampled REITs would increase significantly, with the median DAR level ranging from 44% to 67% under the scenarios, compared to 40% at the end of 2023 (Chart 9). This would lead to a larger share of REITs violating the usual debt covenants under the scenarios. Specifically, the share of the sampled REITs whose DAR exceeds the 60% threshold would increase from 8% at the end of 2023 to 13% - 55% under the scenarios (Chart 10).

Moreover, such deviations from the usual debt covenants were relatively widespread in certain listing regions or investment sectors. The following figures underscore the vulnerabilities of REITs in selected regions or sectors:

- By listing region: A significantly higher proportion of Americas-listed REITs would violate the usual debt covenants under the scenarios, as compared to their counterparts in the rest of the world (Chart 11).

- By investment sector: Larger fractions of office, retail and diversified REITs were estimated to deviate from the usual debt covenants under the scenarios, while a relatively low proportion of industrial REITs would breach the leverage limit (Chart 12).

Chart 9: Distribution of REITs' DAR under the scenarios

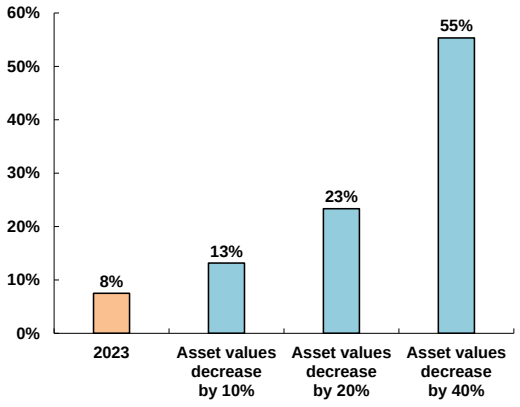


Notes:

1. Each boxplot denotes the distribution of REITs' DAR under the given scenario, with the dotted line indicating the maximum DAR required by the usual debt covenants; and
2. The mean value is denoted by the dot inside the box. The median value is represented by a horizontal line within the box, with 50% of the values falling within the 25th and 75th percentile range shown by the box. The upper and lower end points of the thin vertical lines indicate the 90th and 10th percentiles, respectively.

Sources: S&P Capital IQ and HKMA staff estimates.

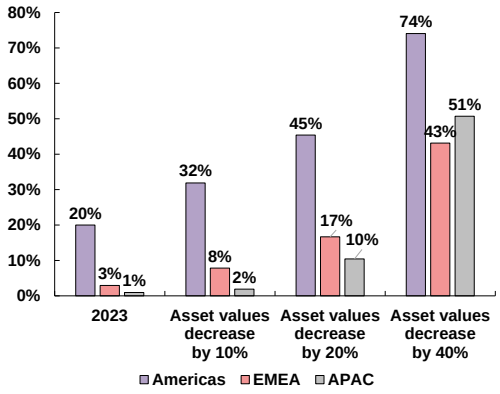
Chart 10: Share of REITs violating the usual debt covenants



Note:
Each bar represents the share of the sampled REITs whose DAR crosses the 60% threshold under the given scenario, expressed as a percentage of the number of the sampled REITs.

Sources: S&P Capital IQ and HKMA staff estimates.

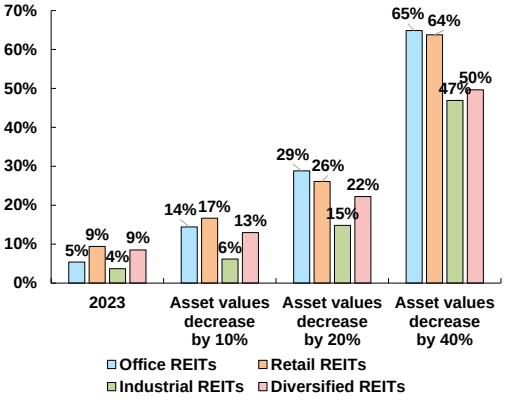
Chart 11: Share of REITs violating the usual debt covenants, by listing region



Note: Each bar represents the share of the sampled REITs listed in the given region whose DAR crosses the 60% threshold under the given scenario, expressed as a percentage of the number of the sampled REITs listed in the region, with the colour indicating the region.

