UBS

UBS Global Real Estate Bubble Index

Chief Investment Office WM

2017

Content

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Editor in Chief
Matthias Holzhey

Authors
Matthias Holzhey
Maciej Skoczek

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Contact
ubs-cio-wm@ubs.com

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Editorial

Dear reader,

In Munich, Toronto, Amsterdam, Sydney and Hong Kong, prices rose more than 10% in the last year alone. Annual price-increase rates of 10% correspond to a doubling of house prices every seven years, which is not sustainable. Nevertheless, the fear of missing out on further appreciation predominates among home buyers. After all, the price increases appear rational, for three reasons.

First, financing conditions in many cities are now more attractive than ever before. Second, the global increase in wealthy households seemingly creates constant demand for the most attractive residential areas. Third, building activity cannot keep pace with this demand.

Expectations tend to be prone to exaggerations in boom phases. The optimistic projections of the trends outlined above create ever-greater price fantasies. However, should sentiment change or interest rates increase, a correction is practically inevitable. In the past, rising interest rates almost always triggered a crash in housing markets. In addition, the dependence of prices on international flows of capital represents an incalculable risk. Plus, once demand fell, even the low growth in supply would no longer provide an anchor.

Vastly overvalued housing markets, as measured by the *UBS Global Real Estate Bubble Index*, have historically been associated with a significantly heightened probability of correction and greater downside than housing markets whose prices developed more in line with the local economy. This year's *UBS Global Real Estate Bubble Index* publication reveals the cities in which caution is required when buying a house and the places in which valuations still seem fair.

In this edition, Los Angeles and Toronto have been added to the selection of financial centers.

We hope you have an engaging read.

Claudio Saputelli
Head Swiss & Global Real Estate
Chief Investment Office WM

Matthias Holzhey
Head Swiss Real Estate Investments
Chief Investment Office WM

UBS Global Real Estate Bubble Index

Key results

Bubble risk seems greatest in Toronto, where it has increased significantly in the last year. Stockholm, Munich, Vancouver, Sydney, London and Hong Kong all remain in risk territory, with Amsterdam joining this group after being overvalued last year. Valuations are stretched in Paris, San Francisco, Los Angeles, Zurich, Frankfurt, Tokyo and Geneva as well. In contrast, property markets in Boston, Singapore, New York and Milan seem fairly valued, while Chicago remains undervalued, just as it was last year.

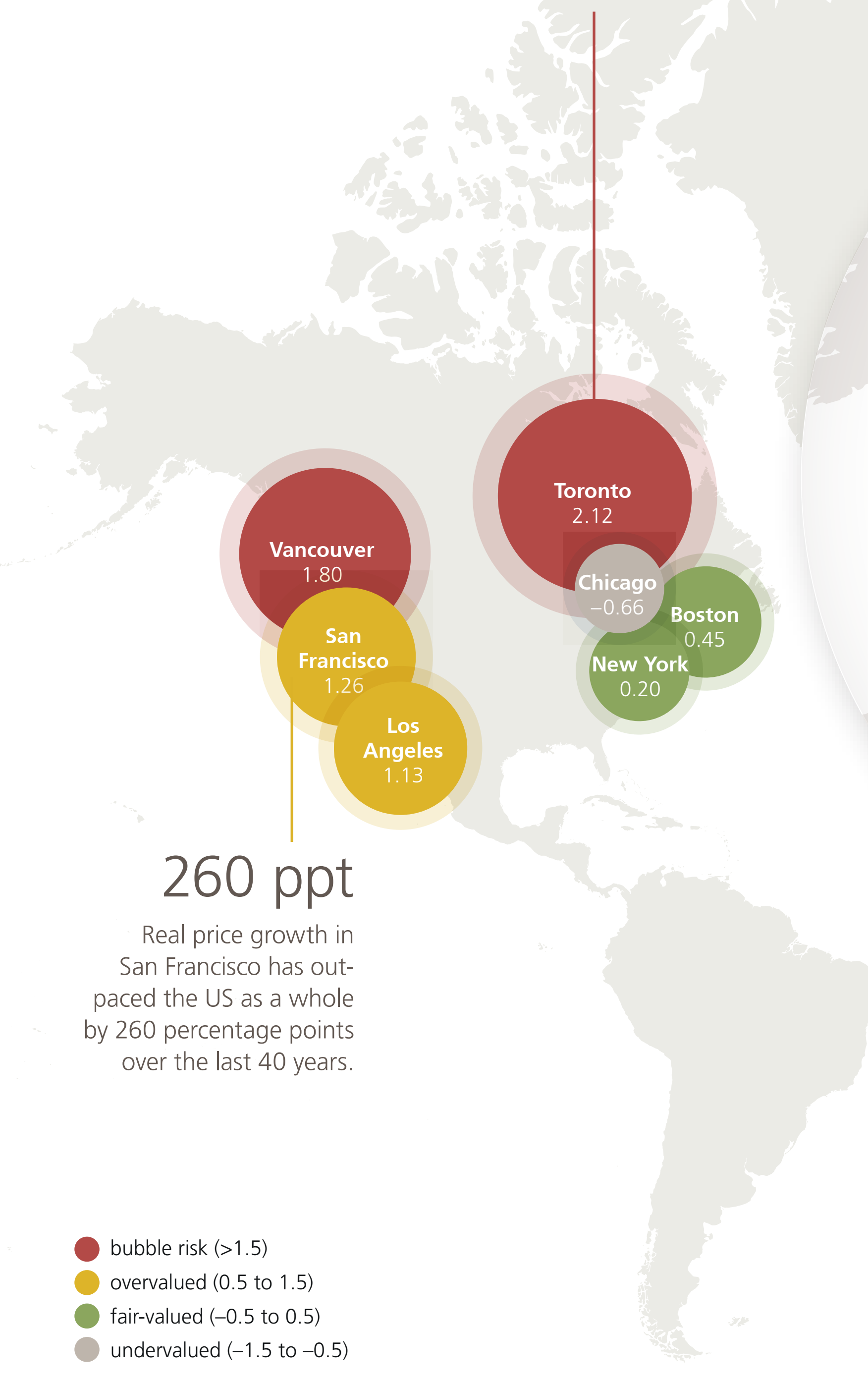
Identification of a bubble

Price bubbles are a regularly recurring phenomenon in property markets. The term "bubble" refers to a substantial and sustained mispricing of an asset, the existence of which cannot be proved unless it bursts. But recurring patterns of property market excesses are observable in the historical data. Typical signs include a decoupling of 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.

The Index does not predict whether and when a correction will set in. A change in macroeconomic momentum, a shift in investor sentiment or a major supply increase could trigger a decline in house prices.

50%

Real housing prices in Toronto rose 50% over the last five years.



