

UBS Global Real Estate Bubble Index

For housing markets of selected world cities
2015



Content

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3 Editorial**4 UBS Global Real Estate Bubble Index**

- 4 Majority of world cities significantly overvalued
- 5 Different regional cycles

6 Global cities benchmarks**7 Single city description**

- 7 London
- 8 Hong Kong
- 9 Singapore
- 10 New York
- 11 Selected world cities

14 Methodology & data

Editorial

Dear reader

Through quantitative easing, central banks have more than tripled the global monetary base since 2008. This gigantic cash injection has lowered real interest rates and slowed the global housing market corrections that began in 2007. The average price decline amounted to 30% in real terms. However, this did not offset the preceding price increase of 130% since the mid-1990s. The correction was thus milder than in previous cycles, setting the stage for today's overheating housing markets.

When inexpensive financing is combined with bullish expectations, real estate prices eventually uncouple from the real economy. We have seen this in the current cycle, particularly in the world's


leading financial centers, where housing prices are now, in many cases, fundamentally unjustified. The risk of a real estate bubble in these cities has risen sharply. While it is not always possible to prove conclusively the existence of a bubble, it remains essential to identify the signs of one early on.

This is why we publish the *UBS Global Real Estate Bubble Index*, to analyze the severity of various bubble symptoms in selected global financial centers. On the following pages we show the cities in which the imbalances are the most distinct.

We hope you find it an engaging read.



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Majority of world cities significantly overvalued

The *UBS Global Real Estate Bubble Index* is designed to track the risk of housing bubbles in global financial centers. Bubble risk is most distinct in London and Hong Kong. Deviations from the long-term norm point to significantly overvalued housing markets in Sydney, Vancouver, San Francisco and Amsterdam. Valuations are also stretched in Geneva, Zurich, Paris, Frankfurt and, to a lesser degree, in Tokyo and Singapore. The US cities of New York and Boston are fairly valued, while Chicago is undervalued relative to its own history.

At risk of a price correction

Cities at or near the bubble risk zone face a higher risk of a large price correction. A change in macroeconomic momentum, a shift in investor sentiment or a major supply increase could trigger a decline in house prices. Between 1985 and 2009, whenever the index exceeded 1.0, i.e.

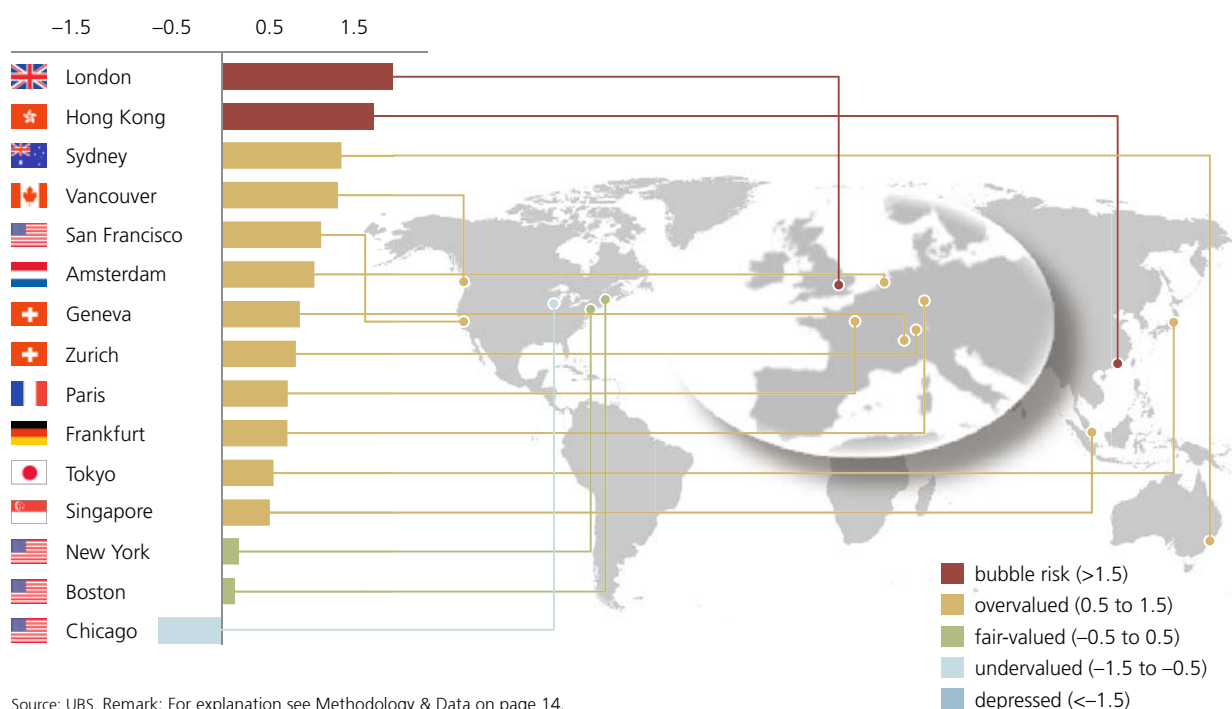
it entered the upper half of overvaluation territory, a real price correction of on average 30% began within three years 95% of the time. Investors in overvalued markets should not expect real price appreciation in the medium to long run.

Macro-environment fosters housing bubbles

Real estate prices in many global cities have doubled since 1998 in real terms. On average, they are higher than they were before the 2007–08 financial crisis. A mix of optimistic expectations, favorable economic fundamentals and capital inflows from abroad has caused valuations to soar in certain cities in recent years. Loose monetary policy has prevented a normalization of housing markets and encouraged local bubble risks to grow.

