

UBS Global Real Estate Bubble Index

2018



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UBS Global Real Estate Bubble Index

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Editorial

Dear reader,

Over the past five years, owner-occupied homes have been a good investment: the median total return of the most important financial centers was 10% annually, accounting for an imputed rental income and book profits from rising prices. So “golden concrete” has seemingly outperformed the stock markets.

On the other hand, the term “affordability crisis” dominates headlines. Fewer and fewer resident households can afford to buy their own home. The crowding out of long-time residents from their local housing markets by foreign investors is triggering political reactions.

Accordingly, foreign and buy-to-let investors are the main group being targeted by new regulatory measures. It is becoming more difficult, more expensive and in some cases outright impossible for them to acquire residential space. Especially in the luxury market, regulatory intervention can bring demand to a standstill and trigger a price correction.

Strained affordability is not only a source of risk for developers and foreign investors. Rising interest rates and tighter lending conditions can abruptly end a real estate boom if property becomes too pricy, as the current example of Sydney shows.

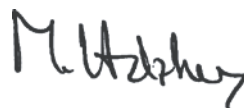
How appealing the returns of owner-occupied homes will be in the next few years is questionable. Last year the house price boom in key cities was already losing intensity and scope. Inflation-adjusted prices declined in almost half of the cities analyzed. The *UBS Global Real Estate Bubble Index* reveals where the imbalances are currently greatest and where the first cracks in the valuation edifice are visible.

We hope you have an engaging read.

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Key results

Most cities in overvalued territory

Bubble risk appears greatest in Hong Kong, Munich, Toronto, Vancouver, London and Amsterdam. Major imbalances also characterize Stockholm, Paris, San Francisco, Frankfurt and Sydney.

Increasingly strained affordability

The median price-to-income (PI) multiple of the cities in the study increased from 5.5 in 2008 to 7.5 today. Buying a 60m² apartment in most world cities exceeds the budget of most people who earn the average annual income paid in the highly skilled service sector.