260 ppt

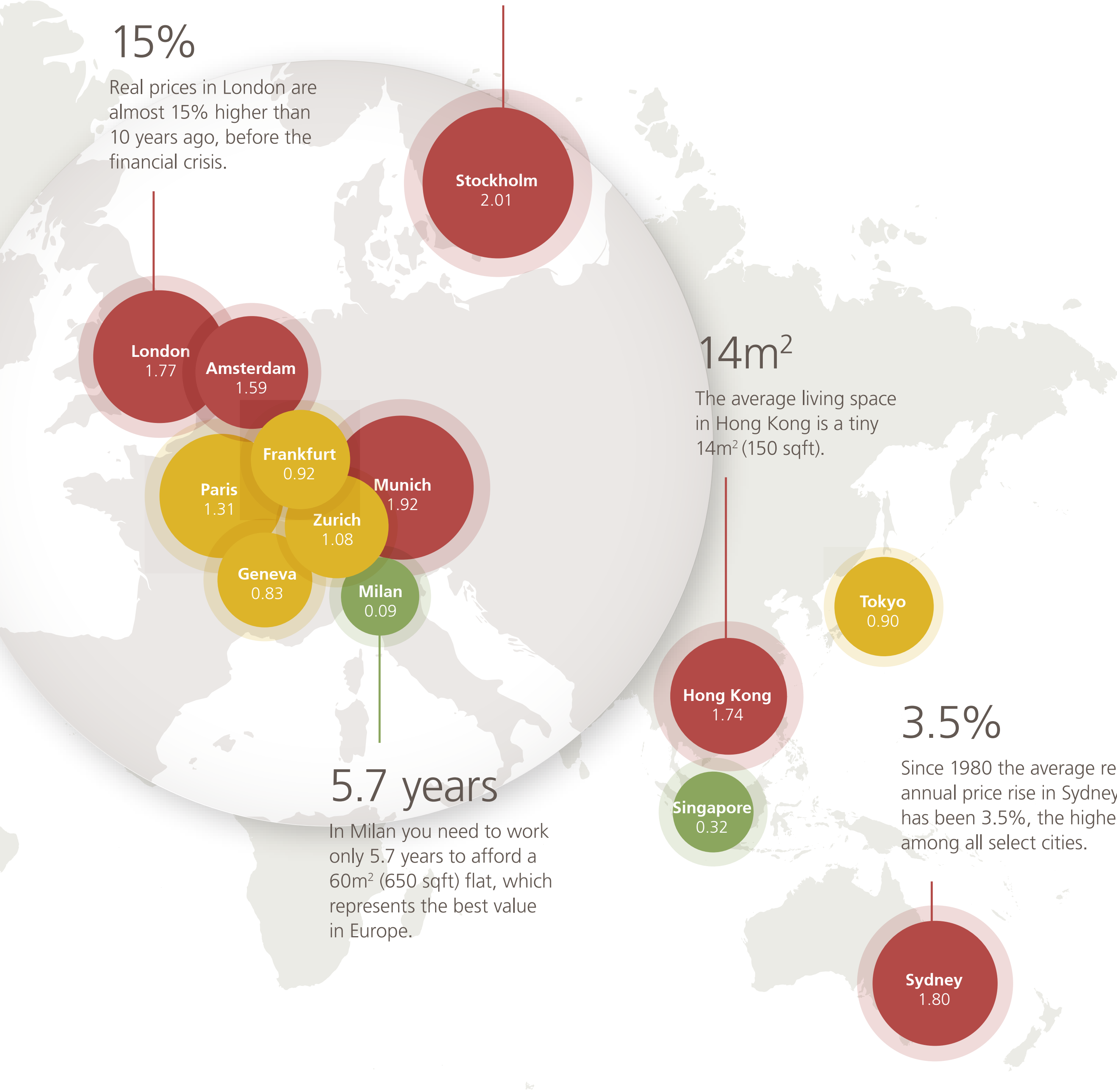
Real price growth in San Francisco has outpaced the US as a whole by 260 percentage points over the last 40 years.

12 years

The price doubled in Stockholm after being adjusted for inflation in the last 12 years.

15%

Real prices in London are almost 15% higher than 10 years ago, before the financial crisis.



14m²

The average living space in Hong Kong is a tiny 14m² (150 sqft).

5.7 years

In Milan you need to work only 5.7 years to afford a 60m² (650 sqft) flat, which represents the best value in Europe.

3.5%

Since 1980 the average real annual price rise in Sydney has been 3.5%, the highest among all select cities.

Superstars or bubbles?

An enticing narrative

According to the *UBS Global Real Estate Bubble Index*, the bubble risk in select world cities has increased significantly over the last five years. Real house prices of those metropolises within the bubble-risk zone have climbed by almost 50% on average since 2011. In the other analyzed financial centers, prices have only risen by roughly 15%. This gap is grossly out of proportion to the differences in local economic growth and inflation rates. Moreover, real incomes and rents have climbed by less than 10% in the same period in the bubble cities. Buying an average apartment typically exceeds the financial means of even highly skilled workers in those cities.

Low mortgage rates whitewash market imbalances
Falling mortgage rates over the last decade have made buying a home vastly more attractive, which increased average willingness to pay for home ownership. In European cities, for example, the annual usage costs for apartments (mortgage interest payments and amortization) are still below their 10-year average, despite real prices escalating 30% since 2007. In Canada and Australia, too, a large part of the negative impact of higher purchase prices on affordability was cushioned by low mortgage rates.

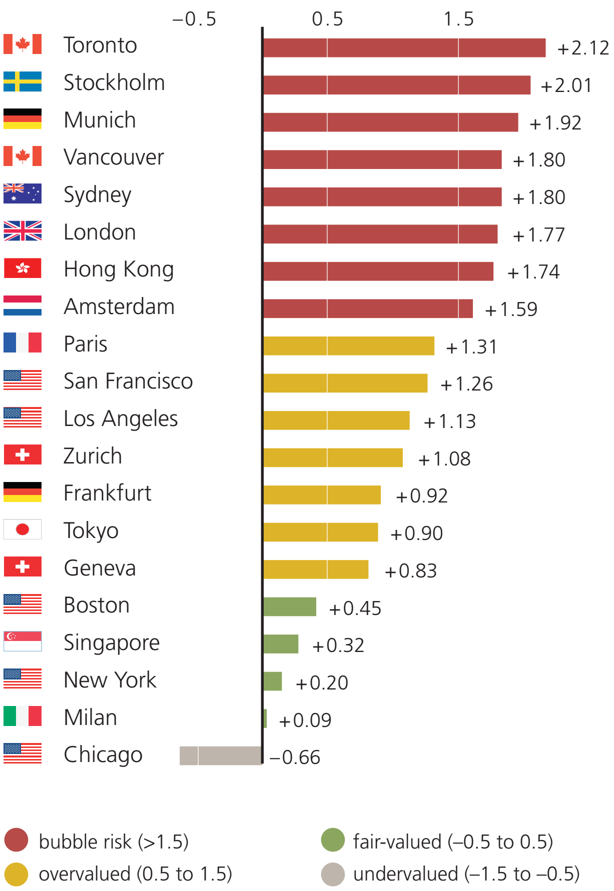
The Superstars take it all?
In world cities the expectation of long-term rising prices firmly supports the demand for housing investment. Many market participants expect the best locations to reap most value growth in the long run – just like Superstars. The economics of Superstars explains why, in some professions, show business for instance, "small numbers of people earn enormous amounts of money and dominate the activities in which they engage."[1] By analogous reasoning, prices in the most attractive cities are expected to outperform average cities or rural areas in the long run. Hong Kong, London and San Francisco are exemplars of this theory.

The intuition is that the national and global growth of high-wealth households creates continued excess demand for the best locations. So, as long as supply cannot increase rapidly, prices in the so-called "Superstar cities" are supposed to decouple from rents, incomes and the respective countrywide price level. The superstar narrative has received additional impetus in the last couple of years from a surge in international demand, especially from China, which has crowded out local buyers. An average price growth of almost 20% in the last three years has confirmed the expectations of even the most optimistic investors.

[1] Rosen, Sherwin. 1981. "The Economics of Superstars." American Economic Review 71 (5): 845–58.

UBS Global Real Estate Bubble Index

Latest index scores for the housing markets of select cities



Source: UBS Remark: For explanation see the section on Methodology & data on page 21.

Mind the fundamentals

The expectation of inevitably rising home prices has made the cities, at the same time, especially susceptible to exaggerations in boom periods, as those expectations are highly self-reinforcing and pro-cyclical. So world cities have regularly endured greater price corrections than countries. After the widespread bust period in the late 1980s, most cities did not recover until the early 2000s. For example, it took New York's housing market 20 years to recover relative to US-wide prices. A homebuyer in London in 1988 had to wait 25 years, i.e. until 2013, for her investment to outperform the UK average.

Less risk paid off

Looking back at boom-bust periods of housing markets in the last 35 years, we infer that fundamentals matter. Nine out of 10 real estate crashes of at least minus 15% were preceded by a distinct overvaluation signal based on the *UBS Global Real Estate Bubble Index* methodology. Real-time calculations derived from it for the period 1980 to 2010 estimated the likelihood of a crash after a bubble-risk warning signal within the subsequent 12 quarters at 50–60%. This compares to an ex-ante probability of a real estate crash of about 12% in a given quarter during that time.

