

MIMS - Credit Opportunities

Markets and Alternatives Research Team

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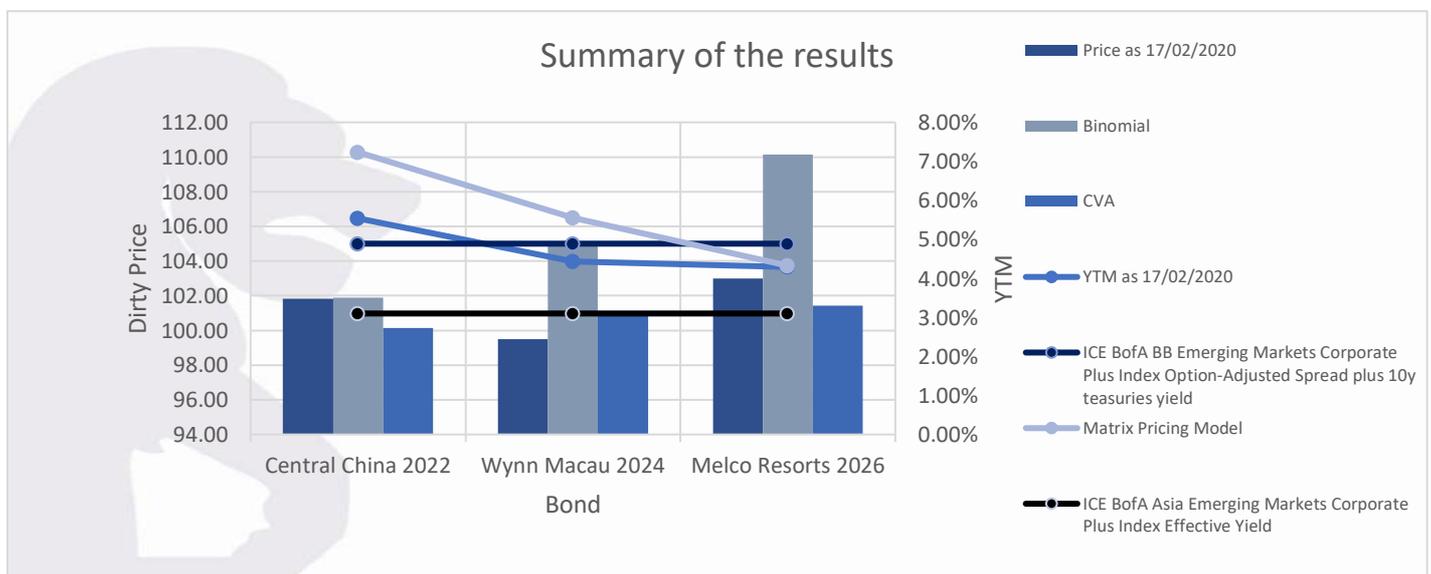
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INTRODUCTION

The present report aims at analyzing with a structural and model driven approach three emerging markets high yield bond. These bonds have been selected through a bottom-up approach. The initial reference for the selection is: UBS Emerging Markets Bond List. Valuation is carried out according to prices as of 17/02/2020. The selected bonds are:

- Central China Real Estate Ltd 6.875% 08Aug2022 Corp (USD)
 - Wynn Macau Ltd 4.875% 01Oct2024 Corp (USD)
- Melco Resorts Finance Ltd 5.250% 26Apr2026 Corp (USD)



MACRO RISKS

In this section is evaluated the exposure towards two macroeconomic factors that could affect the value of the bonds. Namely, exposure towards interest rate shift and, more in general, the monetary policy stance of People's Bank of China, and exposure to US dollar depreciation with a short-term perspective, since each bond is US dollar denominated.

Interest Rate Risk

PBoC Mandate

The Chinese monetary policy aims to keep the value of the RMB stable and contribute to economic growth. According to its official website, the PBoC has 14 official purposes. In the past, the PBOC has mostly focused on managing the quantity of money in its economy and setting quotas on how much banks can lend. That took a definitive turn in 2018 when the central bank stopped setting those specific targets. Instead, China is seeking to establish an interest rate regime like those used by the Fed and European Central Bank.

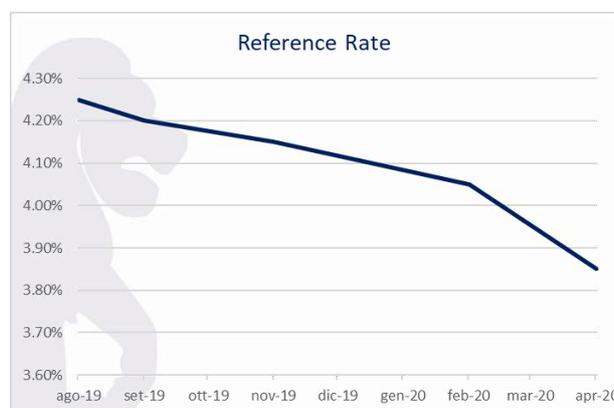
It has several tools to reach its goals:

- Open market operations, OMO
- Reserve requirement ratio, RRR
- Benchmark interest rates
- Rediscounting
- Standing lending facility, SLF
- Medium-term lending facility, MLF
- Pledged supplementary lending, PSL

Monetary Policy (2020-2021)

Remaining committed to the specific goals of maintaining an appropriate aggregate policy, notably lowering financing costs and supporting the real economy in the face of great uncertainties, the PBoC flexibly managed the intensity, pace and focus of policy adjustments:

1. Support measures totaling more than RMB9 trillion were introduced.
2. Central bank lending and central bank discounts totaling RMB1.8 trillion were provided in three phases in line with the needs of pandemic containment and economic development.
3. The PBoC deepened the market-based reforms of interest rates and the exchange rate. The work of shifting the pricing benchmark for outstanding floating-rate loans, which began as scheduled, has been completed smoothly. The PBC also improved the RMB exchange rate formation mechanism, enhanced the flexibility of the RMB exchange rate and intensified macro-prudential management.
4. The PBC improved institutionalized ways of communicating monetary policies and played an active role in international monetary policy coordination.



Macroeconomic Overview

China has recovered so rapidly from the coronavirus pandemic that authorities are pulling back support for the economy more quickly than they did following the 2008 financial crisis. In 2020, China’s gross domestic product (GDP) grew by 2.3 percent, with its volume exceeding RMB100 trillion, and the Consumer Price Index (CPI) rose 2.5 percent.

Beijing’s monetary easing policy, which includes lower interest rates, kicked off in January 2020 after an acceleration in the spread of Covid-19 domestically. The support reached its height nine months later in October.

China’s coronavirus stimulus program ended three months earlier than the 12-month-long one in 2009. Today, the aim of China’s policy is focused more about financial vulnerabilities and addressing the risk of overheating in the real estate and financial markets. However, in January analysts did not expect rate hikes or high-profile measures that could signal a policy cliff and jeopardize the economic recovery but rather more subtle changes.