Two-tier market dynamics

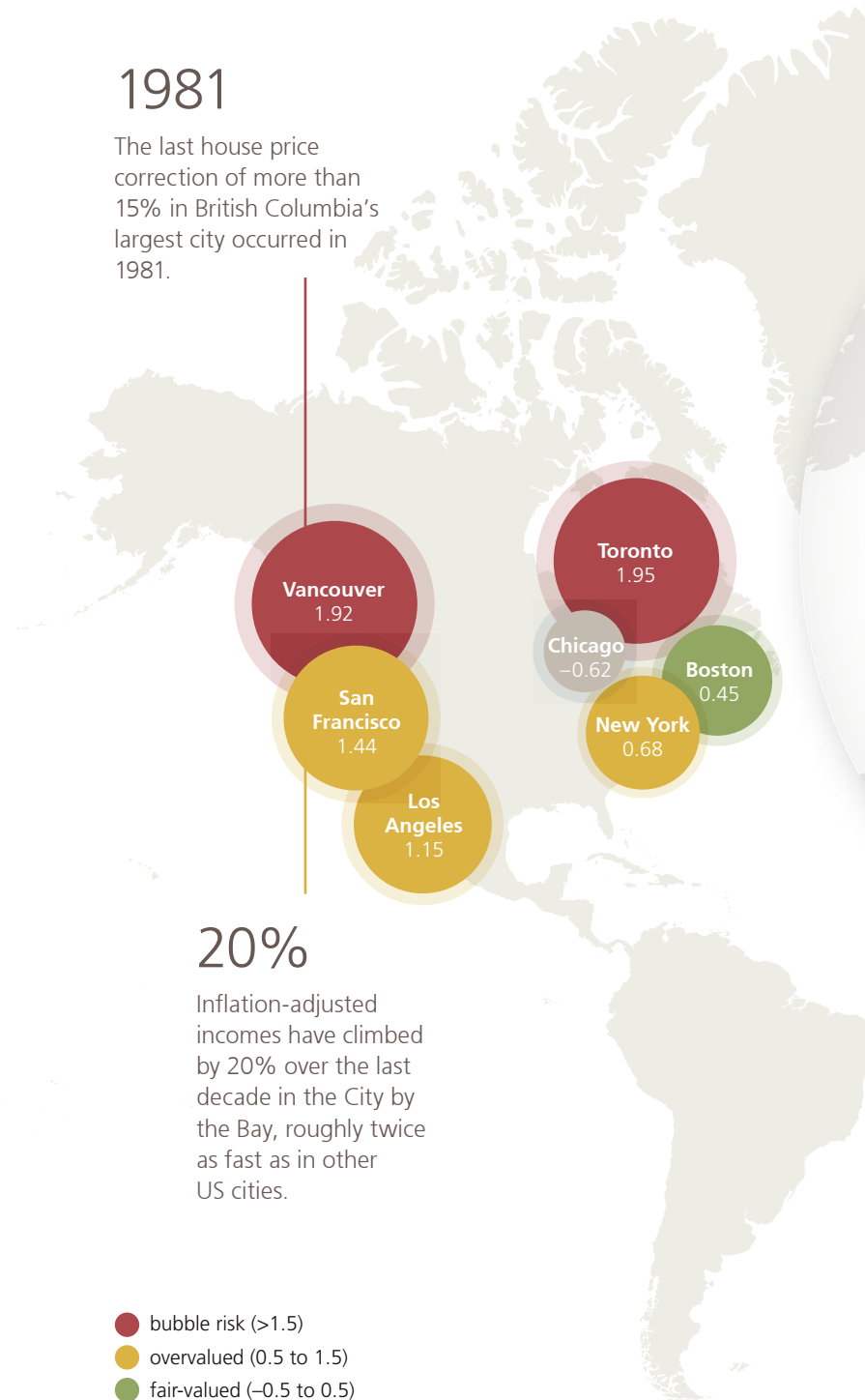
In half of the cities in the study housing markets are booming with inflation-adjusted prices rising at least 5% in the last four quarters. However, in the other half of the cities house prices were stalling or declining.

Beware of rising interest rates

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.