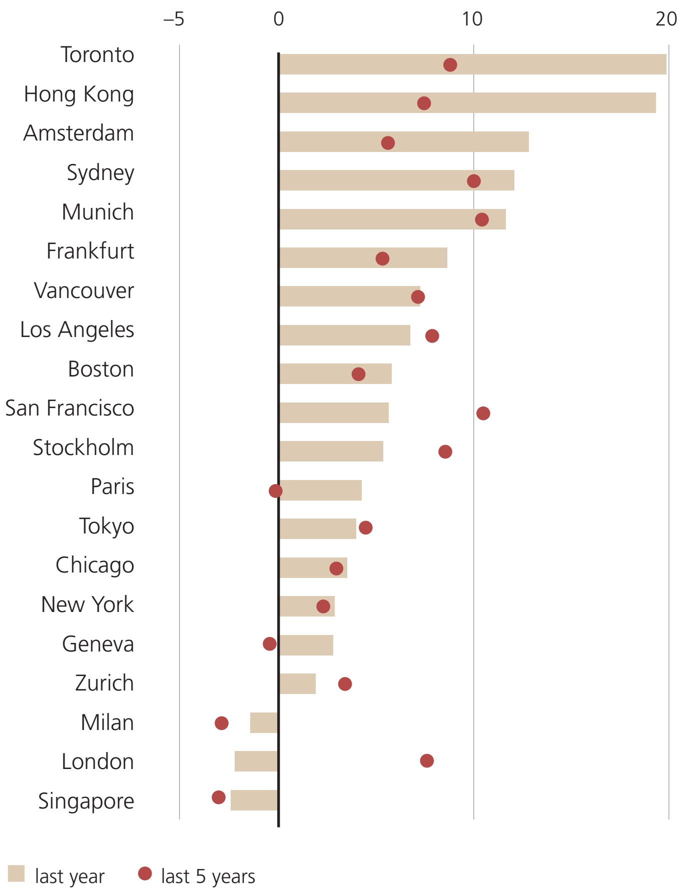
The caveat is that the model has delivered warning signals too frequently and too early for some markets, especially in recent years when the unprecedented quantitative easing programs of central banks distorted market incentives. Risk-averse investors would have missed out on exceptional capital appreciation opportunities. Nevertheless, taking less risk in overheated markets has historically paid off on average: they delivered worse returns over a full boom-bust period than more balanced markets did.

Unpredictable sentiment

Historically, investors have had to be alert to rising interest rates, which have served as the main trigger of corrections. Most such downdrafts in the past 40 years have been preceded by an increase in rates. But today's pronounced dependence of prices on sentiment or foreign capital inflows is a new and unpredictable phenomenon. Also the current affordability crisis may trigger policy responses that could end the housing party rather abruptly. So investors in wildly overvalued markets should at least not expect real price appreciation in the medium to long run.

Housing prices rising in almost all cities

Inflation-adjusted price growth rates, annualized in percent



Sources: see page 22

Regional cycles

Europe – heating up

Over the last four quarters the *UBS Global Real Estate Bubble Index* rose in all cities in continental Europe. Sharp increases were measured in Paris, Amsterdam, Frankfurt and Munich. All European cities, apart from Milan, are at least in overvalued territory.

Improving economic sentiment, partly accompanied by robust income growth in the key cities, has conspired with excessively low borrowing rates to spur vigorous demand for urban housing. As supply is always a constraint in the most appealing cities, soaring prices are the consequence. The combination of inexpensive financing and bullish expectations caused valuations to skyrocket and encouraged local bubble risks to grow.

Prices in Munich, Amsterdam or Stockholm have set records after being adjusted for inflation. Frankfurt has also been picking up momentum. Furthermore, housing market valuations revived again in Paris and have regained nearly all the lost ground since 2012. In Switzerland mortgage market regulations and increasing rental vacancy rates limit price upside for the time being. Valuations are in moderately overvalued territory in both Zurich and Geneva.

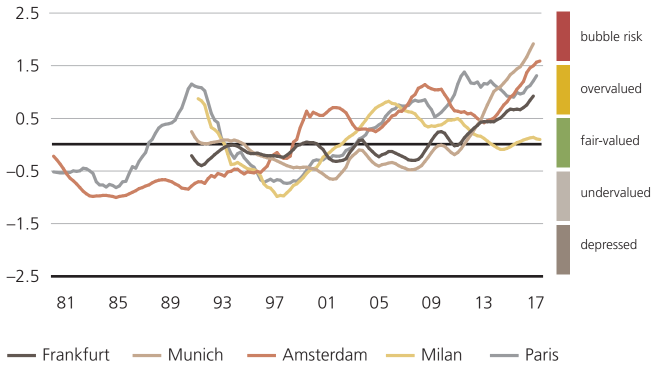
London remains on a separate path than its peers in continental Europe. Low affordability, the economic slowdown and uncertainty about the UK's future relationship with the EU kept housing demand in check for the last four quarters, during which the Index declined. But the city is still in bubble risk territory.

North America – two speeds

House prices in US cities remain below their 2008 peak in real terms, with the exception of San Francisco, where real prices have increased by almost 65% since 2011. The city shows signs of overvaluation but no bubble risk, given its strong economic fundamentals amid the astonishing boom of tech companies. Los Angeles is in overvalued territory, too, as prices have climbed twice as fast as the national average since 2012. Meanwhile, real price growth in Boston has remained close to the national average of 15% in the last four years, while New York and Chicago, oriented toward the financial sector and more traditional industries, have been outpaced by the overall US market. Overall, New York and Boston seem fairly valued while Chicago is undervalued.

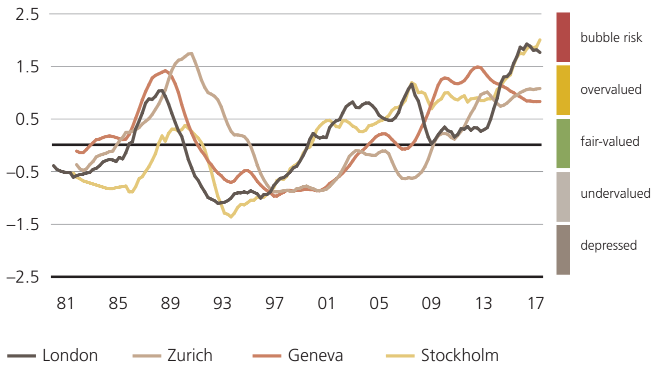
Eurozone

UBS Global Real Estate Bubble Index



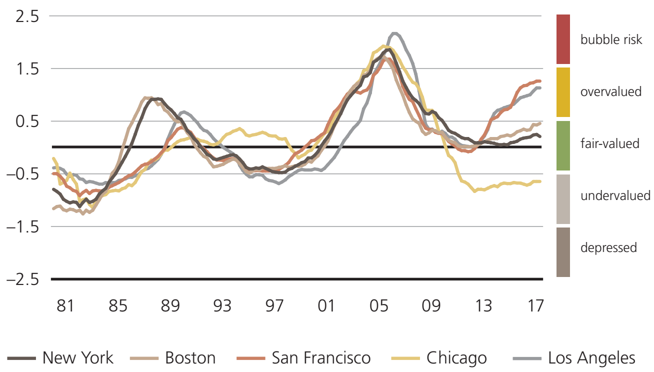
Rest of Europe

UBS Global Real Estate Bubble Index



USA

UBS Global Real Estate Bubble Index



Over the long run Vancouver and Toronto's house prices have moved in rough lockstep. Vancouver had the upper hand until 2008, but Toronto has been catching up rapidly in recent years. Neither city was dragged down by either the financial crisis or weakening commodity prices: the depreciation of the Canadian dollar effectively buffered them against economic headwinds. An overly loose monetary policy for too long, in addition to buoyant foreign demand, unmoored their housing markets from economic fundamentals, and both markets are now in bubble risk territory.

APAC – hot sentiment

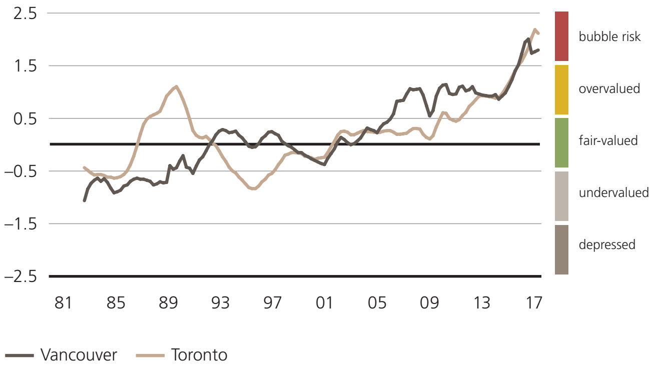
APAC cities illustrate different patterns than their European and US counterparts. With the exception of Tokyo, no severe housing bubbles arose in the late 1980s and housing markets were mostly fairly valued in 2006, pre-financial crisis. Tokyo's property market has improved since the launch of the Bank of Japan's quantitative easing program in 2013. The city is decoupling from the rest of the country due to better demographics and shows moderate signs of overheating.

Property prices in Hong Kong and Singapore soared by double-digit rates after the financial crisis as capital shifted toward emerging economies. Subsequently, Singapore cooled down its housing market via a variety of regulatory measures. For six years now, real prices have been falling modestly, which has dropped the housing market back to fair valuation levels. In Hong Kong, however, regulatory steps to reduce the dynamics of price growth proved ineffective. Residential market prices reached an all-time peak in midyear, thanks to insatiable investor demand and speculative price expectations.