UBS Global Real Estate Bubble Index

Latest index scores for the housing markets of selected world cities



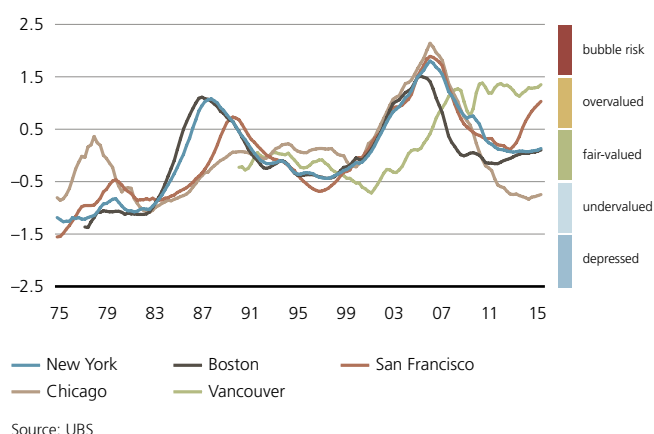
Different regional cycles

North America

The US cities display a significant co-movement of housing prices in boom phases from the 1980s up to 2007. During the past three years local housing markets have developed differently. While Chicago fell into an undervalued state, San Francisco marched ahead and is back in overvalued territory. Its boom has been fueled by foreign demand and a fast-growing economy (Silicon Valley), although prices have risen much faster than incomes. New York has not yet recovered from the 2008 bust and seems fairly valued.

Vancouver did not fully follow the US housing bubble of the last decade although valuations look very stretched today. The dynamic has slowed significantly of late, however, and the city is now moving in line with the overall Canadian housing market.

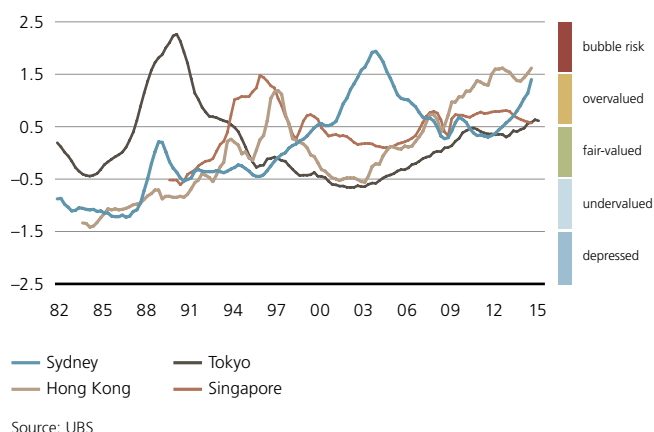
UBS Global Real Estate Bubble Index



Asia-Pacific

APAC cities have followed different patterns than their European and US counterparts. The Asia crisis in the 1990s left its mark on the housing markets of Hong Kong and Singapore. With the exception of Tokyo's, there was no exceptional price behavior in the late 1980s.

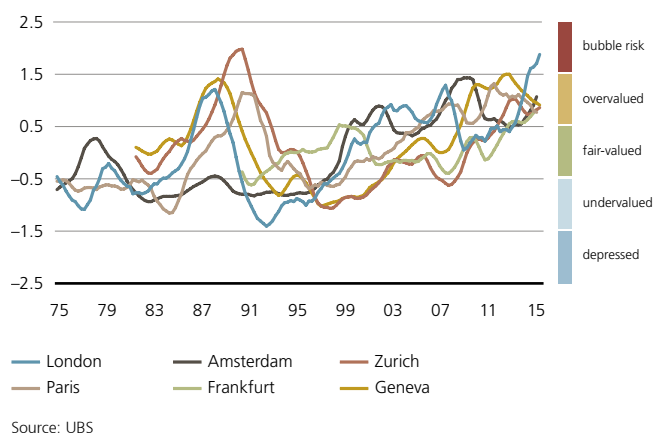
Hong Kong has flirted with a bubble since 2011, while Sydney's market is catching up quickly and trending close to it. After a 15-year decline, valuations in Tokyo started to recover in 2006. The market is now slightly overvalued, but the upward movement remains moderate. Singapore has been ranked as overvalued since 2005, but has not been in danger of a bubble since rents and incomes rose accordingly. In the last two years the market has trended toward a fair valuation.



Europe

All European cities currently exceed fair valuation. London is by far the most overvalued market in Europe, at risk of a bubble as a result of explosive price behavior since 2013. Amsterdam and Frankfurt are also on a rising trajectory in overvalued territory.

The bubble at the beginning of the 1990s was pronounced in all cities except Amsterdam and Frankfurt. After it burst, real estate markets in every city except Frankfurt began a long upward price cycle. Amsterdam and Geneva touched the bubble risk zone in 2008 and 2011 respectively, but subsequently underwent a slight correction.