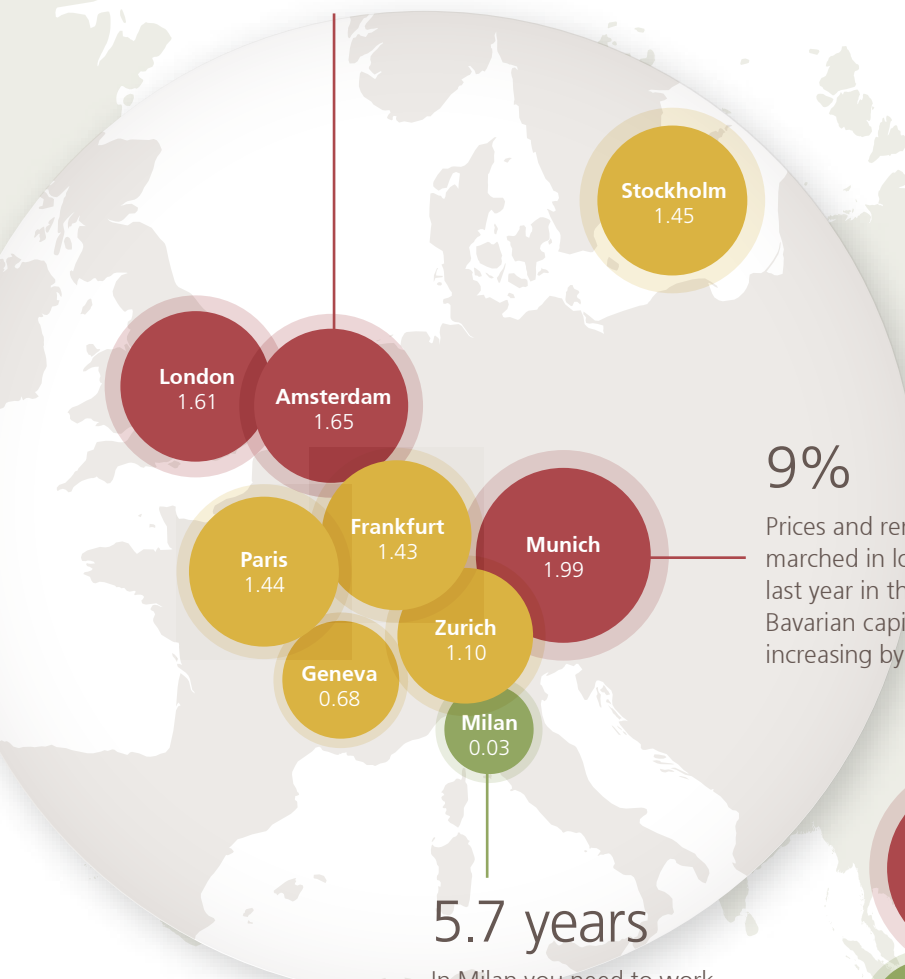
1981

The last house price correction of more than 15% in British Columbia's largest city occurred in 1981.



45%

Real housing prices in Holland's largest city have soared by 45% in the last three years.

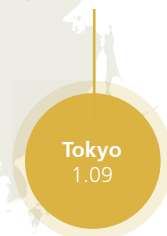


9%

Prices and rents marched in lockstep last year in the Bavarian capital, increasing by 9%.

100 ppt.

Price rises in the Japanese capital have outpaced those in the rest of the country by roughly 100 percentage points since 1998.



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.

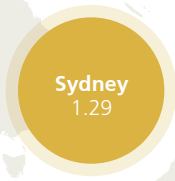
22 years

You need to work 22 years to afford a 60m² flat in the Asian metropolis. Ten years ago it was just 12 years.



Zero

There has been no difference between house price and income growth in Singapore over the last 30 years.



Cracks appearing at the top end

Inflation-adjusted city prices increased by 3.5% on average over the last four quarters, considerably less than in previous years but still above the 10-year average. They remained on an explosive uptrend in the largest Eurozone economic centers, as well as in Hong Kong or Vancouver. But the first cracks in the boom's foundation have begun appearing: house prices declined in half of last year's bubble risk cities.

Two-tier valuation changes

Consequently, discrepancies in housing market valuations widened despite roughly stable aggregate imbalances over the last year. Bubble risk soared in Munich, Amsterdam and Hong Kong. In Vancouver, San Francisco and Frankfurt, too, imbalances continued to grow. More broadly, index scores fell in no less than one-third of the cities. Stockholm and Sydney experienced the steepest drop. Valuations went down slightly in London, New York and Toronto, among others.

Extraordinary breadth of the boom

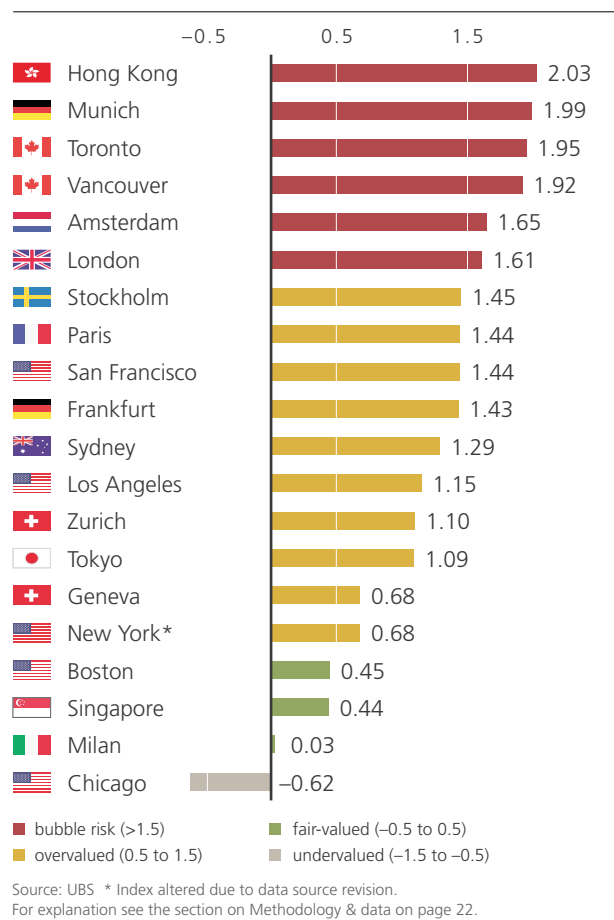
Over the course of the last five years, house prices in major cities have increased by 35% on average. In San Francisco, Munich and Vancouver price growth was double the average. Overall, the price boom has not been spectacular, but it has been broad-based. Until recently nearly all the cities enjoyed rising house prices, something seen in the late 1980s and before the 2008 market crash. This exceptional breadth of the current house price boom has various roots. Easy financing conditions boosted demand almost everywhere. Major cities profited from the growing importance of the digital economy and the wider trend toward urbanization. Finally, the number of wealthy households searching for safe assets in the most attractive residential areas surged.