Sydney's housing market has been overheating since the city became a target for Chinese investors several years ago. Low interest rates, rising wealth and exuberant expectations also buoyed local demand. So valuations soared and pushed the market into bubble risk zone.

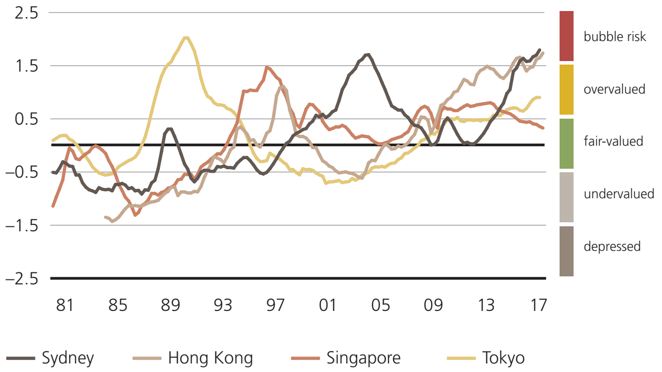
Canada

UBS Global Real Estate Bubble Index



APAC

UBS Global Real Estate Bubble Index



Global cities' benchmarks

Price-to-income

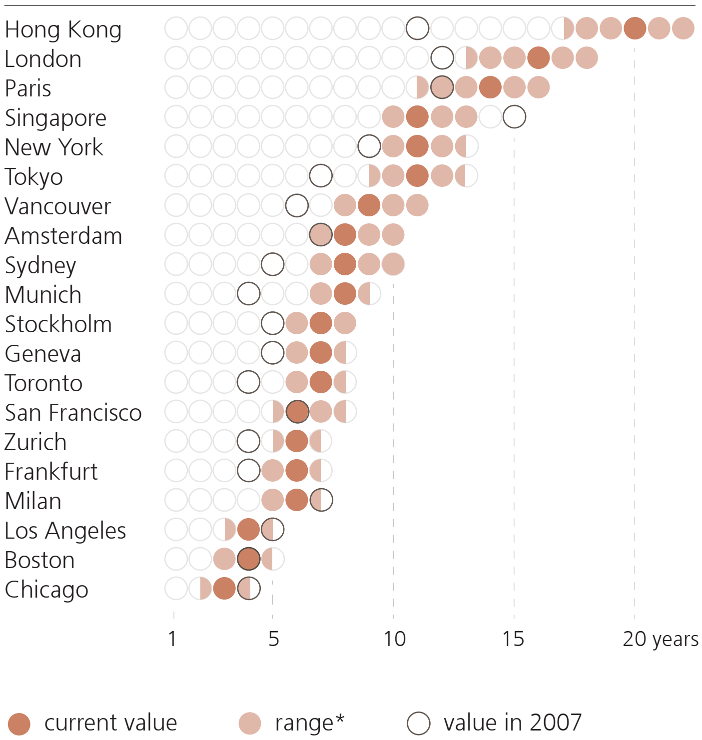
Buying a 60m² (650 sqft) apartment exceeds the budget of people who earn the average annual income in the highly skilled service sector in most world cities. In Hong Kong, even those who earn twice the city's average income would struggle to afford an apartment of that size. House prices have also decoupled from local incomes in London, Paris, Singapore, New York and Tokyo, where *price-to-income* multiples exceed 10. Unaffordable housing is often a sign of strong investment demand from abroad, tight zoning and rental market regulations. If investment demand weakens, the risk of a price correction will increase and the long-term appreciation prospects will shrink.

In contrast, housing is affordable in Chicago, Boston, Los Angeles, Milan and Frankfurt, which limits the risk of a price correction in these cities.

Due to relatively high incomes, purchasing an apartment is also relatively feasible for residents of San Francisco and most European cities, with the exception of Paris and London.

From the perspective of a homebuyer, affordability particularly depends on mortgage interest rates and amortization obligations. Relatively high interest and amortization rates, for example, mean that even the relatively low price-to-income multiples in US cities can place a heavy burden on monthly income. Conversely, even elevated purchase prices can be sustained easily, without the need for full amortization and low interest rates, such as in Switzerland and the Netherlands.

The number of years a skilled service worker needs to work to be able to buy a 60m² (650 sqft) flat near the city center



Source: UBS. Remark: For explanation see the section on Methodology & data on page 21.
* Uncertainty range due to differing data quality

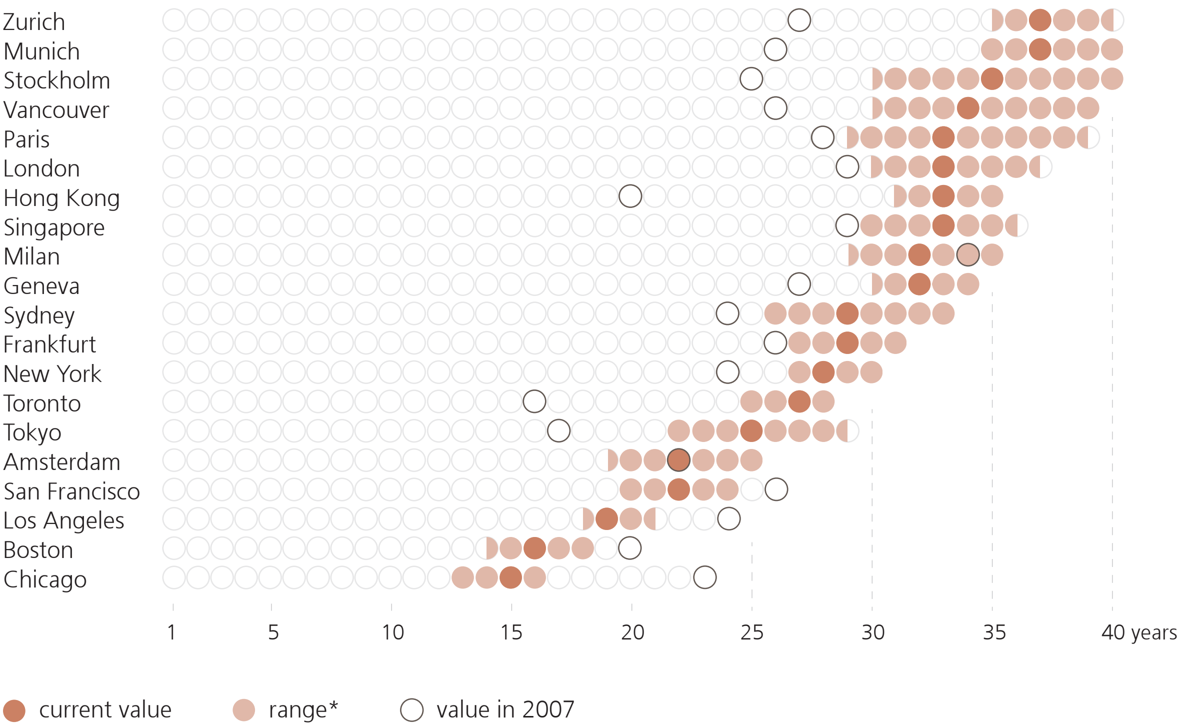
Price-to-rent

Zurich and Munich have the peak *price-to-rent* ratios, followed by Stockholm and Vancouver. Extremely high multiplies indicate an undue dependence of housing prices on low interest rates. Overall, half of the covered cities have price-to-rent multiples above 30. House prices in all these cities are vulnerable to a sharp correction should interest rates rise.

Price-to-rent values below 20 are found only in the US cities of Los Angeles, Boston and Chicago. Their low multiples reflect, among other things, higher interest rates and a relatively mildly regulated rental market. Conversely, rental laws in France, Germany, Switzerland and Sweden are strongly protenant, preventing rentals from reflecting true market levels.

But stratospheric price-to-rent multiples reflect not only interest rates and rental market regulation but expectations of rising prices, for example in Hong Kong and Vancouver. Investors anticipate being compensated with capital gains for overly low rental yields. If such hopes do not materialize and expectations deteriorate, homeowners in markets with high price-to-rent multiples are likely to suffer significant capital losses.