Sources: S&P Capital IQ and HKMA staff estimates.

Chart 12: Share of REITs violating the usual debt covenants, by investment sector



Note: Each bar represents the share of the sampled REITs specialised in a given sector whose DAR exceeds the 60% threshold under the given scenario, expressed as a percentage of the number of the sampled REITs specialised in the sector, with the colour indicating the sector.

Sources: S&P Capital IQ and HKMA staff estimates.

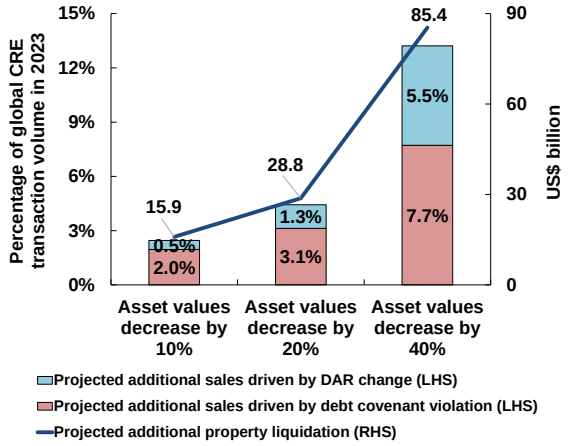
3.2. To what extent would REITs sell off properties under the scenarios?

Given the significant increase in the DAR and the share of REITs violating the usual debt covenants as projected in *Section 3.1*, the sampled REITs were estimated to additionally liquidate a notable amount of their property portfolios under the severe scenario, with a majority of the incremental sales contributed by those whose leverage exceeds 60%. Such a surge in property sales orders could lead to an oversupply in the CRE secondary market in the short run, potentially triggering repeated rounds of CRE asset value declines and sell-offs. Specifically:

- Overall impact: The sampled REITs were estimated to additionally liquidate around US$15.9 billion – US$ 85.4 billion assets under the scenarios (curve in Chart 13). These incremental amounts represented around 3% - 13% of the CRE transaction volume in 2023 (CBRE, 2024). The scale is substantial under the severe scenario.

- Contribution by leverage breaches: Those REITs whose DAR exceeds the 60% threshold would contribute around 59% - 79% of the incremental property sales under the scenarios (red portion of each bar in Chart 13). The results underscore the incentive to avoid violating the usual debt covenants as a key driver to the property sales by REITs.

Chart 13: Simulated increase in REITs' gross property sales



Notes:

1. The curve represents the simulated increase in the sampled REITs' gross property sales (in US$ billion) over one year following the given scenario; and
2. Each bar indicates the simulated increase in the sampled REITs' gross property sales over one year following the given scenario, expressed as a percentage of the global CRE transaction volume in 2023 (CBRE, 2024).

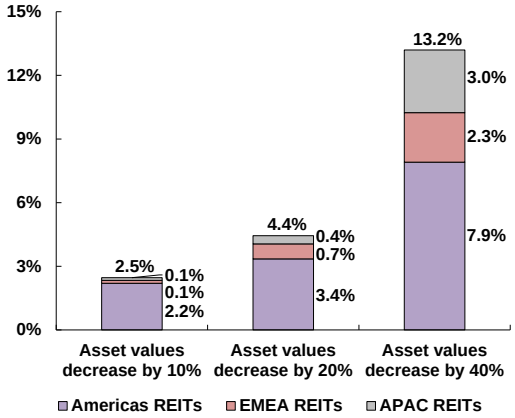
Sources: S&P Capital IQ, CBRE (2024) and HKMA staff estimates.