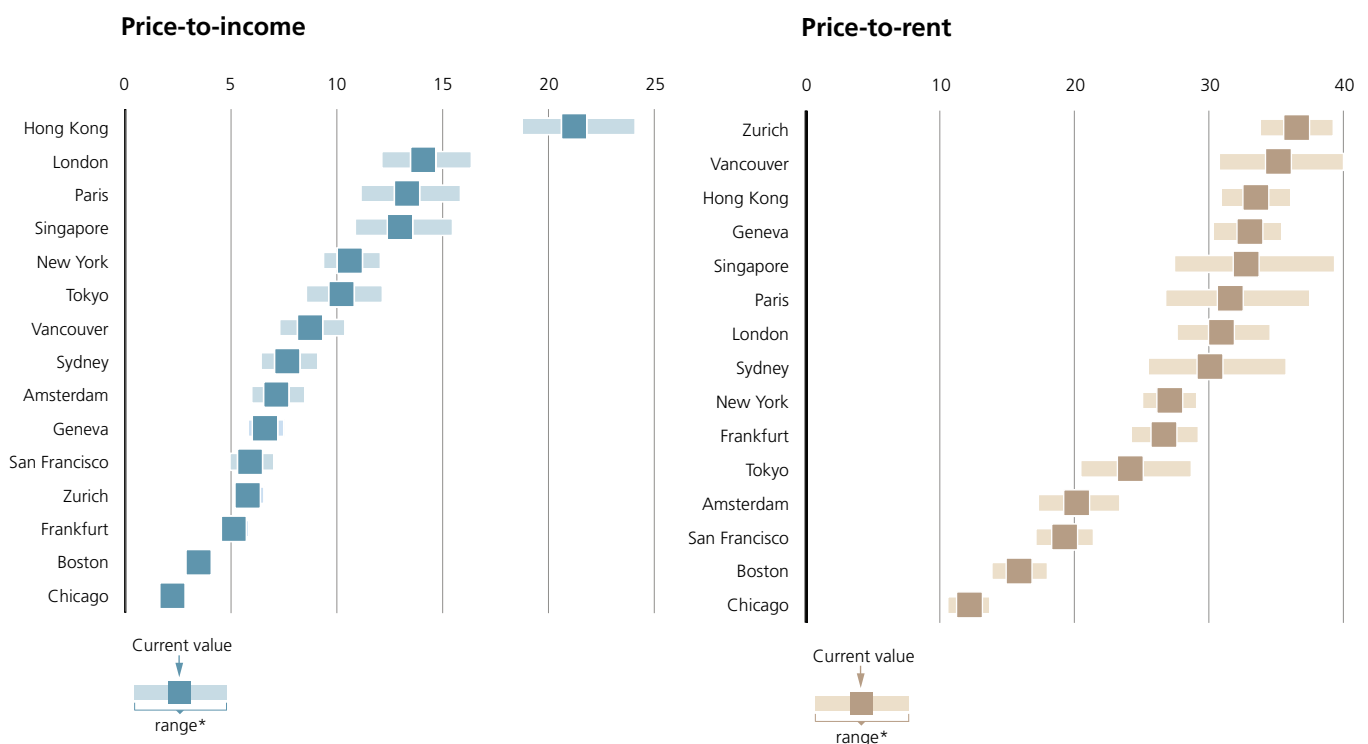


Benchmarking confirms alert signals

Global cities benchmarks

Price-to-income: The number of years a skilled service worker needs to work to be able to buy a 60 m² flat near the city center.

Price-to-rent: The number of annual rents required to purchase a flat of the same size.



* Uncertainty range due to differing data quality

Source: UBS. Remark: For explanation see Methodology & Data on page 14.

Diminished long-term price appreciation prospects

Buying a 60m² apartment exceeds the budget of most people in most world cities who earn the average annual income paid in the highly skilled service sector. In Hong Kong even those who earn twice the average income would struggle to afford an apartment of that size. House prices have also decoupled from local incomes in London, Paris, Singapore, New York and Tokyo, where price-to-income (PI) multiples exceed 10. Unaffordable housing points to high dependence on foreign demand. So the risk of a price correction, should that demand weaken, is elevated, and the long-run appreciation prospects lower. Rental market regulations, i.e. broad access to social or subsidized housing as pertains in Hong Kong and Singapore, can amplify market imbalances. The subsequent crowding out of private supply makes the lofty prices even more vulnera-

ble to demand shifts. In contrast, housing is affordable in Chicago, Boston and Frankfurt, which limits the downside risk of a price correction. Due to relatively high incomes, purchasing an apartment is also feasible for residents of Zurich, San Francisco and Geneva as well.

Dependence on low interest rates

Price-to-rent (PR) multiples are greatest in Zurich, Vancouver, Hong Kong, Geneva and Singapore. The extremely high PR multiplies indicate an undue dependence of housing prices on low interest rates. Paris, London and Sydney follow suit and form a trio of cities with PR multiples around 30. House prices in these cities are vulnerable to a sharp correction should interest rates rise. PR values below 20 are observed in Amsterdam and the US cities San Francisco, Boston and Chicago.

London



Housing market in bubble-risk territory

Key facts

According to the *UBS Global Real Estate Bubble Index*, the housing market is in bubble-risk territory with a score of 1.88.

Price-to-income and price-to-rent ratios have reached all-time highs. Only Hong Kong exhibits worse affordability levels.

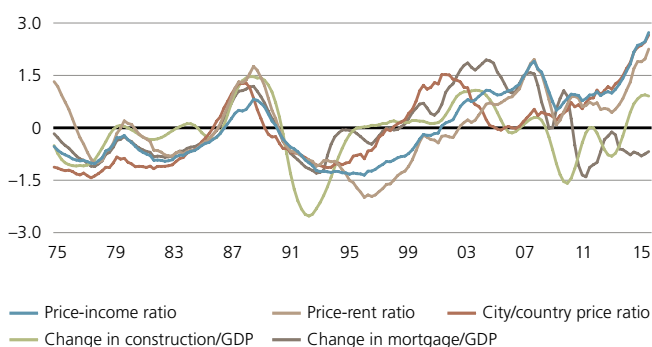
House prices have decoupled from local household earnings due to both local and global investment demand pushing them up.