Furthermore, it may be interesting that PBoC has asked lenders to rein in credit supply, as the surge of lending that sustained the country’s debt-fueled coronavirus recovery renewed concerns about asset bubbles and financial stability. The People’s Bank of China responded in February by instructing domestic and foreign lenders operating in the country to keep new loans in the first quarter of the year at roughly the same level as last year, if not lower. With the economy humming, policymakers have turned their attention to the risk of overheating and launched a broad crackdown on excess lending and financial risk.

FX and Capital Inflows

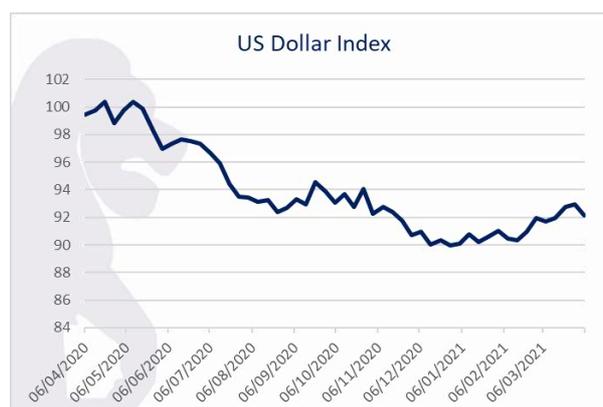
In January Yi said China would have continued to let the market play a decisive role in setting the yuan’s exchange rate in 2021, but it would have kept the yuan basically stable. Moreover, the PBOC has set the yuan reference rate at 6.4391 on the 10/2/2021.

However, China’s currency March was its worst month against the dollar in more than a year and a half, as investors fret that a clampdown on borrowing could slow the country’s swift economic recovery from Covid-19. The tightly regulated onshore-traded renminbi fell 1.4 per cent against the dollar in March to about Rmb6.57 marking its worst one-month drop since August 2019.

The fall represented a partial reversal for China’s currency after a banner 2020, when demand for the renminbi drove gains of 6.7 per cent. Offshore investors, eager to capitalize on the country’s rapid economic rebound from the coronavirus pandemic, poured more than Rmb1tn into China’s bond and stock markets. Economists said that China’s vague recently announced GDP growth target of “over 6 per cent” for 2021 was weighing on the currency. That is because it may signal authorities could be willing to clamp down on financial risk so forcefully that growth for the year could come in well below the 8.5 per cent forecast by economists polled by Bloomberg.

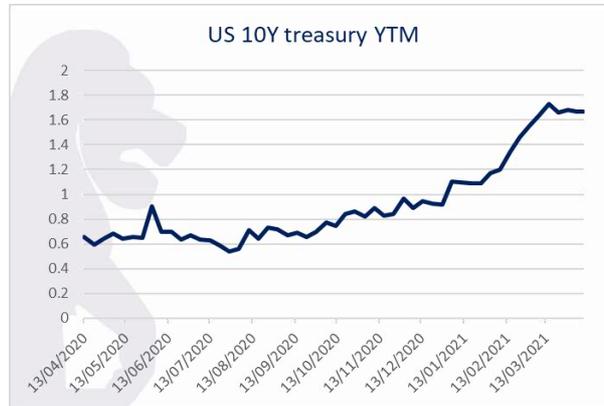
According to some analysts, by the end of 2022, the China yield premium could hit a decade low. Portfolio inflows to China, will slow or even reverse. Inflows are likely to grow is via passive investors, or those that track indices. On Tuesday, FTSE Russell confirmed it would begin adding Chinese debt to its benchmark World Government Bond index in October with a 5.25 per cent weighting. Analysts at Citi estimated the inclusion would drive about \$105bn of passive inflows into Chinese government bonds over a three-year period.

Currency Risk



The outlook of the US currency today is driven in part by macroeconomic factors such as: interest rate parity, inflation expectations, GDP growth and current account; in part by the new monetary policy paradigm based on liquidity. In this paragraph will be briefly analyzed the outlook of the US currency and asses if it represents an investment risk that could undermine the bonds performance.

The macroeconomic factors

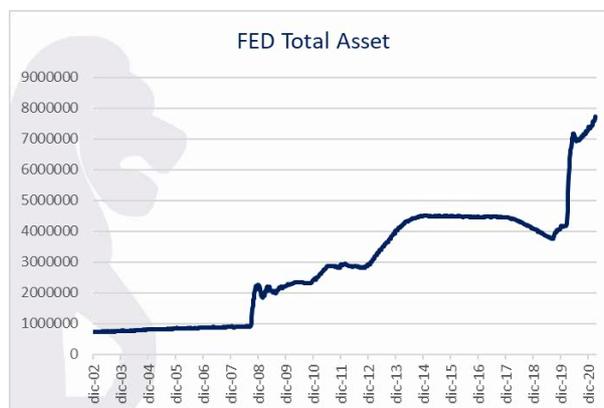


$$(1 + id) = S/F * (1 + if)$$

The covered interest rate parity formula represents a significant metric to assess the outlook of a currency. Its main underlying assumption being that positive/negative differences in interest rates between countries will lead eventually to capital inflows/outflows. Consequently, the recent yield surge in treasuries seem to be supportive for the US dollar.

The treasuries depreciation is the result of the sudden repricing of markets expectations regarding the US economic growth. On the 17th of March, the FED officially revised growth outlook at 6.5% and analysts forecast another revision ahead in the year. Markets also have re-priced inflation expectations with the 10-year inflation breakeven approaching 2.5%, a figure last seen in 2013. Higher supply of treasury due to the new record \$1.9 trillion stimulus plan implemented by the Biden administration along with a possible infrastructure federal plan may only partially offset recent movements in yield, with the risk of further heating the economy leading to a sustained surge in inflation. Consequently, the current environment seems to be supportive.

The monetary component



Although macroeconomic indicators are fundamental to assess the US dollar outlook, we shall not forget the new monetary paradigm based on liquidity. Monetary policies implemented since the financial crisis have consistently led to a negative correlation between total asset of CBs and exchange rates. Fed balance sheet has overcome \$7 trillion,

supporting bond prices, and suppressing nominal yields. The risk of further liquidity injections seems limited, although yield curve control and long-term asset purchase program could be implemented in the short-medium term. This brief analysis has shown that there is a supportive environment for the US dollar in the short to medium term. Thus, we assess a negligible risk in terms of currency exposure, with possibility of benefiting from the currency appreciation.