Additionally, the variation in DAR of REITs projected in *Section 3.1* accounted for regional and sectoral differences in property sales. Our stress-testing results show that:

- By listing region: The Americas-listed REITs, which were more leveraged than their counterparts in other regions, were projected to be the primary drivers of property sales under the scenarios, contributing 60% (7.9% out of 13.2%) to 88% (2.2% out of 2.5%) of the simulated total (Chart 14). Meanwhile, REITs listed in EMEA and APAC are relatively small contributors to property sales.

- By investment sector: Industrial REITs, which were the least leveraged relative to their counterparts in other sectors, were estimated to sell the lowest volume of properties. Across the scenarios, they would contribute merely 6.8% (0.3% out of 4.4%) to 7.4% (1% out of 13.2%) of the simulated aggregate (Chart 15). In contrast, REITs in other sectors are found to be more significant contributors to property sales under the scenarios.

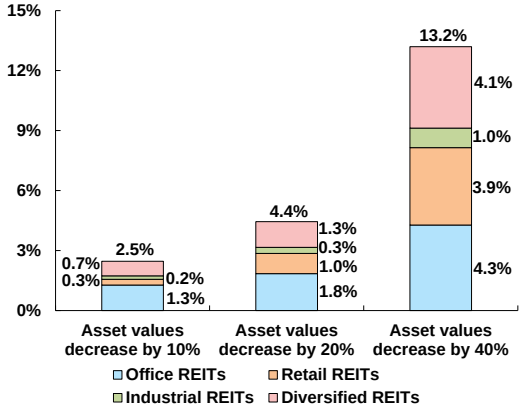
Chart 14: Share of the simulated increase in REITs' gross property sales, by listing region



Notes:
1. Each bar denotes the simulated increase in the sampled REITs' gross property sales over one year following the given scenario, expressed as a percentage of the global CRE transaction volume in 2023 (CBRE, 2024);
2. Each colour indicates the share contributed by REITs listed in the given region; and
3. The figures may not add up to the total due to rounding.

Sources: S&P Capital IQ and HKMA staff estimates.

Chart 15: Share of the simulated increase in REITs' gross property sales, by investment sector



Notes:
1. Each bar denotes the simulated increase in the sampled REITs' gross property sales over one year following the given scenario, expressed as a percentage of the global CRE transaction volume in 2023 (CBRE, 2024);
2. Each colour indicates the share contributed by REITs specialised in the given specific sector; and
3. The figures may not add up to the total due to rounding.

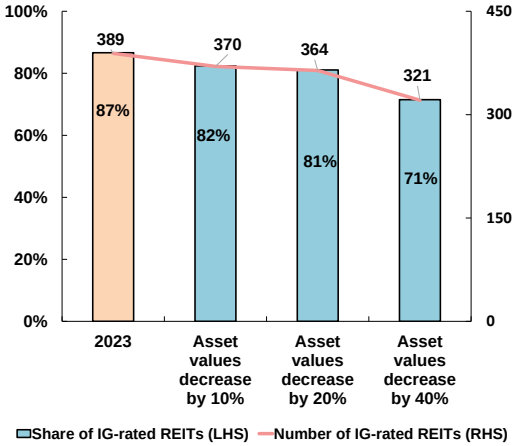
Sources: S&P Capital IQ and HKMA staff estimates.

3.3. How many REITs would be downgraded under the scenarios?

The notable increase in DAR and the share of REITs breaching the usual debt covenants as projected in *Section 3.1* also led to a significant proportion of the sampled REITs losing their IG ratings. Specifically, the share of IG-rated REITs would decline by 5 ppts -16 ppts to 71% - 82% under the scenarios, down from 87% at the end of 2023 (Chart 16). Such credit downgrades could have profound spillover effects. Financial institutions with a large exposure to REITs may suffer direct losses from the depressed security values. Banks, the largest debt holders of REITs, would face heightened default

risks if their credit ratings deteriorate. In case of widespread default, the linkage between the banking and real estate sectors may trigger a credit crunch, severely impacting the financial system.

Chart 16: Number and share of IG-rated REITs



Notes:

1. The curve represents the number of IG-rated REITs in the sample across the given scenarios;
2. Each bar represents the share of IG-rated REITs in the sample across the given scenario, expressed as a percentage of the number of the sampled REITs; and
3. This chart uses a subset of the sampled REITs as credit ratings are not available for the rest of them.