The number of years a flat of the same size needs to be rented to pay for the flat



Source: UBS. Remark: For explanation see the section on Methodology & data on page 21.
* Uncertainty range due to differing data quality

London

Weaker fundamentals

Key facts

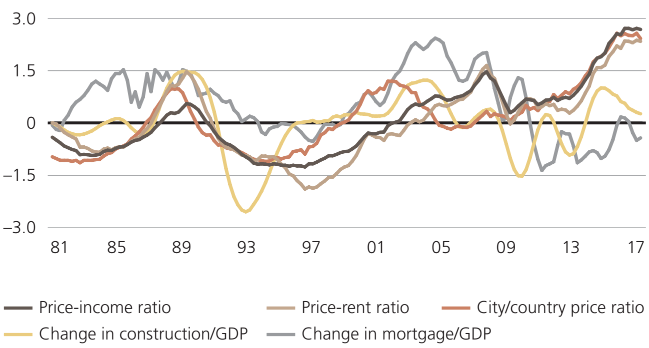
The *UBS Global Real Estate Bubble Index* score for London is 1.77, in **bubble-risk** territory.

The high-end market suffers from oversupply. Prime sales prices and rents have exhibited a downward trend since the middle of last year.

Broad market prices should stagnate from here. High market valuations and political uncertainty call for cautiousness.

Political uncertainty straining price appreciation

Development of sub-indices, standardized values



London's inflation-adjusted housing prices are almost 45% higher than five years ago and 15% higher than before the financial crisis a decade ago. But real income remains 10% lower than in 2007. The rise in house prices, however, has been decelerating since the UK referendum in June 2016, and real prices are 2% lower. The *UBS Global Real Estate Bubble Index* score for London dropped to 1.77, but remains in bubble-risk territory.

Mortgage rates are at all-time lows. Nevertheless, housing remains highly unaffordable for London's citizens. A skilled service worker needs to work almost 16 years to buy a 60m^2 (650 sqft) flat near the city center. Favorable credit conditions and the help-to-buy scheme have kept demand in the lower-price segment high. But the prime market now faces oversupply as increased stamp duties on luxury and buy-to-let properties hamper demand. As a consequence, sales prices and rents in the high-end segment have fallen in almost all London boroughs since mid-2016.

GBP depreciation can make for an attractive market entry point for foreign investors, whose impact, however, should not be overstated. We think London house prices may stabilize in the coming quarters. Low affordability, the economic slowdown and uncertainty about the UK's relationship to the EU are keeping demand in check. On the other hand, we expect supply to slow further this year, considering the decline in housing starts in 1Q17. We continue to advise caution given high market valuations and enormous political uncertainty.

Hong Kong

Driven by sentiment

Key facts

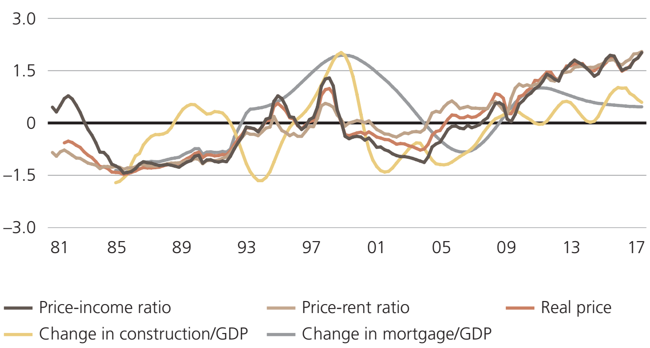
With a score of 1.74, the housing market is in **bubble-risk** territory, according to the *UBS Global Real Estate Bubble Index.*

Prices for small dwellings increased by more than 20% in the last four quarters, more than offsetting previous losses.

Unabated investor demand and firmly entrenched optimistic expectations limit downside in the short term, despite the city featuring the worst housing affordability of all financial centers.

Expectations reheated the market

Development of sub-indices, standardized values



Residential market prices reached an all-time high in mid-year. Thus the *UBS Global Real Estate Bubble Index* score for Hong Kong has increased significantly. Prices – especially for smaller dwellings – surged in the last four quarters. In real terms they are close to three times higher than in 2003, having increased at an average annual growth rate of 10%. Real rents rose in the same period by 3%, while incomes were unchanged.

The latest boom stemmed from strong investor demand, general positive sentiment and the "fear of missing out" on capital gains. This is reflected as well in a frozen secondary market in which people hold on to their properties, expecting prices to rise further. But we anticipate house prices taking a break. A mild correction of a single-digit percentage seems likely in light of rising supply and developers' eagerness to achieve a high sell-through rate.

Real incomes have virtually stagnated in Hong Kong for many years. So housing is less affordable here than in any other city we considered, and the average living space per person amounts to only 14m^2 (150 sqft). Despite the lack of any fundamental entrenchment of home prices, a major house price correction seems unlikely at the moment. Property prices remain driven by the appeal of the residential market to local and foreign investors alike. Nevertheless, prudence is warranted. The dependence on sentiment makes the long-term outlook highly uncertain. Also the possibility of regulatory tightening threatens the overheated market.

Zurich

Affordability rules keep price growth in check

Key facts

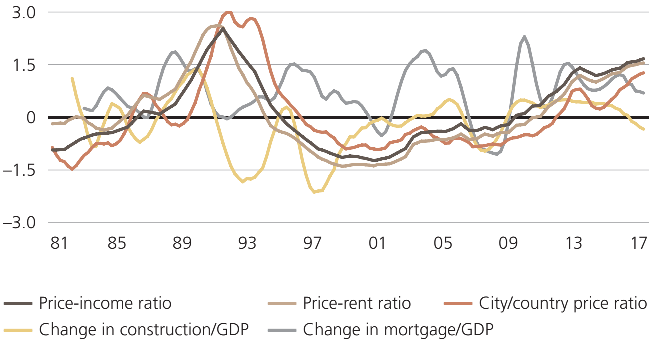
The *UBS Global Real Estate Bubble Index* score for Zurich is in **overvalued** territory at 1.08.

Price appreciation slowed considerably as lending rules now limit the availability of mortgages.

Since yields are very low, valuations are highly sensitive to interest rate increases.

Price growth at a low single digit rate

Development of sub-indices, standardized values



According to the *UBS Global Real Estate Bubble Index*, the valuation of the residential market was stable over the past year. The Index points to a moderately overvalued housing market. Real prices rose 2% over the last four quarters, slightly faster than the countrywide average. But the current rate of price increase is half that of the city's 10-year average.

Favorable financing conditions are keeping demand for home ownership buoyant. The financing costs of purchasing a 60m^2 (650 sqft) apartment require only 10% of the average annual income of a skilled service worker. But bank lending rules limit the availability of mortgages.

Such macroprudential measures have checked price appreciation and stabilized the growth of outstanding mortgages at a below-average volume. Construction activity within the city also remains elevated on top of already rising vacancy rates in the agglomerations. So market rents in the upper-price segment remain under pressure.

Affordability is not unreasonable relative to other cities. Buying a 60m^2 (650 sqft) apartment in Zurich costs a skilled service worker six years' income, but buying a medium-segment property in Zurich only pays off after more than 37 years. This price-to-rent ratio has risen ceaselessly since negative interest rates were introduced by the Swiss National Bank at the end of 2014. So home prices in Zurich are highly sensitive to interest rates, as a rate rise has a greater effect on purchase prices when yields are low.

Singapore

Dawn ahead

Key facts

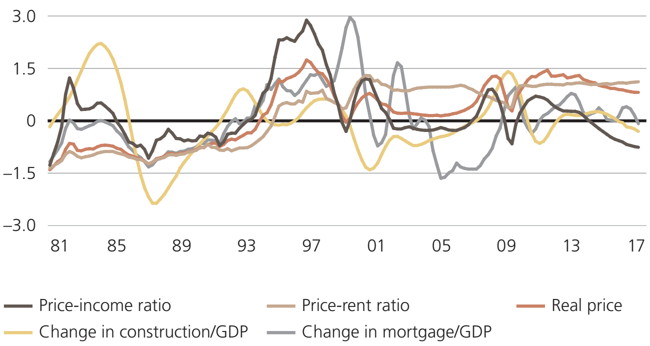
The *UBS Global Real Estate Bubble Index* score for Singapore is in **fair-valued** territory at 0.32.

The government is ending the regulatory tightening cycle, and the supply of private homes is declining fast, setting the stage for a turnaround.

We expect the downward trend of house prices to end this year. We see them rising moderately.

Correction coming to an end

Development of sub-indices, standardized values



Prices and rents continued to decline for the sixth consecutive year. In real terms prices are 18% lower than in 2011 at the previous peak. But the rate of decline is slower than in recent quarters. According to the *UBS Global Real Estate Bubble Index*, the market remains fairly valued, with valuation continuing to decline moderately.