CREDIT RATING

BOND	CREDIT RATING (Moody's)
CENTRAL CHINA 2022	B1
WYNN MACAU 2024	B1
MELCO RESORTS 2026	Ba2

Central China 2022

Central China Real Estate (CCRE) is the leading construction company in China's Henan province. The company's corporate family rating (CFR) has been a consistent Ba3 since 2010. Grounds for Ba3 is CCRE's market leader position in Henan province, 22 years of experience and increasing contracted sales, supporting robust liquidity; while drawbacks are CCRE's geographically undiversified strategic planning, operating mostly in Henan.

CCRE's upgrade to Ba3 in 2013 was overshadowed by the downgrade to B1 in 2017 due to increasing risk of structural and legal subordination. Nevertheless, during COVID-19 pandemic B1 was affirmed partly due to prudent management, convenient reputation, and the firm's ability to achieve a solid 8.5% growth despite COVID-19 pandemic. Stable outlook was supported CCRE's ratio of Adjusted Cash over Short-Term Debt being 113%, which is expected to be sufficient to pay land premiums and short-term debts. Also, more than 90% of its customers buy CCRE properties to stay not for investment, which decreases speculation in the property prices; hence, contribute to stability in prices. Nevertheless, a drawback to operational performance of CCRE is its customers' decreasing disposable incomes during the pandemic, which decreases banks' possibility of granting mortgages to customers. Hence, CCRE's financial exposure to COVID-19 widens because CCRE is known to be the guarantor of its customers for mortgages. Moreover, Moody's stated possible upgrade triggers:

1. Sales increase,
2. CCRE achieves geographic expansion.
3. Enhancement in offshore banking relationship, since Chinese banks are restricted by the government to provide funds to construction firms depending on their projects. For example, funding luxury real estate is not allowed by Chinese government. Knowing CCRE constructs high-end and medium level real estate, it needs to make sure that its access to offshore bank funds are materialized without risks.
4. Adjusted debt over revenue exceed 90%

The following points support Moody's confirmation of CCRE during pandemic:

1. Diversified nature of CCRE (project management service brought 4.3% of revenue in 2019)
2. In 2019 land cost was RMB 1,280 per sqm. while Henan average selling price RMB 6,311 per sqm. and CCRE average selling price was RMB 7,811 per sqm., proving that CCRE can sell at a price level that is way above its competitors in Henan.

Wynn Macau 2024

In 2015, Wynn Resorts' Ba1 Corporate Family Rating (CFR) was put under review for a possible downgrade by Moody's because a) decrease in Macau gaming market revenues where Wynn Resorts generate 61% of its total revenue; b) Chinese government crackdown on corruption, and strict visa regulations c) leverage exceeding 7.0. The focus would be on Wynn Palace's impact on operating performance of Wynn.

In 2016, Wynn CFR was downgraded to Ba2 from Ba1, coupled with negative outlook because Moody's estimated a Debt to EBITDA ratio below 6.0 unsustainable.

In 2017, Moody's downgraded CRF to Ba2 from Ba3, Wynn Macau bonds to Ba3 from B1 due to high leverage caused by expensive construction projects in Macau and Massachusetts; nevertheless, strong liquidity and no nearing debt maturity were underlined.

In 2018, outlook was changed to negative after Moody's doubts that sexual assault allegation directed towards CEO and Chairman Steve Wynn could harm Wynn Resorts' reputation.

On May 1, 2019 Moody's revised Wynn Resorts' outlook to positive from negative, following the news that Massachusetts Gaming Commission allowed Encore Boston Harbor to open, which did reduce Wynn's exposure to sluggish Macau gaming market growth.

On March 16, 2020, Wynn Resorts was placed under review for a possible downgrade due to the company's exposure to Macau and Las Vegas, since the former experienced the strictest lockdown measures and located in the epicenter country; and the latter later became a highly affected area with millions of cases. The review will focus on the firm's ability to preserve its cash balance during low revenue and negative EBITDA quarters. However, as we can understand from Moody's decision to not change Wynn's speculative-grade liquidity rating, Wynn still has good amount cash and unused revolver capacity.

On April 7, 2020, existing ratings of Wynn was confirmed, while speculative-grade liquidity rating had to be downgraded from SGL-1 to SGL-2 due to continuing decline in revenues for an uncertain time and increased risk of covenant violation.

Melco Resorts 2026

Melco Resorts and Entertainment Limited (will be referred to as Melco hereafter) is a casino operator, providing gaming and entertainment services, in Asia. The company endeavors to become a world leader in casino gaming and entertainment through its numerous development and innovation projects.

In May 2018 Moody's upgraded Melco's senior unsecured notes rating and Corporate Family Rating (CFR) to Ba2 from Ba3. The outlook was stable. Melco balance sheet was endowed of high-quality assets, a strong market position, has a resilient financial profile and liquidity. CFR upgrade is mainly due to the parent company's, Melco Resorts Entertainment, improved credit profile. Moody's also anticipated levelled debt rates for the next year and Debt/EBITDA at 1.8x.

On March 16, 2020 Moody's placed Melco under review as a response to a significant fall in revenues impacting the firm's balance sheet strength. Furthermore, decreasing oil, asset, and commodity prices, economic uncertainty, reduced business travels, COVID-19 restrictions, left Melco vulnerable to unprecedented social risk. Melco's gaming revenues obtained from Macau plummeted by 88% in February 2020 compared with 2019. Moody's expected that Debt/EBITDA of the company would reach to 4.2x as of 2020. Nevertheless, we should remember that Melco held approximately \$1.4bn of consolidated cash, which would allow the company to fund for maintenance and run negative cash flow for at least a year.

Moody's review will concentrate on three notable topics:

1. How quickly economies will recover from COVID-19 pandemic
2. Will gaming revenues adhere to COVID-19 recovery of world economies
3. Melco's liquidity position

On May 25, 2020, Melco's rating was confirmed at Ba2 but with negative outlook; A downgrade for Melco would be triggered if:

1. Moody's believes that Melco's financials will deprive a possibility of reaching to pre-Coronavirus levels, or even sustaining 4.5x or below Debt/EBITDA.
2. Notable weakened liquidity positions further deteriorate, due to the pandemic given first quarter 2020 of EBITDA is merely \$55 million – down from \$388 million.

BINOMIAL PRICING MODEL

The first model used to evaluate our bonds is a fixed income version of the Binomial Options Pricing Model. The advantage of this approach is the possibility to forecast different paths for the price of the assets we are considering, depending on the different states of the world. The final evaluation is a synthesis of the results of the different paths.

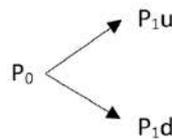
With the strong assumptions of lognormality of returns and arbitrage free markets, we can assume that the price of an asset in discrete time intervals is a binomial variable able to move up of a factor u or down of a factor d .