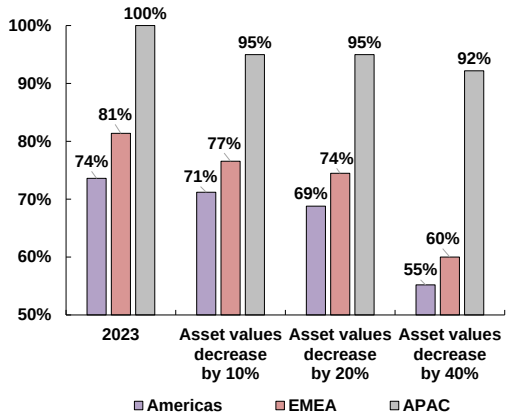
Sources: Bloomberg and HKMA staff estimates.

Similarly, our stress-testing results show that the risks of credit downgrades varied significantly across listing regions and investment sectors, primarily due to the regional and sectoral differences in DAR of REITs as projected in *Section 3.1*. Specifically:

- By listing region: The share of IG-rated Americas-listed REITs would decline by 19 ppts to 55% in the severe scenario, down from 74% at the end of 2023. In contrast, APAC-listed REITs would experience a more modest decline of only 8 ppts (Chart 17).

- By investment sector: Industrial REITs would be the least likely to lose their IG ratings compared to other REIT sectors, with only 9% more of them projected to be downgraded in the severe scenario. In contrast, within other REIT sectors, around 14% to 20% would be downgraded to either HY or DS scales (Chart 18).

Chart 17: Share of IG-rated REITs, by listing region

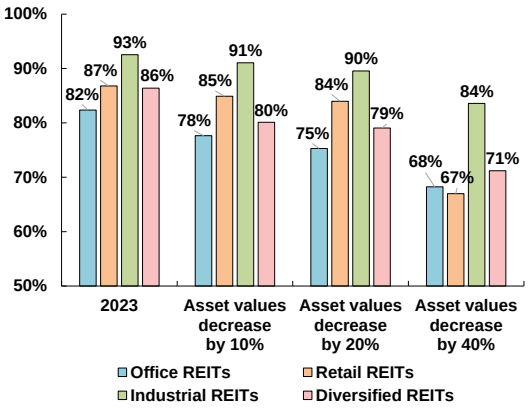


Notes:

1. Each bar represents the share of IG-rated REITs listed in the given region under the given scenario, with the colour indicating the respective region; and
2. This chart uses a subset of the sampled REITs as credit ratings are not available for the rest of them.

Sources: Bloomberg and HKMA staff estimates.

Chart 18: Share of IG-rated REITs, by investment sector



Notes:

1. Each bar represents the share of IG-rated REITs specialised in the given sector under the given scenario, with the colour indicating the respective sector; and
2. This chart uses a subset of the sampled REITs as credit ratings are not available for the rest of them.

Sources: Bloomberg and HKMA staff estimates.

4. CONCLUSION

In conclusion, this stress-testing exercise showed that REITs would face elevated leverage and significant risks of forced property liquidations and credit downgrades if the ongoing CRE market downturn deepens further. It also pointed to significant regional and sectoral variations, with Americas-listed REITs, and retail and office REITs being more vulnerable to leverage breaches, forced liquidations and credit downgrades compared to APAC-listed REITs and industrial REITs.

In the near future, the global CRE markets may continue to face challenges given uncertain interest rate paths and weak demand for office and retail spaces. From a financial stability perspective, it is crucial to closely monitor CRE investors' responses to the development of the CRE market, particularly their potential amplification of pressure on the CRE market due to deleveraging. The spillover risks to the broader financial system, including banks, should also be assessed, especially for the relatively vulnerable REIT segments identified in this stress-testing exercise.