Cling together, swing together?

Despite the breadth of the boom, house price growth rates in the top financial centers did not exhibit patterns of synchronized acceleration or deceleration. In general, synchronization of house prices is only high in times of crisis. This

UBS Global Real Estate Bubble Index

Latest index scores for the housing markets of select cities



Identifying 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 historical data reveals patterns of property market excesses. Typical signs include a decoupling of prices from local incomes and rents, and imbalances in 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.

is no surprise as most downturns in the past 40 years have been preceded by rising interest rates, which are correlated across countries. Idiosyncratic factors such as local affordability, tax policy and supply-side restrictions clearly dominate current housing market dynamics and consequently determine the medium-term outlook.

A crisis of affordability

The growing imbalances stemmed primarily from home prices in cities decoupling from the respective national averages and local incomes. Most households can no longer afford to buy property in the top financial centers without a substantial inheritance. Rents continue to consume a significant share of income. These affordability issues will trigger further policy responses.

Politics may cause an overcorrection

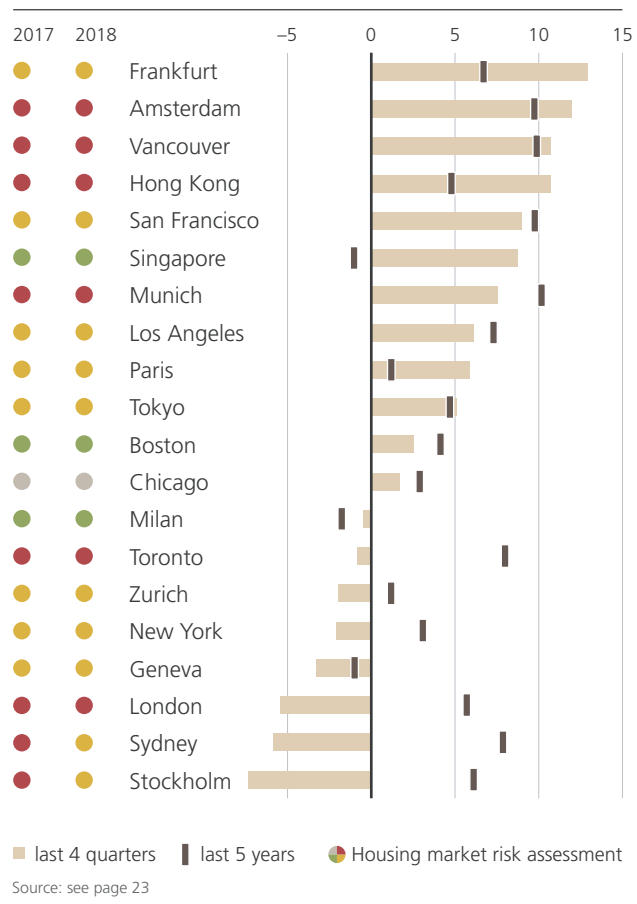
Politicians can act in a range of ways, from increasing taxes on vacant homes through levying stamp duties to curbing leverage. Subsidies for first-home buyers and rent-control measures are other policy options. In markets whose prices are highly influenced by sentiment or foreign capital flows, new regulations pose a significant risk. If implemented at the peak of a boom, they may cause prices to overcorrect. Low affordability also jeopardizes cities' long-term growth potential and could cause investors to reassess their expectations about future capital gains.