Average real dwelling prices have soared by almost 40% since the beginning of 2013, more than offsetting all losses triggered by the financial crisis. The increase has made London one of the most expensive cities in the world based on price-to-income and price-to-rent ratios that have surged to all-time highs. It takes a skilled service-sector worker approximately 14 years of average earnings to be able to buy a 60m² dwelling; the expense of buying a flat is comparable to renting it for 30 years.

London house prices, in real terms, are 6% above their previous 2007 peak despite nationwide prices having declined by 18%. The decoupling of the London real estate market from the rest of the UK is even more drastic considering that, in the same period, real average earnings fell by 7% both in London and UK-wide.

Price level in London has increased strongly

Development of sub-indices, standardized values



Source: UBS

Foreign demand and demand deriving from safe-haven seekers largely explain current valuations. Global geopolitical risk and the high property valuations in Asian cities have helped to propel London house prices to new heights. Domestic buyers too have contributed to the appreciation. The "help-to-buy" scheme, alluring yields on buy-to-let investments and ongoing population growth have stoked demand. We advise caution as the *UBS Global Real Estate Bubble Index*, as well as the cross-sectional benchmarks, point to the risk of a substantial price correction should the fundamentals for real estate investment deteriorate.

Hong Kong



Price correction seems imminent

Key facts

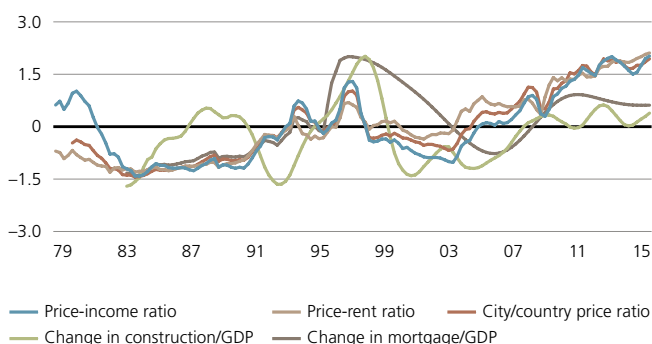
Hong Kong ranks second in the *UBS Global Real Estate Bubble Index* with a score of 1.67, which indicates bubble risk.

Real housing prices have been volatile the last 10 years, with successive periods of double-digit percentage and zero annual growth.

A record-high price-to-income ratio of 21 and a price-to-rent ratio of 33 point to unsustainable price levels.

Hong Kong prices might have reached the limit

Development of sub-indices, standardized values



Source: UBS

Fueled by a credit boom, Hong Kong's residential market performed comparatively well during and right after the financial crisis. Without any long-term correction, property prices are now 60% higher than in 2006 and almost 200% higher than in 2003, when the market bottomed in the aftermath of the Asian crisis. Yet rents have grown only by 35% in real terms and inflation-adjusted incomes stagnated. Subsequently, the local bubble index increased steadily from fair valuation in 2008 to the risk zone in early 2012 and – after a short time in the doldrums – again at the end of last year.

This has made Hong Kong one of the world's most expensive cities for private housing. The average yearly income of a highly skilled worker can buy only around 3m² of living space in the private transactional market. For low income workers, social housing programs mitigate the high prices, though housing conditions remain strained.

The housing prices have decoupled from the local economy and are at significant risk of entering a downward cycle should the international attractiveness of the city come into question. Weaker economic growth in China, a worsening job market and the risk of rising interest rates are overshadowing the outlook. Moreover, construction numbers are at their post-2004 peak, easing the supply shortage and adding to the negative outlook. We expect housing prices to have declined by more than 10% by the end of 2016.

Singapore



Sensitive to unexpected economic shocks

Key facts

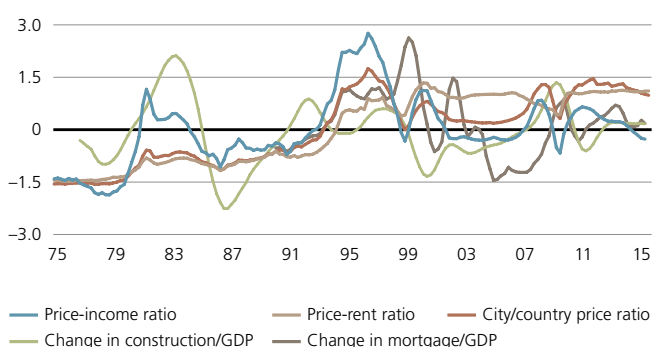
The *UBS Global Real Estate Bubble Index* score for Singapore is 0.56, which is in overvalued territory.

Since mid-2011, inflation-adjusted property prices have declined by almost 15% in one of the longest continuous correction periods in Singapore's history.

The city has enjoyed the greatest economic growth of the main financial centers since 2003, and again since 2009, which has mitigated the impact of the house price increases.

The overvaluation comes to an end

Development of sub-indices, standardized values



Source: UBS

Singaporean real house prices peaked in 2011 after quickly recovering from a short and sharp correction in 2009. Housing benefited from capital inflows and negative real interest rates, which stabilized the market and prevented an even greater correction. Consequently, the *UBS Global Real Estate Bubble Index* remained in overvalued territory.

Government policies seem to have been effective in cooling down the housing market. A higher stamp duty and restrictions on the total debt service ratio have weakened demand. So valuation metrics have been declining and the index has fallen since 2013. We expect prices to fall further amid growing supply. All else being equal, Singapore will reach fair valuation territory next year.

