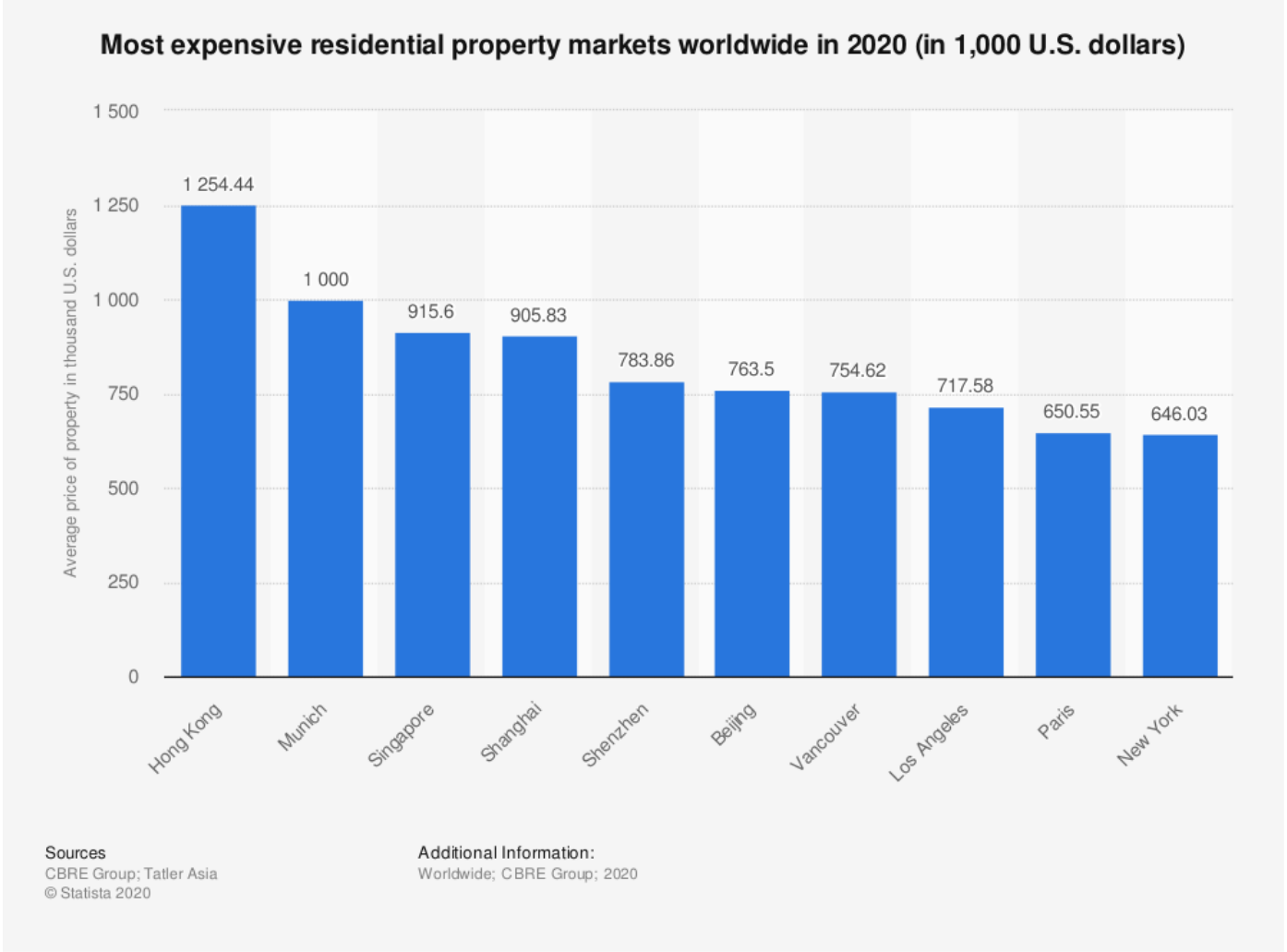
Chapter 20: Mortgages and Mortgage-Backed Securities