Lower risk of economic contagion

In contrast to the boom of the late 1980s and the years preceding the 2008 market crash, no evidence of simultaneous excesses in lending and construction exists. Outstanding mortgage volumes are growing (at best) half as fast as in the run-up to the Great Financial Crisis, which should limit the economic damage of any price correction that occurs. Nevertheless, caution is warranted and investors in wildly overvalued markets should 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



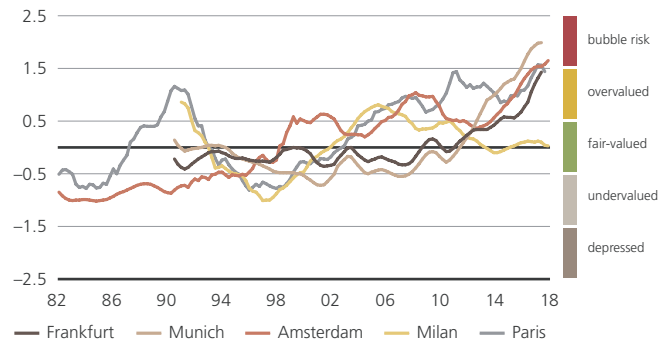
Regional cycles

Eurozone

All cities except Milan boast higher index scores over the last four quarters. Vibrant income growth, excessively low borrowing rates and bullish expectations caused valuations to soar and local bubble risks to rise. Inflation-adjusted prices in Munich, Amsterdam, Paris and Frankfurt have reached record highs. The price growth rates in Frankfurt and Amsterdam hit double-digit territory. In Milan, however, investor demand is subdued due to an uncertain political and economic outlook.

Eurozone

UBS Global Real Estate Bubble Index

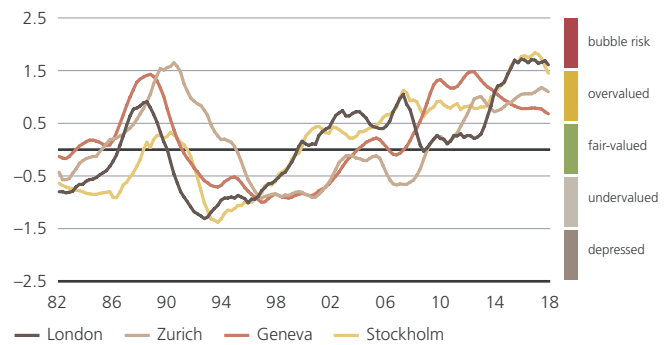


Rest of Europe

Index scores have declined in almost all cities over the last year. In Switzerland tighter mortgage-market regulations and higher vacancy rates for rental apartments limit upside. In Geneva imbalances have been receding since 2012. After years of excessive price growth, a correction set in in Stockholm as stricter amortization regulations reined in demand and caused the city to drop out of bubble-risk territory. London's index score declined for the second year in a row. Strained affordability, political uncertainty and a less-favorable tax environment for international and buy-to-let investors kept housing demand in check.