Despite the real price drop of 6% and earnings growth of 4% since 2013, the affordability of private market housing remains low, with a price-to-income (PI) ratio of 13. In addition, the price-to-rent ratio is at an elevated 32, inter alia, as a result of low mortgage rates. Therefore, the risk of further house price corrections remains substantial, especially if the economic outlook deteriorates. But the dominant position of social housing in Singapore limits any direct impact of private market house-price declines on the overall economy.

New York



Low affordability drags on price growth

Key facts

The New York residential market scores 0.19 according to the *UBS Global Real Estate Bubble Index*, which means it is fairly valued.

The market bottomed in 2012 after a five-year correction. Prices have started to rise again, although growth rates are below the US average.

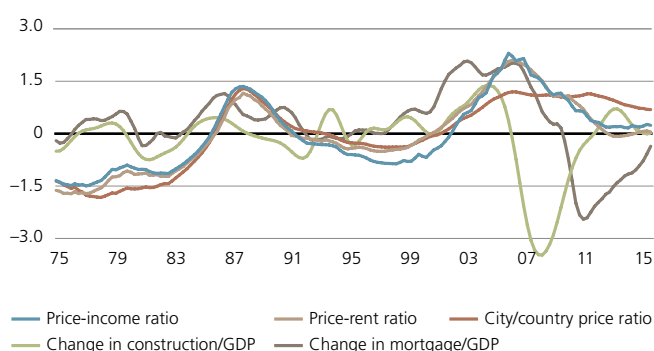
Despite its fair valuation, housing is expensive relative to other world cities. New York is also by far the least affordable of the analyzed US cities.

Real house prices in New York bottomed in 2012 after a five-year severe correction following the subprime crisis. Despite the recent rebound, the price for an average house in inflation-adjusted terms is currently still more than 25% below its 2006 peak. Both price-to-income and price-to-rent ratios reverted to their historical averages.

According to the *UBS Global Real Estate Bubble Index*, the housing market is currently fairly valued. But a historical fair valuation does not necessarily imply affordable housing. The city's price-to-rent ratio of 27 is indeed only average when compared to other cities. However, this multiple is deceptive as New York has some of the highest rents worldwide. Moreover, buying a 60m² home in Manhattan requires 11 years of annual income, which is expensive relative to other cities.

Indices reverted to their historical averages

Development of sub-indices, standardized values



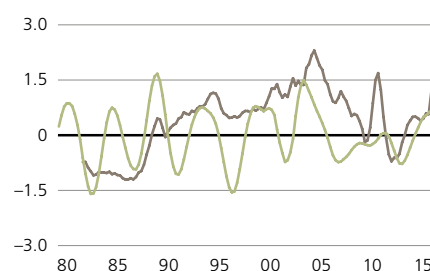
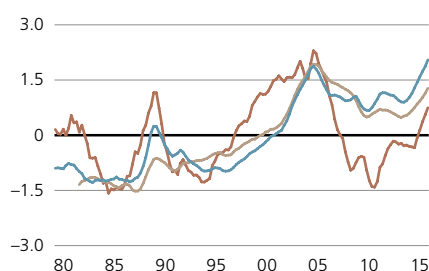
Source: UBS

Real price growth in New York City has lagged the US average since 2012. The impact of foreign demand and low mortgage rates on house prices has been limited to Manhattan. Overall, the city's below-average economic growth and stretched affordability work against more-dynamic price-appreciation trends. We expect future interest rate increases to prevent the bubble index from entering overvalued territory as higher financing costs should dampen the price recovery.

Selected world cities

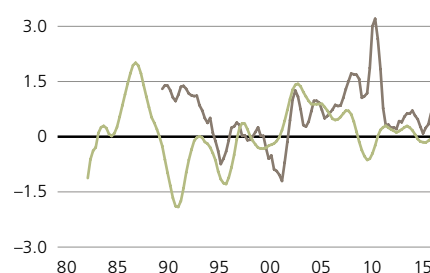
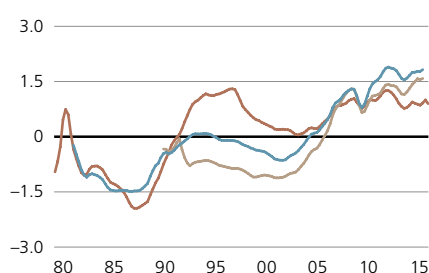
Sydney 1.39 – overvalued

Real housing prices have increased almost 30% since 2012, while rents and incomes have stagnated. The prices are also influenced by strong Asian demand. Gradually deteriorating economic conditions, a slow-down in China and tighter regulations increase the risk of a significant correction in the medium term.



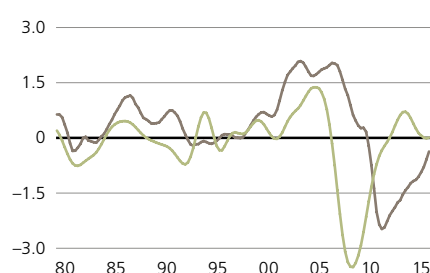
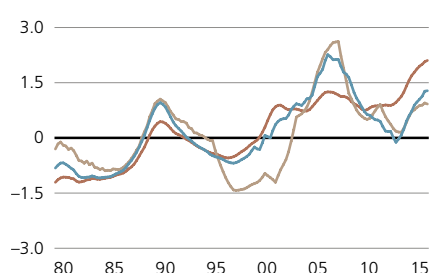
Vancouver 1.35 – overvalued

Though prices were already high, they have risen another 25% since 2006. The previous commodities supercycle and still strong Asian demand amplified the rise. Rents and incomes registered only single-digit growth rates in the same period. The recent plunge in commodity prices and unpredictable foreign demand cloud the current outlook.