Most expensive residential property markets worldwide in 2020 (in 1,000 U.S. dollars)
Average price of property in thousand U.S. dollars
1 500
1 250
1 000
750
500
250
0
1 254.44
1 000
915.6
905.83
783.86
763.5
754.62
717.58
650.55
646.03
Hong Kong
Munich
Singapore
Shanghai
Shenzhen
Beijing
Vancouver
Los Angeles
Paris
New York
Sources
CBRE Group; Tatler Asia
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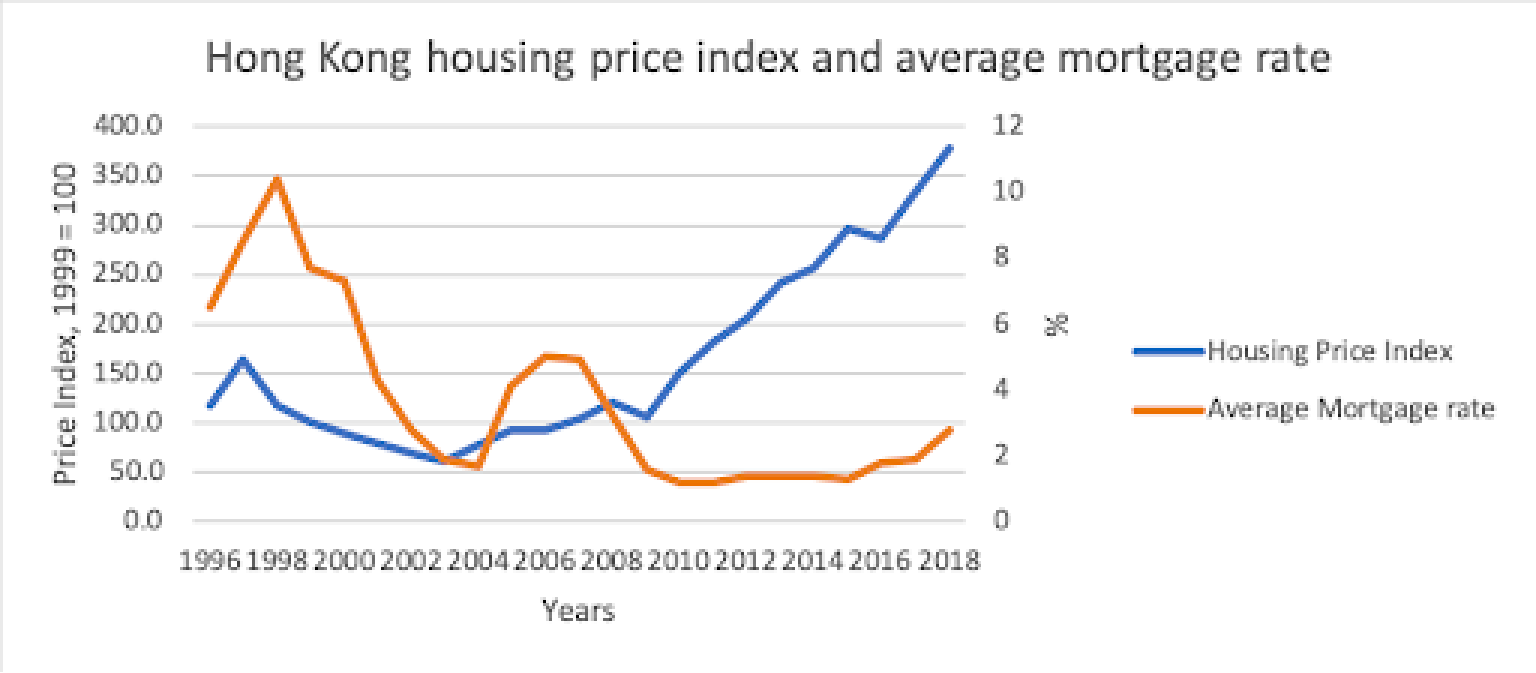
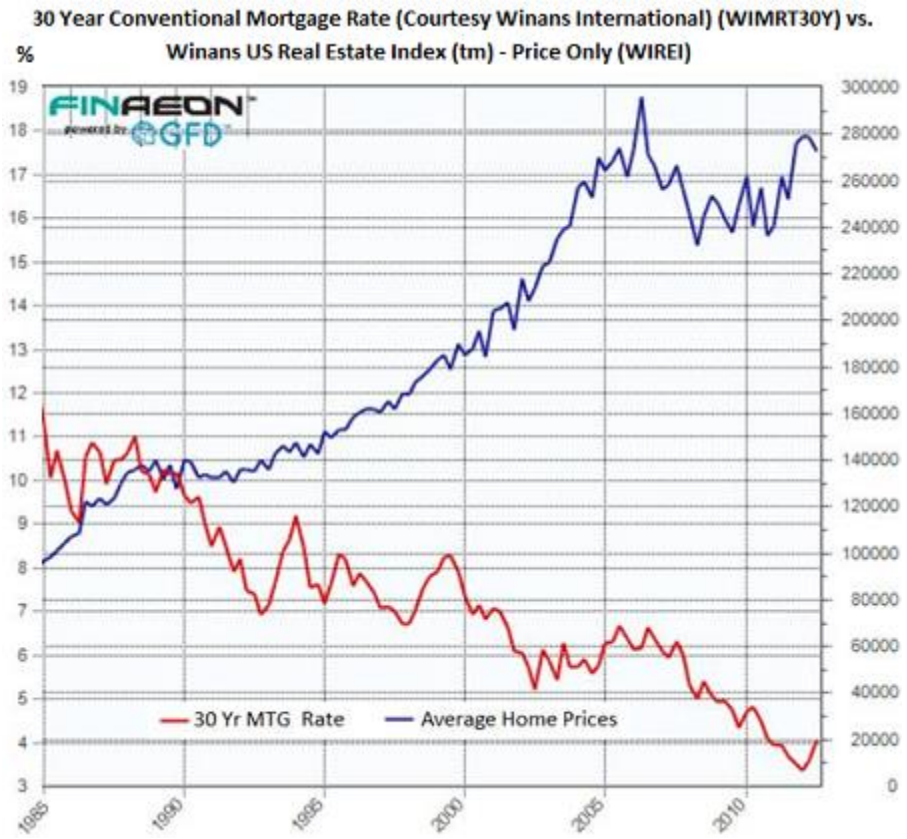
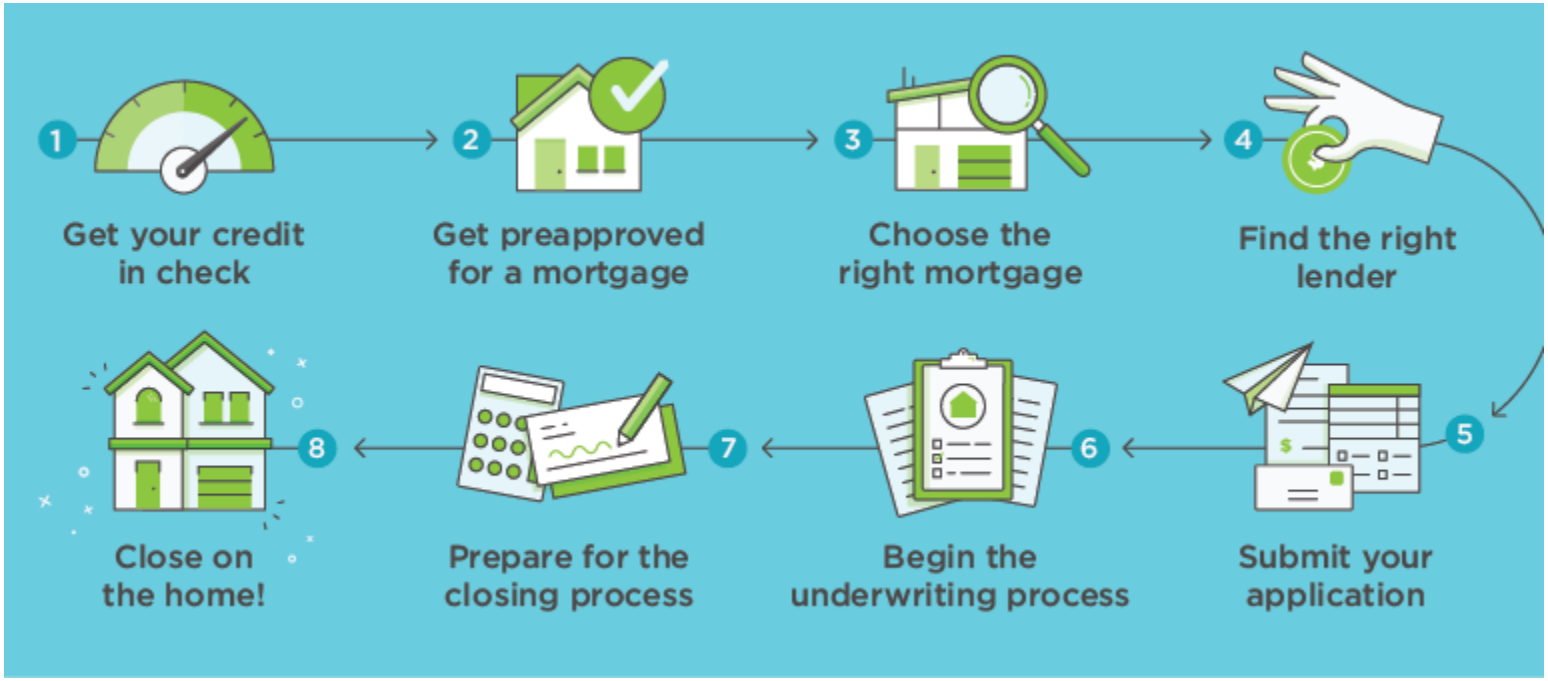
Additional Information:
Worldwide; CBRE Group; 2020