These factors can be easily computed with the historical volatility of the asset and the risk-free rate. The formulas for the probability of u and the u and d factors are:

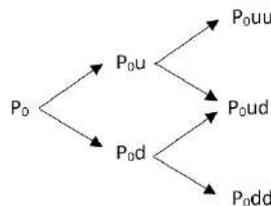
$$u = e^{\sigma\sqrt{\Delta t}} \text{ and } d = 1/u$$

$$p_u = \frac{e^{r\Delta t} - d}{u - d}$$

We can visually represent this first step from t_0 to t_1 as a one-step binomial tree:



The same reasoning can be applied to the two different prices going from t_1 to t_2 . What we obtain at time 3 are three prices. The central one is both the result of the price going down in t_1 and up in t_2 and of the price going up in t_1 and down in t_2 as our u and d factors are constant in time. The same process can be repeated from t_2 to t_3 and so on, until we get to the final period of our evaluation with 2^n different paths.



This method needs more computational power than other models (like the Black-Scholes formula for options) but it is more accurate for long dated assets with dividend or coupons payments. In our work we created two different binomial trees for each bond, one to forecasts the different paths of its YTM, and the other for the risk-free rate that we used for the CVA Adjusted evaluation.

From a practical standpoint, to build a binomial tree two inputs are needed: the volatility of the asset and the risk-free rate. The best risk-free rate proxy for our bonds is Chinese Government Bonds. We picked the maturity more in line with each bond to be consistent with the duration of the steps of the binomial tree we used. Computing the volatility has been more computationally demanding due to the illiquidity of our bonds with no price data, for several weeks or months. We reconstructed the missing points by bootstrapping. Illiquidity and missing data bias are furtherly discussed in our evaluation of the limitations of the model. For the Central China 2022 bond, we used monthly data from October 2019. For the other bonds weekly prices were available. To unsmooth the effects of the low liquidity on volatility we corrected the obtained standard deviation with the formula:

$$\sigma_{unsmoothed} = \sigma_{smoothed} \sqrt{1 + 2 \frac{n}{n-1} \sigma_{serial}}$$

n being the number of observations and σ_{serial} being the correlation of each observation and its previous one.

For practical reasons we planned a 3-step tree for the Central China Bond with 6 months steps, a 4 step one for WYNN Macau with 11 months steps and a 5 step one for Melco Resorts, with 1-year steps. To pair this framework with the payment structure of the bonds we reorganized the coupons and terminal value payments matching our new virtual cashflows with the tree's steps dates. To minimize the bias created we used a temporal proximity criterion to move coupons and we avoided to move the terminal value. Actualization and capitalization of the cashflows was computed using the forward rates we computed from the Chinese Government Bond term structure.

Starting from the 17/02/2020 YTM we constructed the three different binomial trees for our bonds resulting in 8, 16 and 32 yields paths. Actualizing our newly organized cashflows using the yields from each path we obtained one estimated fair price for each path. The average of these fair prices is our evaluation of the bond price at t_0 .

Central China RE 2021 had a price of 102.0 on the market, while our binomial model estimated a 101.9 fair value. As the difference is minimal, our recommendation on the bond is **hold**. For the Melco Resort Finance 2026 bond the price on the market was 104.625, while the result of our analysis is 110.14, so the recommendation is a **buy** as the bond seems to be undervalued as it is for the WYINN Macau 2024 bond that sells at 101.50 but our models estimated at a 104.88 fair price.

Central China 2022				
to	feb-21	ago-22	feb-22	
				6.41%
				0.26
		6.13%		
		0.40		
	5.86%			5.86%
	0.64			0.44
5.60%		5.60%		
1.00		0.46		
	5.36%			5.36%
	0.36			0.25
		5.13%		
		0.13		
				4.90%
				0.05

Wynn Macau 2024				
to	gen-22	dic-22	nov-23	ott-24
				6.34%
				0.11
			5.61%	
			0.18	
		4.97%		4.97%
		0.32		0.32
	4.41%			
	0.57			
3.91%		3.91%		3.91%
1.00		0.49		0.36
	3.46%			
	0.43			
		3.07%		3.07%
		0.19		0.18
			2.72%	
			0.08	
				2.41%
				0.03

Melco Resorts 2026					
to	feb-22	feb-23	feb-24	feb-25	feb-26
					6.44% 0.06
				5.68% 0.11	
			5.00% 0.19		5.00% 0.23
		4.41% 0.33		4.41% 0.32	
	3.88% 0.57		3.88% 0.42		3.88% 0.34
3.42% 1.00		3.42% 0.49		3.42% 0.36	
	3.01% 0.43		3.01% 0.31		3.01% 0.26
		2.66% 0.18		2.66% 0.18	
			2.34% 0.08		2.34% 0.10
				2.06% 0.03	
					1.82% 0.01

The model and our practical application have some limitations. A source of bias may be the forced re-organization of the cashflows we had to make to fit our models. Coupons were not moved more than 6 months, but the accuracy of the model was impacted. In particular, the first coupon was discounted to t0 by one month, making it practically riskless in the model. Furthermore, the illiquidity of the bonds biased our volatility. The unsmoothing formula we applied may have been able to limit this effect. A worth mentioning issue is the presence of data from Covid impacted periods. A clear example is the price of WYNN Macau dropping under 80 during March 2020. These fluctuations may have affected the overall volatility. Other sources of bias may be the limited number of steps of our trees that may affect accuracy. A minor bias may come from our risk-free rate proxy, as the China Government bonds carries a minimal default risk.

CVA Adjustment Model

In this other part of our analysis, we applied a more fundamental approach: we calculated the price of the bonds as the risk-free value of their cashflow (value assuming no default, VND) minus a credit valuation adjustment. To compute this adjustment factor we considered only the default risk. The credit valuation adjustment (CVA) is the sum of the discounted expected loss on the future cashflows and depends on the probability of default and the recovery rates.

$$CVA = \sum_{t=1}^T (Expected\ Exposure_t) * (1 - Recovery\ Rate_t) * (Probability\ of\ Default_t) * (Discount\ Factor_t)$$

This design is possible with the assumption that the default event can happen anytime between two periods, but its financial impact is experienced only at the end of the discrete time-period. The probability of default is a *risk neutral* probability that differs from the actual historical probabilities, and typically prices more aggressively credit risk during

uncertain times. Given the recovery rates we can find it as the default probability value that approximates the sum of the expected values of the cashflows to 100. The final fair price of the bond is VND-CVA.

To apply the model to our data we used the cashflow re-organization from the Binomial Model. The recovery rates we applied come from Moody's *Annual Default Study: Corporate Default and Recovery Rates, 1920 – 2017*. The correct rating classes were picked depending on the bonds evaluated. For the discount factors we constructed a binomial tree, similar to the one from the Binomial Model, with the Chinese Government yields. The 1 Year yield was used for the Central China bond while the 3 Years one was more suitable for the other two bonds. Using the same procedure as in the Binomial model, discounting the cashflows with the right rate, we obtained the risk-free value VND. We computed the *risk neutral* default probability for each bond and discounted it in all the paths from the binomial tree to obtain the CVA. The subtraction of the two is our model's fair value for the assets.