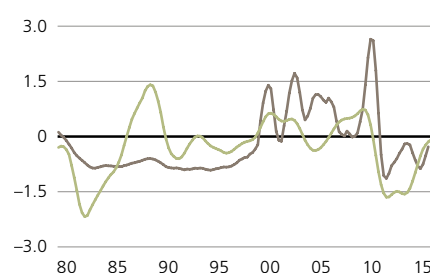
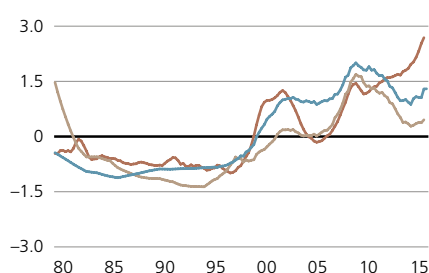
San Francisco 1.15 – overvalued

After a severe real price correction of 30% from 2006 to 2011, the market rebounded in the wake of the technology boom. Current real prices stand only 4% below peak and have outperformed the overall US market. The elevated price level is supported by limited supply growth.



Amsterdam 1.07 – overvalued

Real house prices corrected 25% between 2008 and 2013. The market started to rebound last year. Prices have risen 11% while earnings have stagnated. The city's rebound outpaced the recovery at the national level. Historically low refinancing costs have stopped the deleveraging that began in 2008.



Source: UBS

— Price-income ratio
— Price-rent ratio

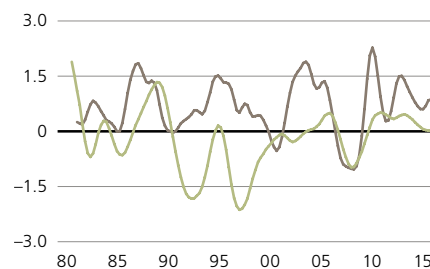
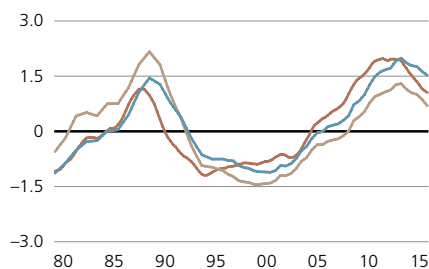
— City/country price ratio

— Change in construction/GDP

— Change in mortgage/GDP

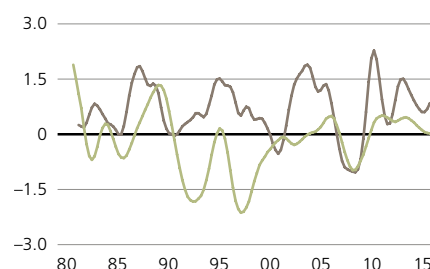
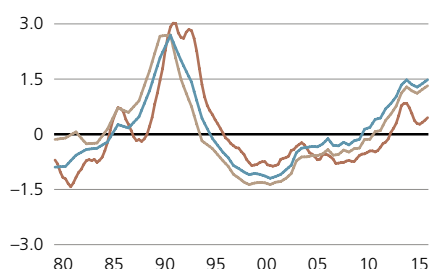
Geneva 0.91 – overvalued

House prices have fallen by 5% in the last three years as countrywide prices rose. Higher rents and stable incomes contributed to a decline of the local bubble index. Mortgage growth rates have also slowed since 2012. Yet affordability remains strained and the price-to-rent multiple is elevated, especially in light of the very high rents.



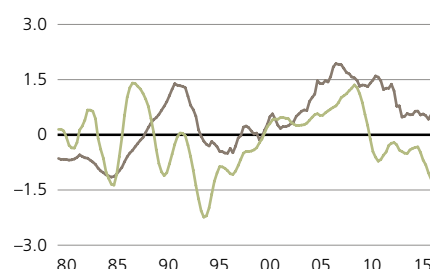
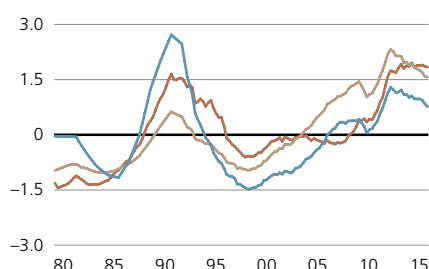
Zurich 0.86 – overvalued

Zurich boasts the highest real house price levels in its history. In the last five years they have climbed 25% while rents and incomes stagnated. In line with the broader Swiss housing market, prices have increased recently at a slower rate. But Zurich still has the highest price-to-rent multiple among the global cities.



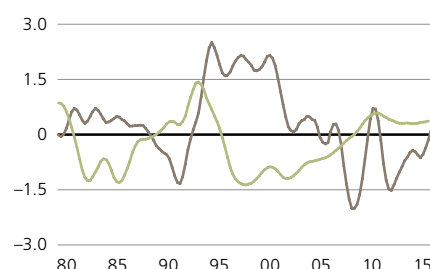
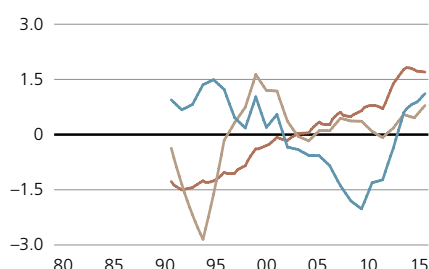
Paris 0.77 – overvalued

Since 1998, prices in Paris have increased 176%, while those countrywide have increased by only 90%. Since 2011 the city has corrected by almost 10%, while rents and incomes are up slightly, so the local bubble index has declined. Affordability remains very stretched, as buying a flat requires about 13 years of income.