Hong Kong housing price index and average mortgage rate
Price Index, 1999 = 100
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
12
10
8
6
4
2
0
%
1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Years
Housing Price Index
Average Mortgage rate


30 Year Conventional Mortgage Rate (Courtesy Winans International) (WIMRT30Y) vs.
Winans US Real Estate Index (tm) - Price Only (WIREI)
%
FINAEON
GFD
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
300000
280000
260000
240000
220000
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
30 Yr MTG Rate
Average Home Prices
1985
1990
1995
2000
2005
2010


1
Get your credit in check
2
Get preapproved for a mortgage
3
Choose the right mortgage
4
Find the right lender
5
Submit your application
6
Begin the underwriting process
7
Prepare for the closing process
8
Close on the home!

MORTGAGE LOANS

- Mortgage loans come in many different varieties.
  - Fixed rate or variable rates
  - Residential or commercial purposes.
- Residential mortgages typically mature in 15 or 30 years and constitute 80% of the total principal of securitized mortgages in the U.S.
- Residential mortgages typically mature in 20 or 30 years and constitute almost 100% of the total principal of securitized mortgages in HK.

Fixed Rate Mortgage Payments

- The most typical mortgage loan in the US is a fixed rate, *level payment* mortgage.
- A homeowner might borrow $100,000 from a bank at 4% and agree to make payments of *X*=$477.42 every month for 30 years, where X satisfies

$$X \sum_{n=1}^{360} \frac{1}{\left(1+\frac{.04}{12}\right)^n} = \$100{,}000$$

- In general, for a monthly payment X on a T-year mortgage with a mortgage rate y and an original principal amount or loan balance of $B(0)$,

$$X\sum_{n=1}^{12T}\frac{1}{\left(1+\frac{y}{12}\right)^{n}}=B(0)$$

$$X\frac{12}{y}\left[1-\frac{1}{\left(1+\frac{y}{12}\right)^{12T}}\right]=B(0)$$

- Given X, solve for y or vice versa (sp. sheet)

- Formula for monthly payment

$$X = \frac{B_0 \times {}^{y}\!/_{12}}{1 - (1 + {}^{y}\!/_{12})^{-12T}}$$

- The fixed monthly payment is often divided into its interest and principal components, a division interesting in its own right as well as for tax purposes;
- Mortgage interest payments are deductible from income for tax purpose while principal payments are not.