Finally, as our stress test primarily focuses on the impact of REITs' leverage on financial stability, it may not capture all the factors influencing a REIT's decision to retain or sell its property portfolios or affecting its credit rating. For instance, REITs may look to mitigate the pressures to deleverage by raising funding through secondary

public offerings[13] rather than asset sales. Also, some REITs may choose to sell assets in order to fund future investment opportunities, rather than to repay debt. While various robustness tests have been conducted on our estimations,[14] readers should interpret our results with caution due to these limitations.

[13] From our sample, REITs raised US$33.7 billion and US$23.7 billion (after deducting their stock re-purchases) through equity offerings in 2022 and 2023, respectively. These figures accounted for around 1.6% and 1.1% of the total assets of REITs in these respective years. Raising funds from these equity offerings should have helped lower leverage levels of the REITs, partially mitigating their pressures to deleverage through property liquidations.

[14] Our stress-testing framework was back-tested for the 2023 position. The back-testing results are presented in *Annex A3*.

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ANNEX

Annex A1: Estimation of the impact of the change in DAR on the change in net property sales

To estimate the impact of the change in DAR on the change in net property sales, we conducted a fixed-effect linear regression, which can be represented by Equation (1):

$$\begin{aligned}\Delta Sales_{i,t+1} = {} & \beta_1 DARCovenant_{i,t} + \beta_2 \Delta DAR_{i,t} + \beta_3 ICRCovenant_{i,t} + \\ & \beta_4 \Delta ICR_{i,t} + \beta_5 Sales_{i,t} + \beta_6 Sales_{i,t-1} + \beta_7 Sales_{i,t-2} + \\ & \theta FE_i + \delta Year_t + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where,

$\Delta Sales_{i,t+1}$	=	the change in REIT *i*'s net property sales ratio from year *t* to year *t+1*, where the net property sales ratio in year *t* is measured by REIT *i*'s property transaction cash flows in year *t* divided by its total asset value in year *t-1*;
$DARCovenant_{i,t}$	=	a dummy variable which equals 1 if DAR of REIT *i* is larger than 60%[15] in year *t* and 0 otherwise;
$\Delta DAR_{i,t}$	=	the change in DAR of REIT *i* from year *t-1* to year *t*;
$ICRCovenant_{i,t}$	=	a dummy variable which equals 1 if ICR of REIT *i* is smaller than 1.5[16] in year *t* and 0 otherwise;
$\Delta ICR_{i,t}$	=	the change in ICR of REIT *i* from year *t-1* to year *t*;
$Sales_{i,t}$	=	the ratio of REIT *i*'s property transaction cash flows in year *t* to its total asset value in year *t-1*;
$Sales_{i,t-1}$	=	the ratio of REIT *i*'s property transaction cash flows in year *t-1* to its total asset value in year *t-2*;
$Sales_{i,t-2}$	=	the ratio of REIT *i*'s property transaction cash flows in year *t-2* to its total asset value in year *t-3*;
FE_i	=	a vector of variables representing the REIT-level fixed effects;
$Year_t$	=	a vector of variables representing the year fixed effects;
$\varepsilon_{i,t}$	=	the residual term.

In the regression model, the dependent variable is the change in net property sales ratio from year *t* to year *t+1*, as our objective is to predict the ratio in a year after the CRE market shock. Considering the possible correlation between consecutive net

[15] The usual debt covenant for REITs to obtain bank loans and issue IG bonds is to maintain a DAR within 60% (Lai, 2023; Frankel, 2014; Olazabal et al., 2012).

[16] The usual debt covenant for REITs is to ensure their ICR of at least 1.5 (Lai, 2023; Frankel, 2014; Olazabal et al., 2012).

property sales ratios, we also include the ratios in the previous three years as a control variable. Furthermore, we control for the impact of ICR, since it is another important indicator of a REIT's financial health. A low ICR signifies that a REIT may face difficulty in repaying debts with its earning, which could potentially lead to asset liquidations.