Frankfurt 0.76 – overvalued

After 15 years of stagnation, real house prices have ascended 20% since 2010 to trigger an overvaluation signal by the index. City prices have significantly outperformed the countrywide housing recovery. But good affordability and comparatively low price-to-rent multiples leave scope for more appreciation if economic conditions remain accommodative.



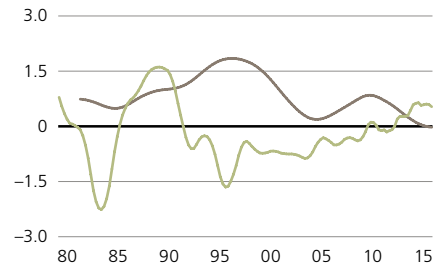
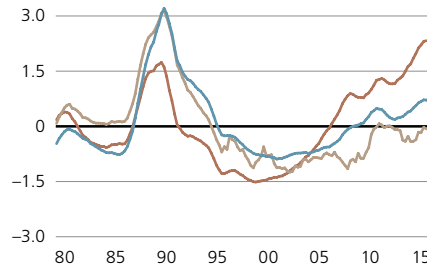
— Price-income ratio — City/country price ratio
— Price-rent ratio

— Change in construction/GDP — Change in mortgage/GDP

Source: UBS

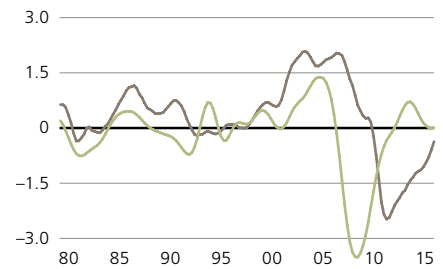
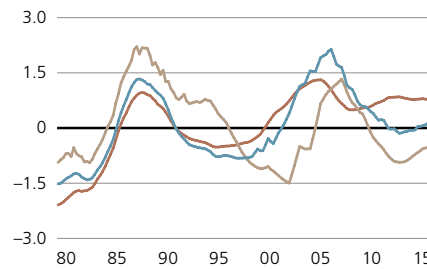
Tokyo 0.60 – overvalued

In 2012 real house prices in Tokyo ended their secular downtrend and have increased by 15% since. The city is outpacing the rest of the country, where prices continue to fall. Yet Tokyo house prices still stand 45% below their peak of 25 years ago. Nevertheless, affordability is strained with a price-to-income multiple above 10 as incomes have stagnated since 2012.



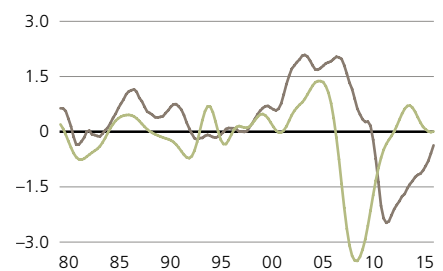
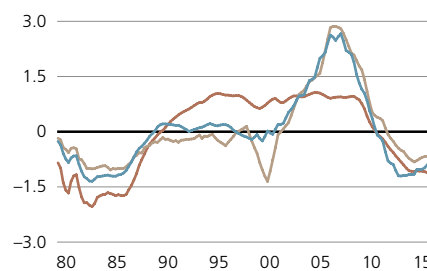
Boston 0.15 – fair-valued

Currently, the price growth is in line with the course of the US housing market. But real house prices have not yet recovered from the 2006–2012 30% correction. Job earnings are almost 10% higher than in 2006, which has led to the second-best housing affordability measure of the selected global cities.



Chicago -0.70 – undervalued

Real house prices are still 31% below their 2006 peak. They only began to recover in 2013 and have increased since by about 8%. The recovery remains comparatively weak, dragged down by the sluggish local economy. The cheap valuation is supported by the lowest price-to-income and price-to-rent multiples among the selected cities.



— Price-income ratio — City/country price ratio
— Price-rent ratio — Change in mortgage/GDP

— Change in construction/GDP — Change in mortgage/GDP

Source: UBS

Methodology & data

UBS Global Real Estate Bubble Index

Price bubbles are a regularly recurring phenomenon in property markets. The term bubble refers to a substantial and sustained mispricing of an asset. Their existence cannot be proven conclusively unless they burst, but recurring patterns of property market excesses are observable in the historical data. Typical signs are a decoupling of house prices from local incomes and rents, and distortions of the real economy, such as excessive lending and construction activity. The *UBS Global Real Estate Bubble Index* gauges the risk of a property bubble on the basis of such patterns.

Our index traces the fundamental valuation of housing markets, the valuation of cities in relation to their country and economic distortions (lending and building booms). Tracking current values, the index uses the following risk-based classifications: depressed (score below -1.5), undervalued (-1.5 to -0.5), fair-valued (-0.5 to 0.5), overvalued (0.5 to 1.5) and bubble risk (above 1.5). This classification is aligned with historical bubble episodes.

The index score is a weighted average of the following five standardized city sub-indices: price-to-income and price-to-rent (fundamental valuation), change in mortgage-to-GDP ratio and change in construction-to-GDP ratio (economic distortion) and relative price-city-to-country indicator. The price-city-to-country indicator in Singapore and Hong Kong is replaced by an inflation-adjusted price index. The approach cannot fully satisfy the complexity of the bubble phenomenon. We cannot predict if or when a correction will happen. Hence, "bubble risk" refers to the prevalence of a high risk of a large price correction.