Rest of Europe

UBS Global Real Estate Bubble Index

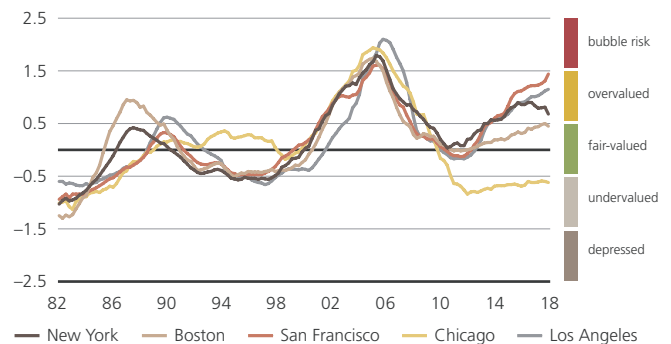


United States

Overall, the index scores for the cities in this study are below their 2006 peak values. The divergent rates of market valuation increases since then reflect regional differences in economic growth. Last year rising mortgage rates and decreasing affordability only partly curbed housing demand. In Boston and Chicago valuations remained mostly low. New York's score dropped slightly given the lack of price growth over the last four quarters. On the other hand, scores rose in the West Coast cities of Los Angeles and San Francisco. Notably, real prices in San Francisco have climbed 9% since last summer and now exceed their 2006 peak by more than 20%. This city is approaching high valuation risk.

United States

UBS Global Real Estate Bubble Index

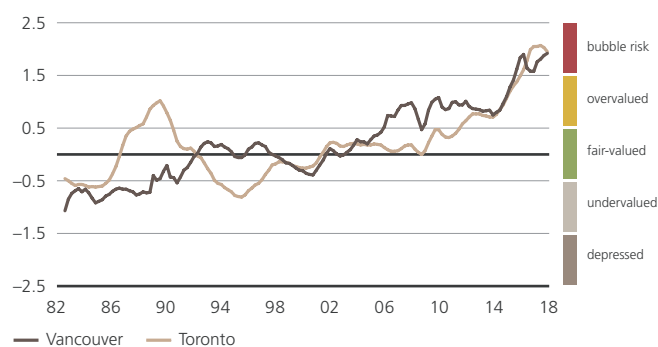


Canada

Vancouver, whose house prices accelerated to a double-digit rate relative to last year, has a ballooning index score. Higher stamp duties for foreign investors proved futile in braking its boom. By contrast, Toronto's price dynamics have slowed considerably and its index score declined somewhat from last year's. In both cities, valuations have trended upward since the late 1990s. Neither the financial crisis nor weakening commodity prices has dragged them down. But rising rates, stricter market regulations or an economic downturn could turn the lights out on the party given the high valuations and strained affordability.

Canada

UBS Global Real Estate Bubble Index



Hong Kong and Singapore

In contrast to those of their US and European counterparts, property prices in Hong Kong and Singapore soared by double-digit rates shortly after the Great Financial Crisis as capital shifted to emerging economies. But in Singapore overall house prices have stayed pretty much the same since 2012. Last year's price climb provoked an increase in stamp duties targeted at speculative investors. Valuations still managed to inch up but the city remains in fair-valued territory. By contrast, the index points to bubble-risk territory in Hong Kong, where house prices have continued to increase by an annual rate of almost 10% since 2012. Regulatory measures proved ineffective to restrain insatiable investor demand and speculative price expectations.

Hong Kong and Singapore

UBS Global Real Estate Bubble Index

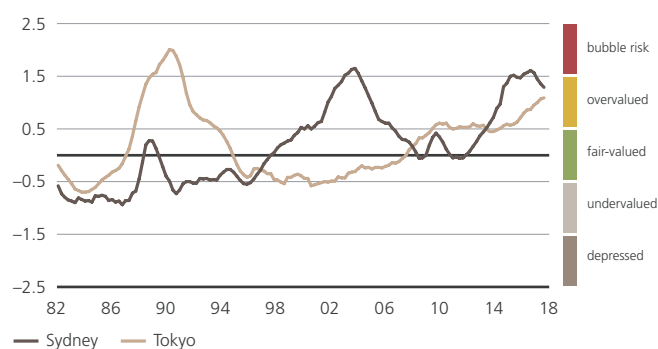


Japan and Australia

Tokyo's housing market decoupled from the rest of country due to relatively supportive demographics and low interest rates. Over the last four years prices have moved up 25% and the city's index score has entered overvalued territory. But valuations are still far away from the inflated environment of the late 1980s. Sydney's housing market reached bubble-risk territory in 2015 thanks to buoyant foreign demand, low interest rates and exuberant expectations. It peaked last year and has since corrected by 5% in real terms in light of tighter mortgage lending. Despite its index score plunging, the city remains highly overvalued.