Using the *Goal Seek* function we found the spread between the risk-free rate and the implicit rate in our VND-CVA price, namely the Z Spread, a proxy of credit risk.

For the Central China bond the result of our evaluation is 100.10, against a market price of 102.00. our model's recommendation is **sell**. Our fair value for the Melco bond is 101.44, while the market evaluates it at 104.625, so the recommendation is still a **sell**. For WYNN, our fair value is 101.00, while on the market it sells at 101.50, resulting in a **hold** recommendation.

The limitations of the model are similar to the Binomial one. We can add that our recovery rates refer to data before 2017 so the Covid's impact may be undervalued. Furthermore, these recovery rates are aggregated data, so no regional effect is taken into account. Different national policies and default laws may affect these rates.

BOND	CREDIT RATING	Z-Spread
CENTRAL CHINA 2022	B1	4.413%
WYNN MACAU 2024	B1	2.256%
MELCO RESORTS 2026	Ba2	2.442%

DCF MODEL

YTM

In this section, it is analyzed the YTM of the 3 bonds. It is produced both a time-series and pointwise analysis of the YTM¹.

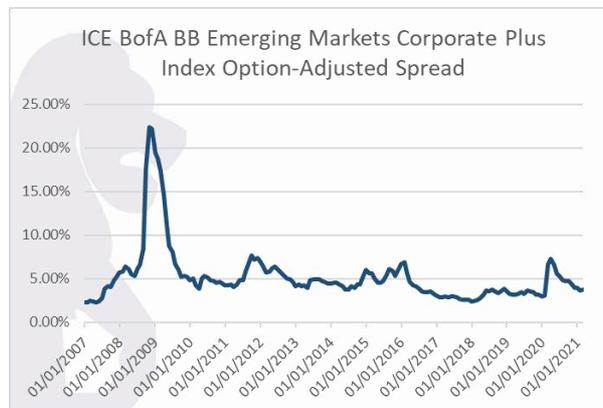
Firstly, two indexes are introduced. They will be used in the following part as a benchmark. The first index is the ICE BofA BB Emerging Markets Corporate Plus Index Option-Adjusted Spread² (The ICE BofA OASs). The ICE BofA OASs are the calculated spreads between a computed OAS index of all bonds in a given rating category and a spot Treasury curve. An OAS index is constructed using each constituent bond's OAS, weighted by market capitalization. In this index are included only bond with a credit risk between Ba1 and Ba3. Given that it is a spread, for the pointwise analysis, it is necessary to correct the index with the risk-free rate. It is computed both with the yield of the 3 and 10-year treasury bonds. The index on the 17th of February was 3.60% and adding the YTM of the 3 years (0.23%) and 10 years (1.29%) treasury we get respectively 3.83% and 4.89%.

The second index is the ICE BofA Asia Emerging Markets Corporate Plus Index Effective yield. It is an index that includes only securities issued by countries associated with the region of Asia (excluding Kazakhstan, Kyrgyzstan, Tajikistan,

¹ YTM are computed in the report according to dirty prices. The charts below plot historical YTM on clean prices.

² The option-adjusted spread (OAS) is the measurement of the spread of a fixed-income security rate and the risk-free rate of return, which is then adjusted to take into account an embedded option.

Turkmenistan, and Uzbekistan). This is a more general index because it does not include only the bonds of a specific rating class. This index is not a spread, so it is not necessary to do any correction. The value of the index on the 17th of February was 3.10%



In the chart above is plotted the historical values of ICE BofA OAS from January 2007 to March 2021. To have a good understanding of its fluctuations, it is useful to make a consideration. According to Eduardo Cavallo and Patricio Valenzuela (2007), the firm level characteristics accounts are the principal determinant of the corporate spread. In addition to that, two of the main non-firm specific determinants of the corporate spread in the Emerging Market are volatility (a proxy for idiosyncratic risk) and 'sovereign risk'. These findings explain in particular the high values recorded from the index during the 2 most recent crisis.

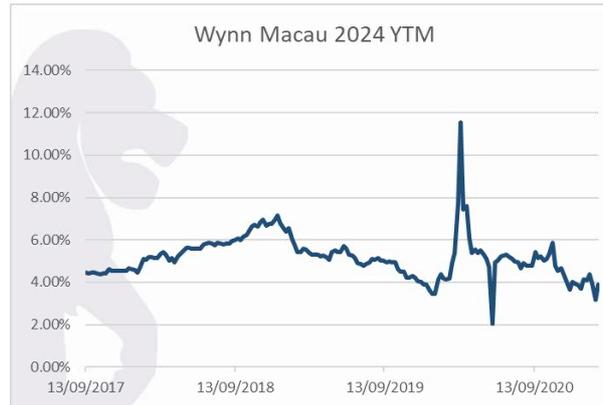
At the beginning of the time sample analyzed the spread was 2.38%. During the financial crisis of 2008, the spread spiked, reaching the maximum level of 22.43% in November 2008. After 2009 the index started to come back to a mean level settling around a value of 5% after 2010. From February 2016, the spread decreased arriving at the pre-crisis level (around 3%). At the beginning of 2018, the spread reached the minimum value of 2.38%.

Due to the Covid pandemic, there was another increase in the spread. However, this time the spike was much lower than the one recorded during the financial crisis of 2008. In April 2020, the spread was 7.12%. Finally, in March 2021 the value of the index was 3.51%.

In chart below are plotted the fluctuations of the YTM of the 3 bonds.



Central China 2022: for this bond is persistent negative trend for the yield. It started in October 2019 with a YTM of 7.39% and reaches a value of around 5.50% in December 2020, with almost always a negative slope.



Wynn Macau 2024: this is the earliest issued bond among the 3. In September 2019, the yield was 4.40%, and it continued to increase constantly until January 2019, when it reached the value of 6.96%. After this date we have a change in the trend, with a decline declined for the next 12 months. In January 2020, before the Covid crisis, the yield was 3.44%. For this bond, the crisis produced the highest spike, with a yield of around 11%. However, only after 2 months the yield came back to pre-crisis value and remained constantly around 5%.



Melco Resort: Until 2020 the YTM of this bond was stable, almost always between 4-5%. During the first month of the COVID pandemic, the yield spiked, reaching a value of 9.12%. After 6 months the yield came back to values around 5%. From the end of 2020 the YTM has started to decrease arriving at 3.42%.