- Letting $B(n)$ be the principal amount outstanding after the mortgage payment due on date n, the interest component on the payment on date n+1 is

$$B(n) \times \frac{y}{12}$$

and the principal component is

$$X - B(n) \times \frac{y}{12}$$

Remaining principal value

$$B_n = X \frac{12}{y}\left(1 - \frac{1}{(1+{}^{y}\!/_{12})^{12T-n}}\right)$$

Table 20.1: First Rows of an Amortization Table, in Dollars, of a 100,000 Dollar 4% 30-Year Mortgage

Payment Month	Interest Payment	Principal Payment	Ending Balance
			100,000.00
1	333.33	144.08	99,855.92
2	332.85	144.56	99,711.36
3	332.37	145.04	99,566.31
4	331.89	145.53	99,420.78
5	331.4	146.01	99,274.77

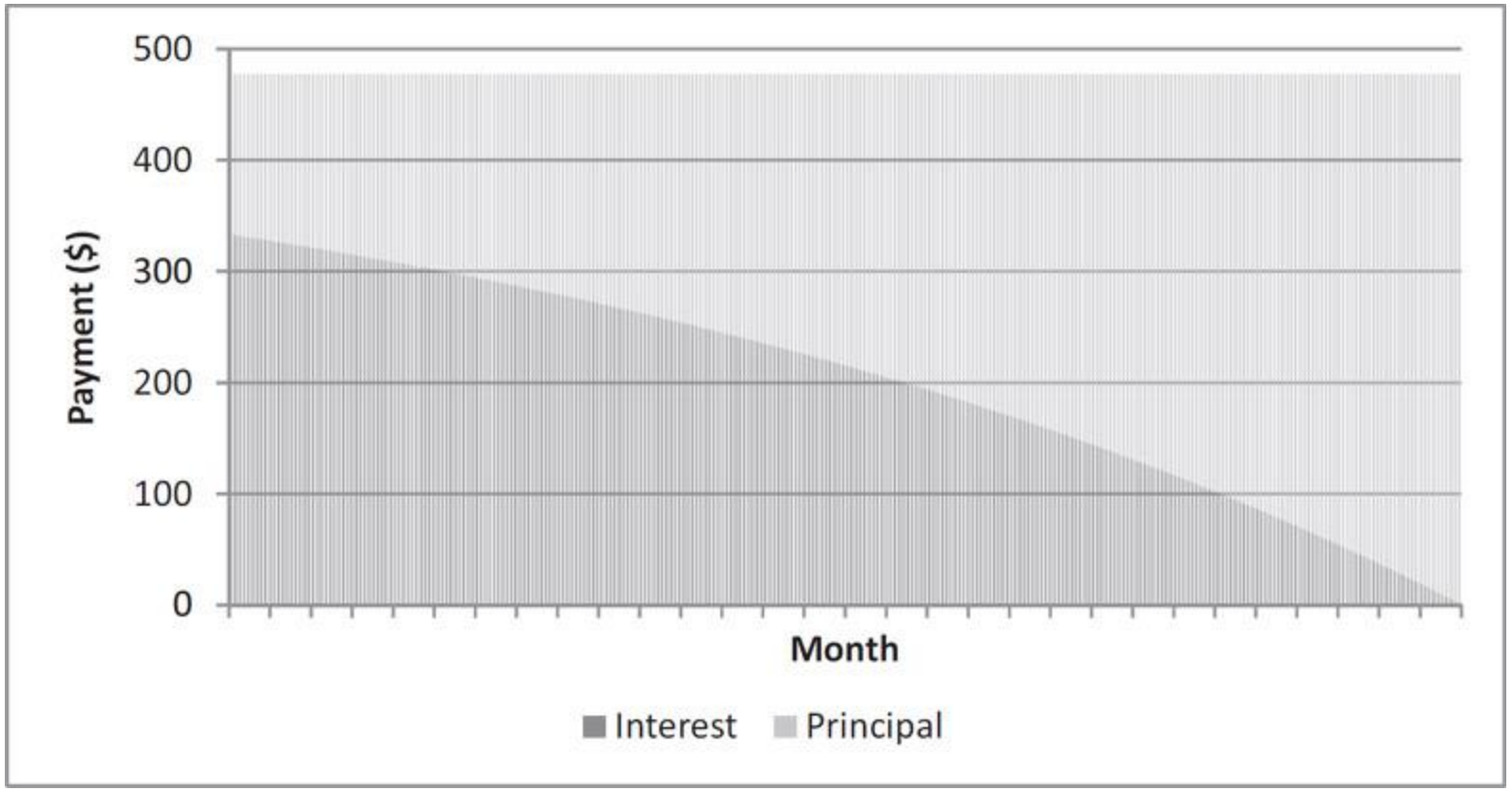


Figure 20.1: Amortization of a $100,000 4% 30-Year Mortgage

- The outstanding balance of a mortgage on any date can be computed through discounting.
- For example, after 5 years or 60 monthly payments there remain 300 payments. The PV of these payments at 4% is