As a result of strong supply, vacancy rates have increased from 6% to 9% in the last three years. The elevated supply of new homes between 2014 and 2016 and multiple rounds of restrictive government policies cooled the property market. Both factors are set to reverse. The government relaxed some cooling measures, signaling an end to the tightening cycle. The figures for housing permits are the lowest they've been since the early 1990s. New private home supply is forecast to decline by 30% this year and 25% next. A housing market turnaround seems to be in the cards, and we foresee price growth at a low single digit rate next year.

Private market housing remains barely affordable as the price-to-income ratio for a 60m^2 (650 sqft) flat is still 11 (public housing, however, represents 80% of the total market). It has improved significantly, though. A decade ago it hovered around 15. Income increased by close to 40% in this period, while house prices remained unchanged. Rents even declined by 10%.

New York

Oversupplied high-end market

Key facts

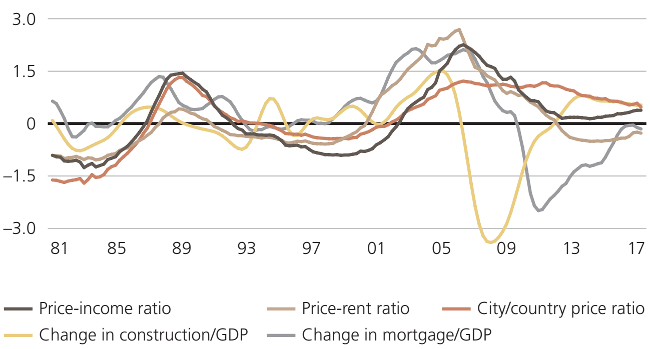
The *UBS Global Real Estate Bubble Index* score for New York is 0.20, which is in **fair-valued** territory.

However, housing in the city center is largely unaffordable, as buying a 60m² (650 sqft) flat requires as much as 11 yearly incomes.

Manhattan house prices have continued to decouple from the broader metropolitan area. But increasing supply is already pressuring the high-end market.

Rising financing costs stalled price growth

Development of sub-indices, standardized values



Up only slightly since last year, the *UBS Global Real Estate Bubble Index* score for New York remains in fair-valued territory. Over the last four quarters, real prices in the New York metropolitan area rose by less than 3% and are, in total, 10% higher than in 2013, when the market bottomed out. The pace of price growth is only the half the national average.

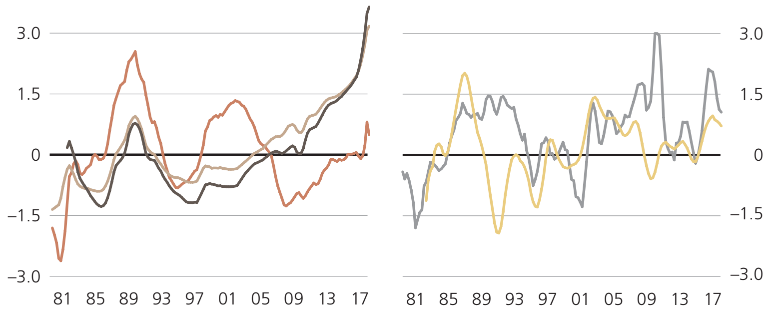
New York City is already one of the most expensive and unaffordable markets in the world. Average incomes have increased by only 7% since 2013. A highly skilled worker needs 11 years to afford a 60m² (650 sqft) flat, and rents – despite a slight decline last year – remain among the highest worldwide as well. Declining population growth and rising financing costs were already limiting housing demand in the region. Should financing costs continue to escalate, the strained affordability might dampen the outlook even more.

In Manhattan, house-price dynamics were much stronger in the last couple of years than in the overall New York metropolitan area, propelled by demand from global investors and a series of new luxury developments. But the momentum has already slowed in the high-end market. The transaction amount has fallen considerably since 2015, and the average time to sell a property has doubled since 2013. Moreover, a large number of new units will become available in coming quarters. Buyers will have to be lured by additional discounts from developers.

Select cities

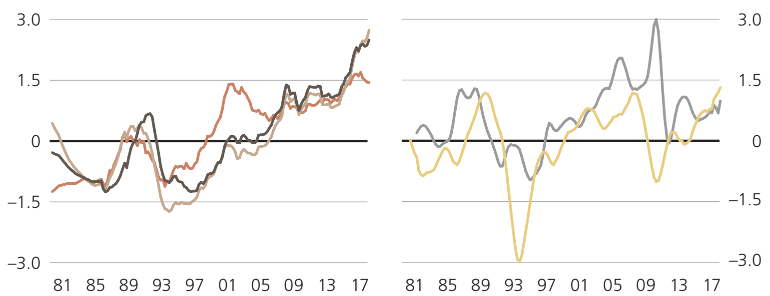
Toronto

House prices here are making up ground lost to Vancouver. Price growth accelerated last year and reached an excessive 20% year on year in the last quarter. Real prices have doubled in 13 years, while real rents have increased by only 5% and real income by less than 10%. A strengthening Canadian dollar and further interest rate hikes would end the party.



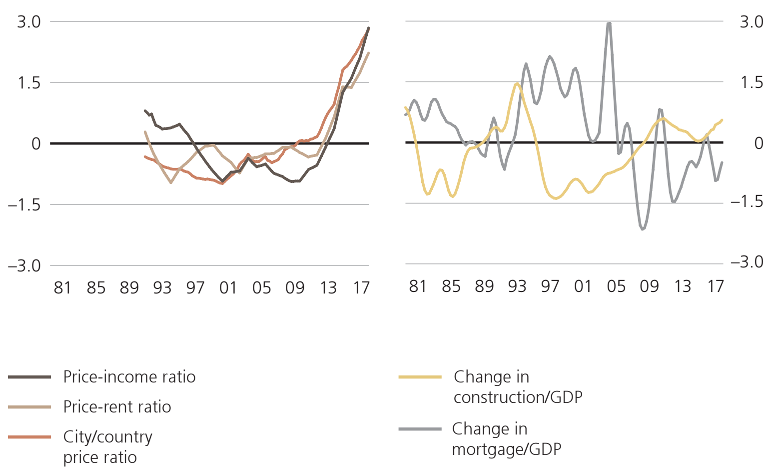
Stockholm

In the last 10 years, real prices have climbed by 60%, more than twice as fast as incomes, chiefly due to favorable financing conditions. Price growth sputtered over the last four quarters to 5%, below the national average, yet market imbalances increased further. Rising mortgage debt and building investments confirm overvaluation signals.



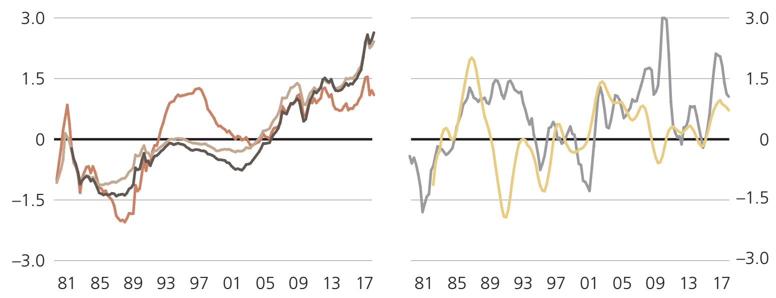
Munich

House prices remained on an explosive trajectory: in 2016 they again increased at double-digit rates against the backdrop of record-low vacancy. Real prices have risen 85% in the last 10 years and affordability continues to deteriorate. It takes a skilled service employee an all-time high of eight work years to buy a 60m² (650 sqft) flat.



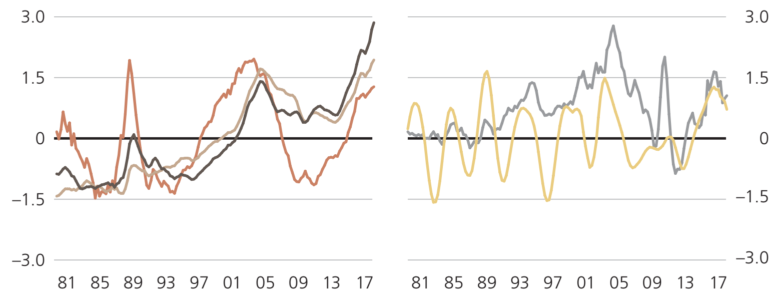
Vancouver

Price growth peaked in the middle of last year when real prices soared 25% year on year. In 2Q17 the growth slowed to 7%, falling below the country average. Income and rental growth were solid at 3% and 5% year on year respectively. So valuations were slightly dampened in recent quarters, but the market remains in the bubble-risk zone, harboring substantial downside and elevated correction risk.