For the pointwise analysis, the YTM is computed assuming as starting date the 17th of February 2021. The goal of our analysis is to understand if the bonds chosen have a better performance than an average bond in a similar risk class or compared to an average bond independently from the risk. Hence, we compare the YTM with the 3 benchmarks we introduced before.

As will be evident from the analysis, all the 3 bonds have an YTM higher than ICE BofA Asia Emerging Markets Corporate Plus Index Effective Yield (3.10%). These results are reasonable given that the previous index is an average that includes also bond with lower credit risk and so with lower yield.

On the other hand, the results that we get comparing the performance each bond with the other 2 benchmarks are more interesting:

- Central China: the price of the bond is 102\$ and the YTM 5.54%. For this bond, the YTM is higher than the 2 benchmarks. However, this high YTM is not surprising given that Central China is the riskiest bond among the three.
- Melco Resort: the price of the bond is 104.625\$ and the YTM 4.29%. In this case, the YTM is higher than the index plus the 3-year treasuries yield, but lower than the spread plus the 10 years treasuries yield.
- Wynn Macau: the price of the bond is 101.5\$ and the YTM 4.43%. In this case too, the YTM is higher than the index plus the 3-year treasuries yield, but lower than the spread plus the 10 years treasuries yield.

In conclusion what emerges from this analysis is that Central China has an interesting rate of return, while for Melco and the Wynn Macau we remain more prudent but still positive. According to the UBS EM bond list, the 3 bonds of our analysis are all described as attractive. In that report, an “attractive” bond is a bond that is expected to generate a total return exceeding the average return of comparable instruments.

MATRIX PRICING MODEL

In the fixed-income market, the matrix pricing model is traditionally targeted towards estimating the discounted price of bonds that are illiquid, not actively traded or to estimate the required yield spread of a bond to be issued in the future.

This is done by targeting actively traded comparable bonds, meaning bonds with similar credit quality (coupon rate, credit rating and type of issuer), and different maturities. The process is as follows:

- Calculation of the yield-to-maturity (YTM) of comparable bonds, using the discounted cash flow model. The method estimates the value or price of the bond based on its expected future cash flows. Since the current prices of the comparable bonds are available, this model is used to compute the YTM of the bonds.

$$Price = \sum_i^t \frac{(Cash\ flows)_t}{(1 + YTM)^t}$$

- Through linear interpolation, the YTM of the target bond is estimated.

Certain assumptions are to be taken into account when we employ the matrix algebra model.

- We consider a linear relationship between the yield-to-maturities of bonds of the same issuer.
- We set the date 17th of February 2021 as the purchase date of the target bonds. The quoted price on the day of purchase is considered the clean price of the bond and the dirty price is estimated by adding the accrued interest between the last coupon payment and the purchase date.
- Expectation’s theory related to the discounted cash flow method holds. This suggests that short-term interest rates are used to determine long-term interest rates in the fixed-income market³.

Model limitations

The risks of valuation are related to the limitations of the DCF method and the corollaries of expectations theory. In our matrix model we consider that YTM_A (YTM of non-target bond A) and YTM_B (YTM of non-target bond B) remain stable (related to the projection of short-term interest rates) regarding future cash flows, which experience frequent fluctuations, based on macroeconomic factors, such as benchmark interest rates and expectations in future interest rates, inflation or in general changes in monetary policy. Furthermore, the operating cash flows and the capital expenditure of the firm is considered constant and linear. However, these projections can deviate, due to uncertainty related to the firm’s financial position and managerial strategy.

The YTM_C (YTM of target bond) is estimated in two ways. The first relies on the linear interpolation between YTM_A and YTM_B (taking the average in the case that bond C has an equal distance in years-to-maturity between bond A and bond B). The second is based, once again, on the DCF method. These results are afterwards compared, followed by characterization of the reasons behind the estimated spread.

³ Roberto Perotti, “PRELIMINARIES: NOMINAL AND REAL INTEREST RATES AND THE YIELD CURVE” (Feb 21, 2021), retrieved on April 4, 2021

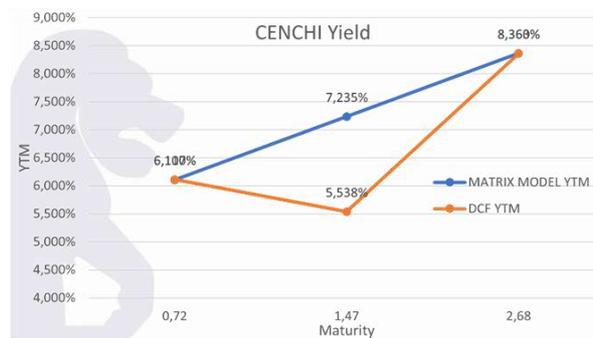
Model Implementation

Central China 2022

BOND & CREDIT RATING	COUPON
CENTRAL CHINA 2021 (BB-)	6,107%
CENTRAL CHINA 2022 (BB-)	5,538%
CENTRAL CHINA 2023 (BB-)	8,363%

By employing the DCF method, we estimate that the YTM of CENCHI 2021 (6,107%) and the YTM of CENCHI 2023 (8,363%). Subsequently, we take calculate their average (7.235%), which we compare to the DCF YTM we estimated for CENCHI 2022 (5,538%).

A notable observation can be made on the spread between CENCHI 2022 and CENCHI 2021 by 0,569 percentage points, which is also reflected in a higher bond price. This difference in the 2022 bond price of Central China Real Estate could be related to the fact that property developers constituted 27% of missed payments during the first quarter of 2021, seeing the recent default of real estate companies China Fortune Land Development and Tianjin Real Estate Group. This has been in light of China’s recently promulgated “three red line policy”, setting a 70% cap on debt-to-asset ratio, a 100% ceiling on net debt to equity and targeting a cash to short-term borrowing of minimum 1. This falls under the Chinese government’s strategy of gradually deleverage housing developers and keep under control a volatile property bubble.

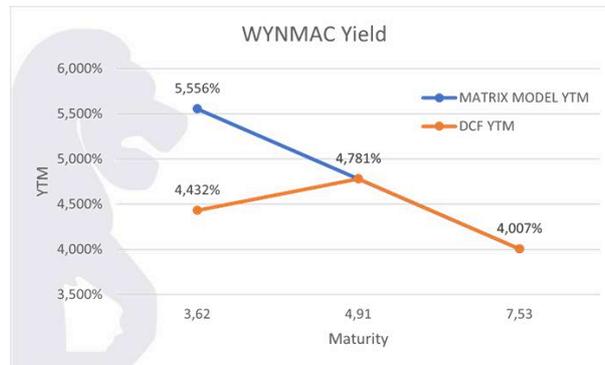


Wynn Macau 2024

BOND & CREDIT RATING	COUPON
WYNNMAC 2024 (BB-)	4,432%
WYNNMAC 2026 (BB-)	4,781%
WYNNMAC 2028 (BB-)	4,007%

With the assumption that there is a linear relationship between yields of bonds with different maturities, we consider WYNNMAC 2026 as the average with the target bond being WYNNMAC 2024. The linear yield estimate is 5,556% while the DCF estimate is calculated at 4,432%.