$$\$477.42 \sum_{n=1}^{300} \frac{1}{\left(1+\frac{.04}{12}\right)^n} = \$477.42 \frac{12}{.04}\left[1 - \frac{1}{\left(1+\frac{.04}{12}\right)^{300}}\right]$$

$$= \$90{,}448$$

Floating-Rate Mortgage

- In Hong Kong, most mortgages are indexed to either Prime Rate of HIBOR (1m or 3m).
- The calculation of monthly payment is identical to that of fixed-rate mortgages.
- Ex: Consider a 30-yr mortgage of $1m principal and with rate HIBOR +0.8% initiated today.

Floating-Rate Mortgage

- The MP is

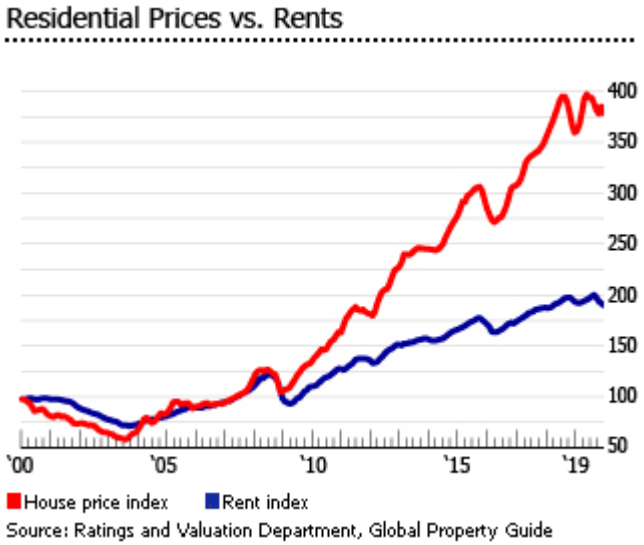
$$X = \frac{\$1m \times \left(0.19643\% + 0.8\%\right)/12}{1 - \frac{1}{\left(1+\left(0.19643\% + 0.8\%\right)/12\right)^{360}}}$$

$$= \$3,214.76$$

with

$$\text{interest payment} = \$1\text{m} \times \left(0.19643\% + 0.8\%\right)/12 = \$830$$

$$\text{Principal payment} = \$3214.76 - 830 = \$2384.76$$


Residential Prices vs. Rents
400
350
300
250
200
150
100
50
'00
'05
'10
'15
'19
House price index
Rent index
Source: Ratings and Valuation Department, Global Property Guide