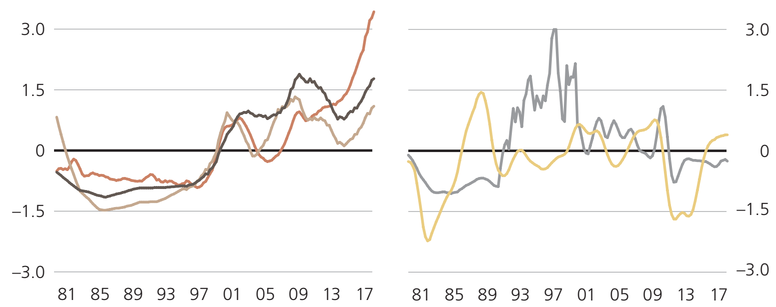
Sydney

All sub-indicators point unequivocally to elevated risk on the housing market. The dip in prices in 2015–16 proved short-lived. Real prices again shot up 12% in the last four quarters and are now 60% higher than in 2012. Incomes increased by a meager 2% in inflation-adjusted terms. Tax breaks and interest-only loans are whitewashing the worsening affordability for the time being.



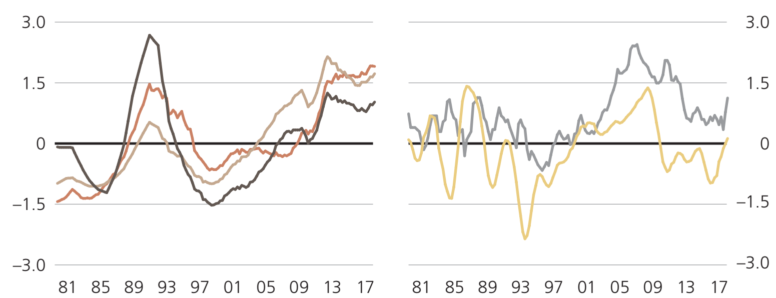
Amsterdam

Since 2015 real prices have increased by 30% and the city has entered bubble-risk territory. The city's housing market sharply decoupled from the weak countrywide housing market. Deviations from market fundamentals in the capital are, however, not extreme. Remarkably, income and rental growth have kept pace with price growth since 2008, limiting the downside risk.



Paris

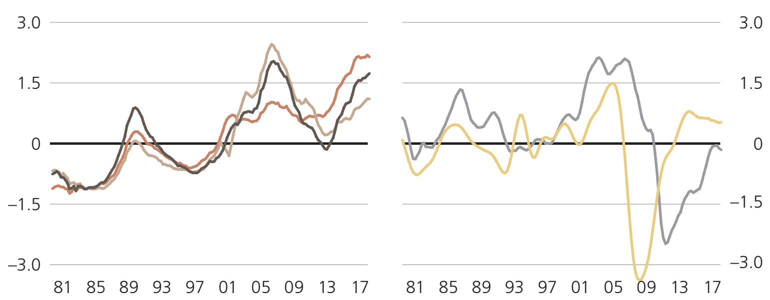
Between 1998 and 2011, real prices for housing almost tripled. After a correction of roughly 10%, prices have recovered almost fully in the last two years. The housing market looks increasingly overvalued again. An improving economic outlook boosted mortgage and housing demand in recent quarters, but the worst housing affordability in continental Europe limits upside.



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

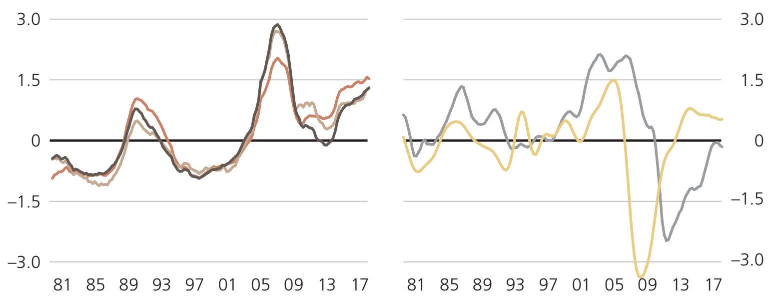
San Francisco

In the wake of the technology boom and buoyant foreign demand, real house prices have soared 65% since 2012. Price growth has slowed in recent quarters, but remain with 6% above the national average. Despite the thriving economy, average incomes have risen only 10% since 2012 and have not kept pace with house prices, worsening housing affordability further.



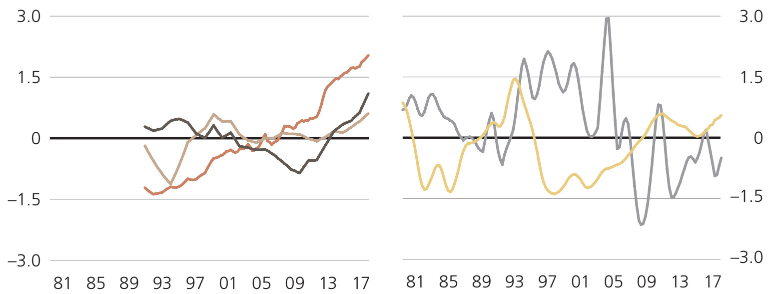
Los Angeles

Since 2012 real housing prices have increased by 45%, while across the US the figure is just 23%. The prospering economy and demand from China are fueling the boom and show no sign of decelerating. Prices, however, are still 20% below their 2006 peak. While income growth has escalated in the last two years, housing affordability is stretched and should slow price growth.



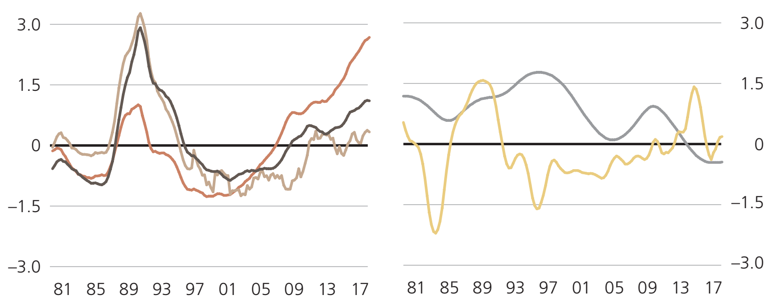
Frankfurt

House-price growth accelerated last year and outperformed the countrywide housing boom. Frankfurt exhibited the third-fastest house price appreciation of the European cities in this study last year. Demand is supported by a dynamic economic environment and a spirit of optimism (the narrative of "Brexit gains"). But affordability and price-to-rent multiples leave scope for more appreciation.



Tokyo

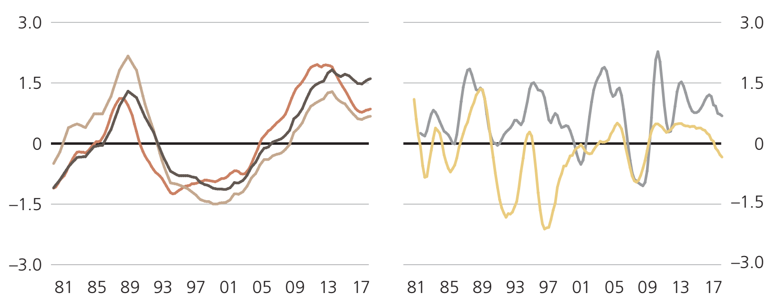
The city's housing market continues to decouple from the rest of the country's. Since 2012 real prices in it are up 25%, while they are down 10% nationwide. Low interest rates are sustaining the local boom, but housing is becoming increasingly unaffordable as income growth lags behind. The expected long-term decline in population limits the upside.



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

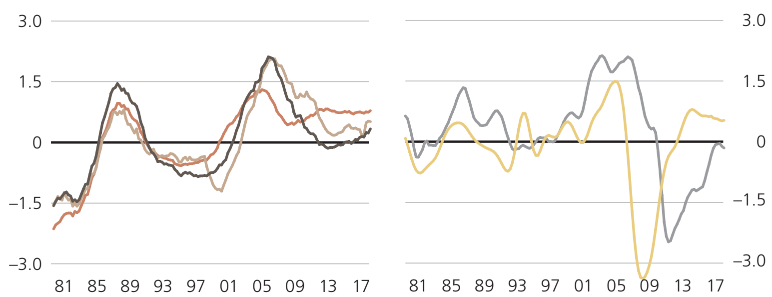
Geneva

Home prices seemed to have reached a bottom after a price correction of roughly 10% in real terms since 2012. This year the market is showing signs of recovery. Valuations are increasing again in line with re-emerging price growth. The price-to-income ratio is elevated in historical as well as absolute terms. The city exhibits the lowest affordability in Switzerland.