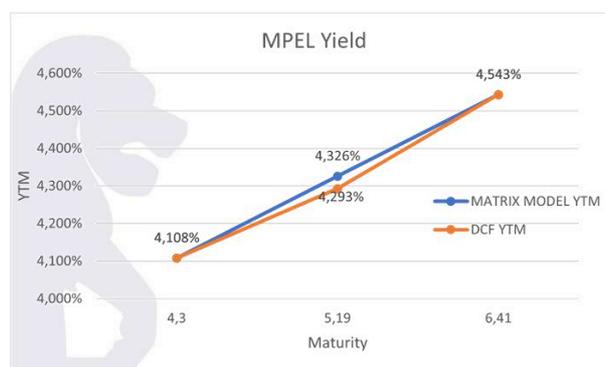
With Wynn Macau also being one of the largest providers of casino, restaurant and premium hospitality services in China, investors seem to show more faith in the near future economic boost in post-pandemic times, amid China’s continuously relaxing COVID measures, rather than in the far future, as indicated by a fall of 0.774 percentage points spread between the 2026 and 2028 maturity bonds. This can both be directed both towards uncertainty in China’s monetary policy, inflation unpredictability as well as the sustainability of the company’s growth.



Melco Resorts 2026

BOND & CREDIT RATING	COUPON
MPEL 2025 (BB)	4,108%
MPEL 2026 (BB)	4,239%
MPEL 2027 (BB)	4,543%

The yield as the average of those of MPEL 2025 and MPEL 2027 is estimated at 4,326%. The yield of MPEL 2026 based on the DCF model, is calculated at 4,293%. In this case, we see only a small deviation from the matrix model expected YTM of 0,033%.



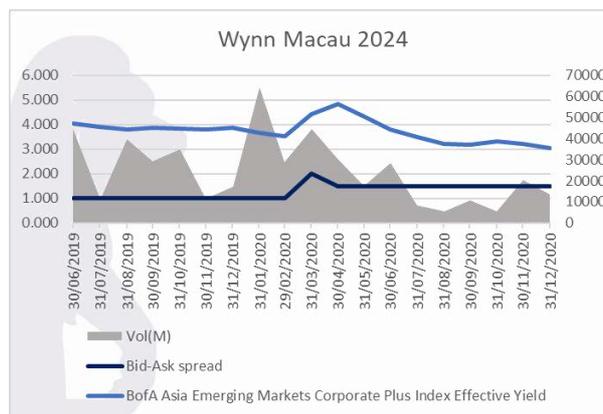
Melco resorts finance, as a real estate developer specializing in casino-related property, will also be subjected to China’s “three red lines” and gradual QE tapering. In this case projections of a strong longer-term Chinese economic recovery reaching 9% as well as a continued growth in the casino industry might be overshadowing signs of a tightening of monetary policy by rising repo rates and long-term interest rates.

LIQUIDITY ANALYSIS

All the bonds that we consider in this report are illiquid. So, in this section, we provide an analysis of the volume of the 3 bonds.

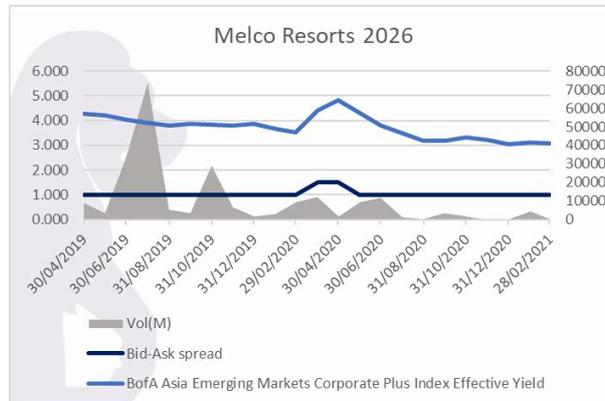


Central China 2022: this is the bond with the lowest number of traded contracts. The number of traded was always lower to 5000 million. The only exception to that was September 2020 with around 6000 million traded contracts. There were also 3 months, almost 20% of the total number of months, with a trading volume of 0. These low trading volumes can be an explanation for the high-risk premium of this bond.



Wynn Macau 2024: this is the bond with the highest trading volume. There were no months with 0 volumes traded. In particular, the volume traded was very high in the first 12 months after the issuing with a value predominantly higher than \$20000 million (there were only 3 months with volume around \$10000 million). For this bond, the month with the highest number of trading contracts was January 2019, with a trading volume of around \$60000 million. In the second semester of 2020, the trading volumes decrease significantly, with values well below \$10000 million. However, in August and November, the number of the contract was higher, respectively around \$10000m and \$20000 million. In these 2 months two important events happened: on 26 August 2020 were issued US\$600 million 5.625% senior notes due 2028, which included a US\$250 million add-on to existing notes due 2026; in November, Wynn Macau Ltd announced the intention to use their proceeds for “repayment of a portion of the amounts outstanding under the Wynn Macau [Ltd] credit facilities”.

Melco Resort 2026: for this bond, the trading volumes have been not very high, with a number of contracts traded almost always below \$10000 million. The most evident exception to this trend was July 2019. In this month there was a huge increase in the trading volume (\$73903 million). One of the possible reasons for this increase could be that in July 2019 Melco Resort issue US\$600 million senior notes due 2027 with a coupon of 5.625%. Another exception on the opposite side was November 2020. It was the only month with 0 traded contracts.



SENSITIVITY ANALYSIS

Duration and Convexity

Duration is regarded as the period after which the bond holder is expected to receive cash payments. It is seen and used as sensitivity of a bond to changes in interest rates.

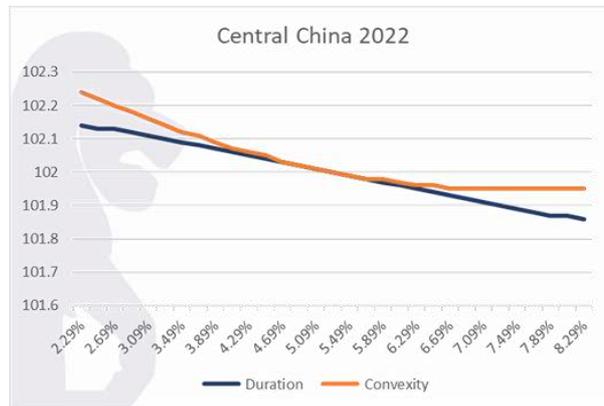
It is usually observed that bonds with longer maturity or bonds with smaller coupon rates are more sensitive to changes in interest rates. This also translates to the trade-off between price risk and re-investment risk. As interest rates and bond prices have an inverse relationship, a holder of a short-term bond would be more concerned with price risk, with rising interest rates carrying the disadvantage of falling bond prices and vice-versa. In contrast, an investor who is looking to hold a bond for a longer period, even until its maturity, and is interested in re-investing their coupon payments in the meantime, will be favored by rising interest rates and vice versa. Therefore, price risk and re-investment risk seem to move in opposite directions, with duration being the holding period at which they offset each other.