The regression result is presented in Table A1, where the linear and threshold effects of DAR are both confirmed. For every ppt increase in DAR, the net property sales ratio in the coming year would increase by 0.12 ppt. If DAR exceeds 60%, there would be a significant jump of 3.9 ppts in the ratio over the coming year. Although $\Delta ICR_{i,t}$ is estimated to be close to zero and statistically insignificant, $ICRCovernant_{i,t}$ exhibits a positive influence on the net property sales ratio. Specifically, if ICR decreases to a value below 1.5, the ratio would increase by 2.6 ppts. In terms of the sales ratios from the previous years, it is observed that for every ppt increase in the ratio, the sales ratio in the following year would decrease by 0.94 ppt. This reflects a sudden increase in property liquidations by REITs in response to changes in DAR in the short-term, though the effect may be somewhat moderated as the market reaches a more stable state over time.

Table A1**:** Regression result of Equation (1)

Dependent variable: $\Delta Sales_{i,t+1}$	Coefficient	t-statistics	P>t
$DARCovenant_{i,t}$	0.039***	3.84	0
$\Delta DAR_{i,t}$	0.118***	4.46	0
$ICRCovenant_{i,t}$	0.026***	3.79	0
$\Delta ICR_{i,t}$	-5.76E-07	-0.38	0.705
$Sales_{i,t}$	-0.938***	-154.94	0
$Sales_{i,t-1}$	1.62E-06***	3.91	0
$Sales_{i,t-2}$	-4.37E-07	-1.06	0.291
FE_i		Controlled	
$Year_t$		Controlled	
No. of obs.		4,462	
	R-squared		
Within		0.8684	
Between		0.7394	
Overall		0.8319	

Note: *, ** and *** represent the statistical significance at the 10%, 5% and 1% levels, respectively.
Source: HKMA staff estimate.

Annex A2: Estimation of the impact of the change in DAR on the change in credit rating

To estimate the impact of the change in DAR on the change in credit rating, we also adopted a fixed-effect regression model, which can be written as Equation (2):

$$\begin{aligned}\Delta Credit_{i,t} = {} & \beta_1 DARCovenant_{i,t} + \beta_2 \Delta DAR_{i,t} + \beta_3 ICRCovenant_{i,t} + \\ & \beta_4 \Delta ICR_{i,t} + \beta_5 Credit_{i,t-1} + \beta_6 Credit_{i,t-2} + \\ & \beta_7 Credit_{i,t-3} + \theta FE_i + \delta Year_t + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where,

$\Delta Credit_{i,t}$	=	the change in the credit rating of REIT *i* assigned by Bloomberg from year *t-1* to year *t*;
$DARCovenant_{i,t}$	=	a dummy variable which equals 1 if DAR of REIT *i* is larger than 60%[17] in year *t* and 0 otherwise;
$\Delta DAR_{i,t}$	=	the change in DAR of REIT *i* from year *t-1* to year *t*;
$ICRCovenant_{i,t}$	=	a dummy variable which equals 1 if ICR of REIT *i* is smaller than 1.5[18] in year *t* and 0 otherwise;
$\Delta ICR_{i,t}$	=	the change in ICR of REIT *i* from year *t-1* to year *t*;
$Credit_{i,t-1}$	=	the credit rating of REIT *i* assigned by Bloomberg in year *t-1*;
$Credit_{i,t-2}$	=	the credit rating of REIT *i* assigned by Bloomberg in year *t-2*;
$Credit_{i,t-3}$	=	the credit rating of REIT *i* assigned by Bloomberg in year *t-3*;
FE_i	=	a vector of variables representing the REIT-level fixed effects;
$Year_t$	=	a vector of variables representing the year fixed effects;
$\varepsilon_{i,t}$	=	the residual term.

The variables in Equations (2) are mostly the same as the ones in Equation (1), as DAR and ICR are the main financial indicators used to determine a REIT's credit rating. To translate the credit ratings into a numerical format for our analysis, we assign numerical values to the rating categories, as shown in Table 1. A higher number indicates a downgrade credit rating, reflecting a higher default risk.