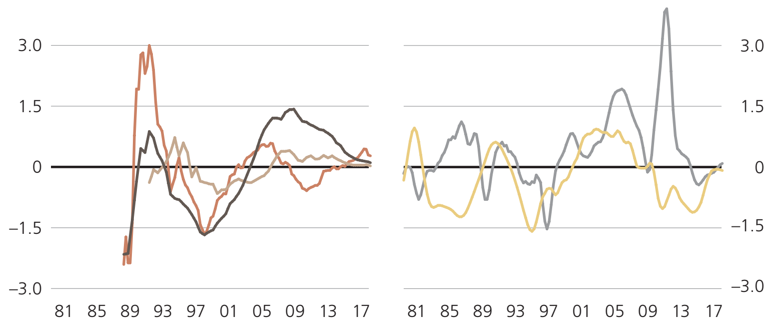
Boston

House prices increased by 6% last year and are now 20% higher than in 2012. The regional economy and incomes are growing faster than the national average. Housing affordability remains good compared to other cities in the study. A $60m^2$ (650 sqft) flat costs only four annual household incomes. As population growth remains vigorous and supply may be slowing, prices should continue to rise.



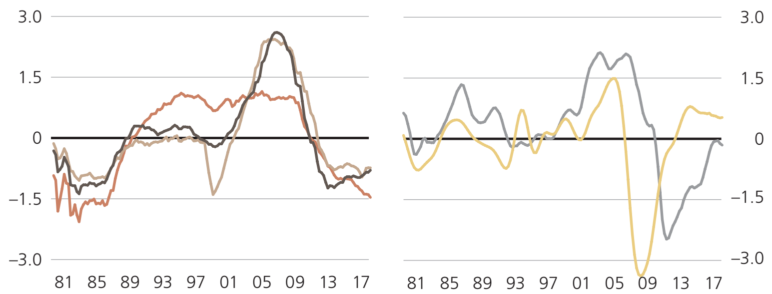
Milan

Real housing prices remain some 30% below the 2007 level. Slow economic growth has continued to hamper a housing recovery. The latest data indicates an improving outlook and steady employment growth in Lombardy, which will support incomes. So we expect home prices to recover. The city exhibits the best affordability of all the European ones in the study.



Chicago

Since 2012 prices have risen by 15% in real terms but remain 30% below their 2006 peak. Decreasing population, sluggish employment and lackluster economic and income growth hinder the recovery of broad-based demand in the housing market. We expect price growth to lag behind the national average in the coming quarters.



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

Change in construction/GDP
Change in mortgage/GDP

Methodology & data

UBS Global Real Estate Bubble Index
The *UBS Global Real Estate Bubble 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 the *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. For time series shorter than 30 years the coefficient of variation of an equivalent indicator on the country-level is used as a floor value to calculate the volatility of the city-level indicator. 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 22.

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, this method results in city-specific weights on sub-indices. To prevent overweighting country-level variables and to increase the comparability of cities, the deviation from the average weight across all cities is limited. So fixed weights that approximate the average factor-analysis weight of single sub-indices across the cities complement the calculation. The final weights are subject to minor changes when new data enters 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 60m^2 (650 sqft) 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 the *UBS Prices and Earnings* survey and from official statistical sources. Real estate prices and rents range widely near the city center. Our estimates are cross-checked, validated using different sources and have been updated on an annual basis. However, we also specify an uncertainty range due to the differing quality of our data sources.

Data sources

		Price Index (City)	Rent Index (City)	Income Index (City)	Price Index (Country)	Mortgage, Construction, GDP, Inflation (Country)
Amsterdam	2017Q2	CBS, Maastricht University	NVM, UBS P&E	UBS P&E, CBS	CBS, FED Dallas	DNB, CBS, EUKLEMS, Bloomberg
Boston	2017Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Chicago	2017Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Frankfurt	2016Q4	Bulwiengesa	Bulwiengesa, OECD	Destatis, UBS P&E, OECD	FED Dallas	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg
Geneva	2017Q2	Wüest Partner	Statistique Genève	FTA, FSO	Wüest Partner	SNB, SECO, BFS
Hong Kong	2017Q2	RVD	RVD	Census and Statistics Department Hong Kong, Bloomberg	RVD	Census and Statistics Department Hong Kong, HKMA, Macrobond, Bloomberg
London	2017Q2	Nationwide, Lloyds Banking Group	ONS, UBS P&E	ONS	Nationwide, Lloyds Banking Group	BoE, ONS, EUKLEMS, Macrobond, Bloomberg
Los Angeles	2017Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Milan	2017Q2	Nomisma	Nomisma, OECD	Dipartimento delle Finanze, UBS P&E	FED Dallas	Banca d'Italia, Hypostat, Istat, EUKLEMS, Macrobond, Bloomberg
Munich	2016Q4	Bulwiengesa	Bulwiengesa, OECD	Destatis, UBS P&E, OECD	FED Dallas	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg
New York	2017Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Paris	2017Q1	BIS, CGEDD	CGEDD, Clameur, UBS P&E	Insee, Bloomberg, UBS P&E	FED Dallas	BdF, Insee, EUKLEMS, Macrobond, Bloomberg
San Francisco	2017Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Singapore	2017Q2	Government of Singapore	Government of Singapore, UBS P&E	Government of Singapore	Government of Singapore	Government of Singapore, Bloomberg
Stockholm	2017Q2	Statistics Sweden	Statistics Sweden, UBS P&E	Statistics Sweden, UBS P&E	Statistics Sweden	Statistics Sweden, Bloomberg
Sydney	2017Q1	REIA, ABS	REIA, NSW Government, UBS P&E	ABS, UBS P&E	FED Dallas	ABS, RBA, Macrobond, Bloomberg
Tokyo	2017Q1	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, Macrobond, Bloomberg
Toronto	2017Q2	Sauder School of Business UBC, Bloomberg	Canadian Housing Observer, Sauder School of Business UBC	Statistics Canada	FED Dallas	Statistics Canada, BoC, Bloomberg
Vancouver	2017Q2	Sauder School of Business UBC, Bloomberg	Canadian Housing Observer, Sauder School of Business UBC	Statistics Canada, Government of British Columbia	FED Dallas	Statistics Canada, BoC, Bloomberg
Zurich	2017Q2	Wüest Partner	Statistik Stadt Zürich	FTA, FSO	Wüest Partner	SNB, SECO, BFS

Benchmarking sources

	Earnings	Real Estate (prices and rents)
Amsterdam	UBS P&E, CBS	Globalpropertyguide.com, numbeo.com
Boston	BEA	Zillow, numbeo.com, CBRE
Chicago	BEA	Zillow, numbeo.com, CBRE
Frankfurt	UBS P&E, Destatis	Bulwingesa, globalpropertyuide.com, numbeo.com
Geneva	UBS P&E, Federal Income Tax Statistics, FSO	Wüest Partner
Hong Kong	UBS P&E, Census and Statistics Department Hong Kong	Hong Kong Statistical Office
London	UBS P&E, ONS	GLA datastore, findpoperly.co.uk, numbeo.com
Los Angeles	BEA	Zillow, numbeo.com, CBRE
Milan	UBS P&E, Dipartimento delle Finanze	Nomisma
Munich	UBS P&E, Destatis	Bulwingesa, globalpropertyuide.com, numbeo.com
New York	BEA	Elliman, Zillow, globalpropertyguide.com
Paris	UBS P&E, Insee	Globalpropertyguide.com, numbeo.com
San Francisco	BEA	Zillow, numbeo.com, CBRE
Singapore	Department of Statistics Singapore, Demographia.com	Globalpropertyguide.com, numbeo.com
Stockholm	UBS P&E, Statistics Sweden	Globalpropertyguide.com, numbeo.com, Statistics Sweden
Sydney	UBS P&E, ABS	Globalpropertyguide.com, numbeo.com
Tokyo	UBS P&E, INDB, Tokyo Metropolitan Government	Globalpropertyguide.com, numbeo.com
Toronto	Statistics Canada	Canada mortgage and housing corporation (CMHC), Globalpropertyguide.com, numbeo.com, Toronto Real Estate Board, condos.ca
Vancouver	Statistics Canada	Canada mortgage and housing corporation (CMHC), Globalpropertyguide.com, numbeo.com, Real Estate Board of Greater Vancouver, condos.ca
Zurich	UBS P&E, Federal Income Tax Statistics, FSO	Wüest Partner

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