Japan and Australia

UBS Global Real Estate Bubble Index



Global cities' benchmarks

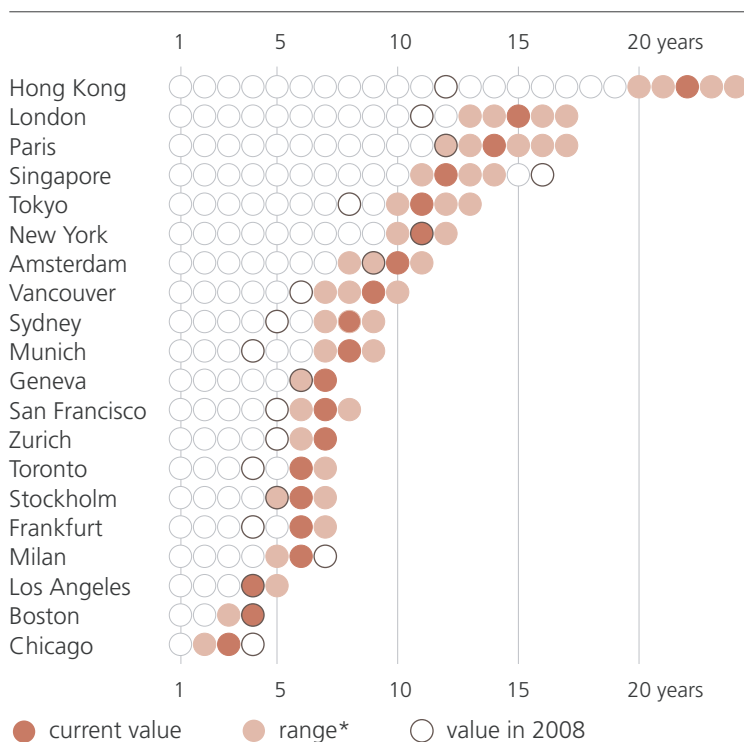
Price-to-income

Buying a 60m² 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, Frankfurt or Milan, 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, Zurich and Geneva.

From the perspective of a homebuyer, affordability also 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 22.
* Uncertainty range due to differing data quality