The Macaulay duration, or simply duration, is the weighted average of the time to receive cash payments from a bond and it is measured in years, while modified duration indicates the percentage change in a bond price by a 1% change in interest rates.

It is observed that with a greater than one percentage points change in interest rates, the price of the bond falls less than the predicted duration if interest rates increase, while the price of the bond rises more than the predicted duration if interest rates decrease. This is due to the factor of convexity, which allows a more accurate prediction of bond prices in the occasion of larger interest rate fluctuations.

Central China 2022

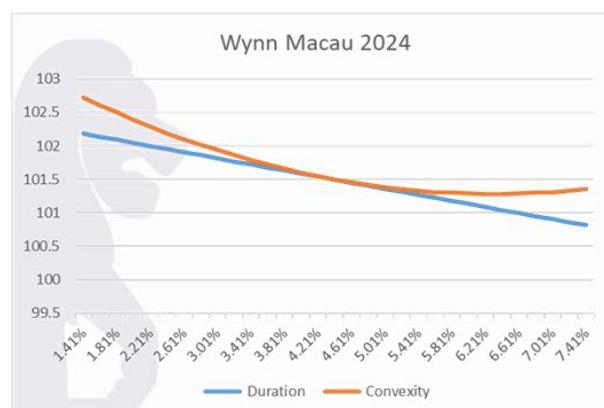
Duration	1,421
Modified Duration	1,277
Convexity	2,058



Central China Real Estate 2022 has an estimated duration of 1,421 years, having the lowest interest rate risk compared to MPEL 2026 and WYNNMAC 2024, which would be expected due to the shorter time to maturity (1,47 vs 5,19 vs 3,62 years) and the relatively high coupon rate (6,875 vs 5,250 vs. 4,875). As a result of the shorter maturity, the bond also presents the lowest convexity measure (2,058), meaning that duration will be more accurate in predicting small yield changes, but also that the bond will experience greater losses when rates rise and smaller gains when yields fall, compared to bonds with similar credit quality but greater convexity.

Wynn Macau 2024

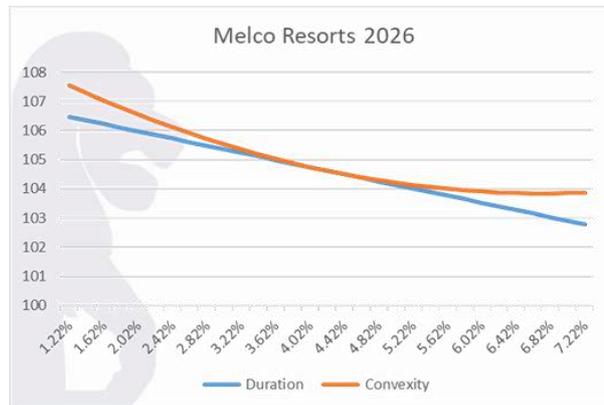
Duration	3,299
Modified Duration	2,972
Convexity	11,603



We find Wynn Macau 2024 in the middle, having a duration of 3,299 years and a convexity measure of 11,603, attributed to its relatively medium time to maturity of 3,62 years and a coupon rate of 4,875%, the lowest of the three.

Melco Resorts 2026

Duration	4,552
Modified Duration	4,172
Convexity	22,576



Melco resorts finance presents the highest duration of 4,172 years out of the three bonds, and thus interest rate risk, which can be explained by the longer maturity of 5,19 years and a coupon rate (5,250) that is smaller than CENCHI 2022 (6,875), even though it is higher than that of WYNMAC 2024 (4,875) by 0.375 percentage points. At the same time, it also has the highest convexity measure (22,576) compared to the other two bonds, fortifying its hedging against wide rate fluctuations.

To complete our assessment of interest rate risk we compute the subsequent equation:

$$\frac{\Delta B}{B} = -D\Delta y + \frac{1}{2}C(\Delta y)^2$$

The equation is a Taylor series expansion of the classic linear relationship between duration and price changes; it also includes convexity, further characterizing the relationship with rate changes. As possible interest rate paths we look for each bond at two different scenarios:

- Changes in risk free rates proxied through Chinese government bond yields with similar maturities. This scenario prices more hawkish (dovish) monetary policies.
- Changes in credit risk pricing proxied through ICE BofA BB Emerging Markets Corporate Plus Index Option-Adjusted Spread. This scenario prices changes in credit risk pricing.

The paths are generated within binomial process through historical volatility.

Central China 2022	Probability	0.18	0.42	0.32	0.08
Probability	Rate shift	0.92%	0.28%	-0.26%	-0.73%
0.79	0.11%	-1.33	-0.51	0.19	0.81
0.19	0.03%	-1.23	-0.41	0.30	0.91
0.02	-0.04%	-1.13	-0.31	0.40	1.01
0.00	-0.12%	-1.03	-0.21	0.50	1.11

Wynn Macau 2024	Probability	0.12	0.34	0.35	0.16	0.03
Probability	Rate shift	1.82%	0.82%	0.00%	-0.67%	-1.21%
0.15	1.08%	-8.48	-5.62	-3.19	-1.15	0.55
0.36	0.49%	-6.76	-3.89	-1.47	0.57	2.28
0.33	0.00%	-5.28	-2.41	0.01	2.05	3.76
0.14	-0.42%	-4.01	-1.14	1.28	3.32	5.03
0.02	-0.77%	-2.92	-0.06	2.37	4.41	6.11



Melco Resorts 2026	Probability	0.08	0.26	0.35	0.23	0.08	0.01
Probability	Rate shift	2.54%	1.36%	0.41%	-0.37%	-0.99%	-1.49%
0.09	1.49%	-16.57	-11.97	-8.01	-4.65	-1.82	0.53
0.28	0.81%	-13.79	-9.18	-5.22	-1.86	0.97	3.32
0.34	0.24%	-11.37	-6.77	-2.81	0.55	3.38	5.73
0.21	-0.23%	-9.30	-4.70	-0.74	2.63	5.45	7.81
0.06	-0.63%	-7.53	-2.93	1.04	4.40	7.23	9.58
0.01	-0.96%	-6.02	-1.42	2.55	5.91	8.74	11.09

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