The regression result is shown in Table A2. Similarly, DAR exhibit both linear and threshold effects on a REIT's credit rating. When the DAR covenant is not violated, for every ppt increase in DAR, the credit rating of each REIT was estimated to be lowered by 0.04 grade. However, if the increase in DAR results in a violation of the usual debt covenant, the credit rating would be further downgraded by 0.89 grade.

[17] The usual DAR covenant for REITs to obtain bank loans and issue investment-grade bonds is to maintain a DAR within 60% (Lai, 2023; Frankel, 2014; Olazabal et al., 2012).

[18] The usual ICR covenant for REITs is to ensure their ICR of at least 1.5 (Lai, 2023; Frankel, 2014; Olazabal et al., 2012).

Regarding the impacts of control variables, it is found that a violation of the usual debt covenant on ICR (i.e., ICR < 1.5) and a better credit rating (i.e., a lower numerical number of credit grade) in the previous year might both lead to a greater credit downgrade.

Table A2: Regression result of Equation (2)

Dependent variable: $\Delta Credit_{i,t}$	Coefficient	t-statistics	P>t
$DARCovenant_{i,t}$	0.894***	3.2	0.001
$\Delta DAR_{i,t}$	4.090***	6.84	0
$ICRCovenant_{i,t}$	1.060***	7.35	0
$\Delta ICR_{i,t}$	-1.38E-05	-1.09	0.275
$Credit_{i,t-1}$	-0.766***	-43.98	0
$Credit_{i,t-2}$	0.130***	7.62	0
$Credit_{i,t-3}$	0.007	0.43	0.67
FE_i		Controlled	
$Year_t$		Controlled	
No. of obs.		3660	
R-squared			
Within		0.6912	
Between		0.0093	
Overall		0.5134	

Note: *, ** and *** represent the statistical significance at the 10%, 5% and 1% levels, respectively.
Source: HKMA staff estimate.

Annex A3: Back-testing results for the 2023 position

We have conducted a back test to evaluate the predictive power of the stress-testing framework by testing whether the estimates deviate significantly from the actual figures for the 2023 position. This back-testing exercise was conducted in three steps:

- Selection of REITs: We chose REITs listed in jurisdictions where CRE asset values declined in 2022.[19]

- Assumption of response: For simplicity, we assumed that the property value of each selected REIT would fall by the extent as CRE asset values within its listing region, as REITs' investment are typically domestically focused.

- Simulation: Based on the aforementioned assumption, we simulated the property sales and credit ratings of each selected REIT using the methodology outlined in *Section 2*.

The back-testing exercise indicates that our estimates closely align with the actual figures. Specifically:

- Property sales volume: The estimated increase in the selected REITs' gross property sales was US$10.7 billion, which was very close to the actual figure of US$11.2 billion. By listing region, the estimates remain consistent with the actual figures, as shown in Table A3 below.

Table A3: Estimates and actual figures of the selected REITs' property sales volume

	(1) Americas	(2) EMEA	(3) APAC	(4) Total
(a) Estimates	US$9.4 billion	US$0.8 billion	US$0.6 billion	US$10.7 billion
(b) Actual figures	US$9.9 billion	US$0.8 billion	US$0.5 billion	US$11.2billion
(a) ÷ (b)	95%	93%	113%	96%

Sources: S&P Capital IQ and HKMA staff estimates.

- Credit rating: The share of IG-rated REITs was estimated at 73%, which is nearly identical to the actual figure of 71%. By listing region, the estimates were also very close to the actual figures, as summarised in Table A4 below.

[19] This includes the US from Americas (which CRE asset values declined by 0.8% in 2022), the euro area from EMEA (2.8%), and Hong Kong and Singapore from APAC (1.5% on average).

Table A4: Estimates and actual figures of the share of IG-rated REITs

	(1) Americas	(2) EMEA	(3) APAC	(4) Total
(a) Estimates	66%	65%	91%	71%
(b) Actual figures	68%	68%	91%	73%
(a) ÷ (b)	98%	95%	100%	98%

Sources: Bloomberg and HKMA staff estimates.