The sub-indices are constructed from specific city-level data, except for mortgage-to-GDP and construction-to-GDP ratios, which are

calculated on the country level. Publicly available data is used in most cases. In a few cases the data consists of or is supplemented by additional sources, including the results of UBS Prices & Earnings survey. The index length varies by city depending on data availability. The longest data series starts in 1975, the shortest in 1990. The availability of data was also a criterion when including the cities in the index. We considered the importance of the city for global financial markets and residential real estate investments. Please see the description of data sources on page 15.

The weights of the sub-indices are determined using factor analysis, as recommended by the OECD Handbook on Constructing Composite Indicators (2008). Factor analysis weights the sub-indices to capture as much of the common underlying bubble risk information as possible. As the drivers of bubbles vary across the cities, the method results in city-specific weights on sub-indices. These weights are also subject to minor changes when new data enters into the calculation or past data is revised.

Benchmarking

The analysis is complemented by a city benchmarking using current price-to-income (PI) and price-to-rent (PR) ratios. The PI ratio indicates how many years a skilled service worker needs to work to be able to buy a 60m² flat near the city center. The PR ratio reveals how expensive owner-occupied homes are relative to rental apartments. The higher the ratios, the more expensive buying becomes. Earnings data is taken primarily from UBS Prices and Earnings 2015 survey or from official statistical sources. Real estate prices and rents range widely near the city center. Our estimates are cross-checked and validated using different sources. However, we also specify an uncertainty range due to the differing quality of our data sources.

UBS Global Real Estate Bubble Index data sources

		Price Index (City)	Rent Index (City)	Income Index (City)	Price Index (Country)	Mortgage, Construction, GDP, Inflation (Country)
New York	2015Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Boston	2015Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Chicago	2015Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
San Francisco	2015Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Amsterdam	2015Q1	CBS, Maastricht University	UBS P&E	UBS P&E, Bloomberg	CBS, FED Dallas	DNB, CBS, EUKLEMS, Bloomberg
Hong Kong	2015Q2	RVD	RVD	Census and Statistics Department Hong Kong, Bloomberg	RVD	Census and Statistics Department Hong Kong, HKMA, Bloomberg
Singapore	2015Q1	Urban Redevelopment Authority	Urban Redevelopment Authority, UBS P&E	Government of Singapore	Government of Singapore	Government of Singapore, Bloomberg
Sydney	2015Q1	REIA, ABS	REIA, NSW Government, UBS P&E	ABS, UBS P&E	FED Dallas	ABS, RBA, Bloomberg
Tokyo	2015Q1	The Real Estate Transaction Promotion Center, Haver Analytics	Miki Syoji, Official Statistics of Japan	INDB, Tokyo Metropolitan Government, UBS P&E	FED Dallas	ESRI, EUKLEMS, Bloomberg
Vancouver	2014Q4	Teranet, Sauder School of Business UBC	Canadian Housing Observer, Sauder School of Business UBC	Statistics Canada, Government of British Columbia	FED Dallas	Statistics Canada, BoC, Bloomberg
Zurich	2015Q2	Wüest & Partner	Statistik Stadt Zürich	FTA, FSO	Wüest & Partner	SNB, SECO, FSO
Geneva	2015Q2	Wüest & Partner	Statistique Genève	FTA, FSO	Wüest & Partner	SNB, SECO, FSO
Paris	2015Q1	BIS, CGEDD	CGEDD, Clameur, UBS P&E	Insee, Bloomberg, UBS P&E	FED Dallas	BdF, Insee, EUKLEMS, Bloomberg
London	2015Q2	Nationwide, Lloyds Banking Group	ONS, UBS P&E	ONS	Nationwide, Lloyds Banking Group	BoE, ONS, EUKLEMS, Bloomberg
Frankfurt	2014Q4	Bulwiengesa	Bulwiengesa	Destatis, UBS P&E	FED Dallas	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg

Benchmarking sources

	Earnings	Real Estate (prices and rents)
New York	Census 2013	Elliman / Zillow / globalpropertyguide.com
Boston	Census 2013	Zillow / numbeo.com / CBRE
Chicago	Census 2013	Zillow / numbeo.com / CBRE
San Francisco	Census 2013	Zillow / numbeo.com / CBRE
Amsterdam	UBS P&E 2015	Globalpropertyguide.com / numbeo.com
Hong Kong	UBS P&E 2015	Hong Kong Statistical Office
Singapore	Department of Statistics Singapore; Demographia.com	Globalpropertyguide.com / numbeo.com
Sydney	UBS P&E 2015	Globalpropertyguide.com / numbeo.com
Tokyo	UBS P&E 2015	Globalpropertyguide.com / numbeo.com
Vancouver	Statistics Canada (2013)	Canada mortgage and housing corporation (CMHC) / Globalpropertyguide.com / numbeo.com
Zurich	UBS P&E 2015; Federal Income Tax Statistics 2012	Wüest & Partner
Geneva	UBS P&E 2015; Federal Income Tax Statistics 2012	Wüest & Partner
Paris	UBS P&E 2015	Globalpropertyguide.com / numbeo.com
London	UBS P&E 2015	GLA datastore / findpaperly.co.uk / numbeo.com
Frankfurt	UBS P&E 2015	Bulwiengesa / globalpropertyguide.com / numbeo.com

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