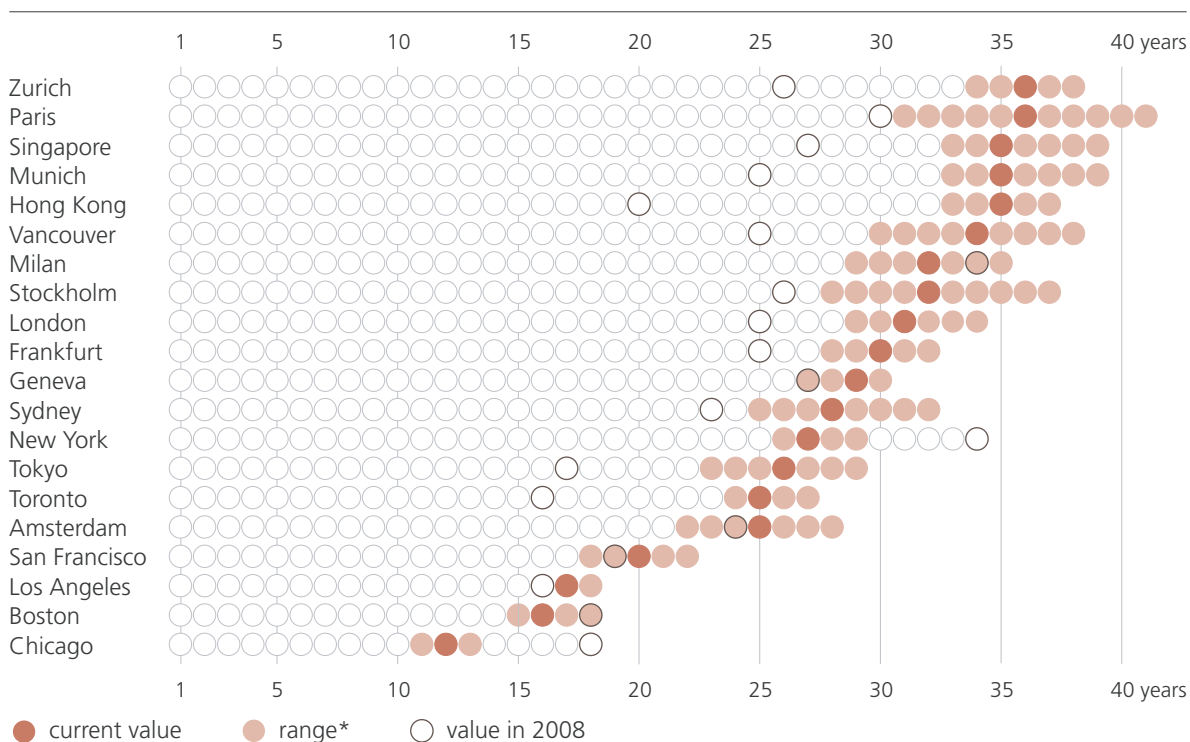
Price-to-rent

Zurich and Paris have the peak *price-to-rent* ratios, followed by Singapore and Munich. Extremely high multiples 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 pro-tenant, 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



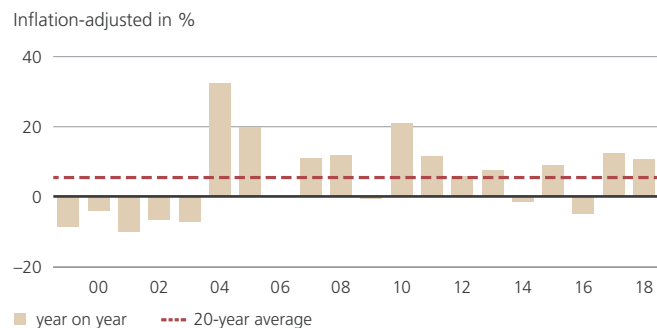
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Hong Kong

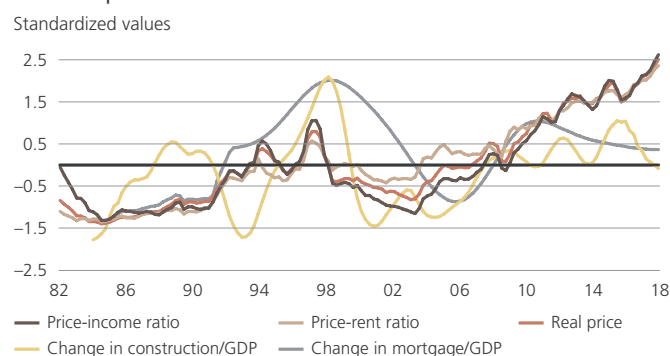


High risk, high reward

Annual house price growth rates



Development of sub-indices



The Hong Kong property market has retained its vibrant momentum. Residential market prices have risen again by more than 10% in inflation-adjusted terms over the last four quarters, raising the city's *UBS Global Real Estate Bubble Index* score higher within the **bubble-risk** zone. Since 2008 prices have doubled while rents have gone up by 15% and incomes have remained unchanged in real terms.

The market is chronically undersupplied. Demand remains buoyant thanks to the residential market's high appeal to local and foreign investors alike. So over the last decade its affordability has fallen the most among the cities considered in this study. Even for highly skilled workers, property ownership is now out of reach. With citizens priced out of their own market, political pressure has mounted to curb price growth. Recently, the government announced an occupancy tax for vacant, completed units to encourage developers to sell them as quickly as possible, in an effort to improve supply.

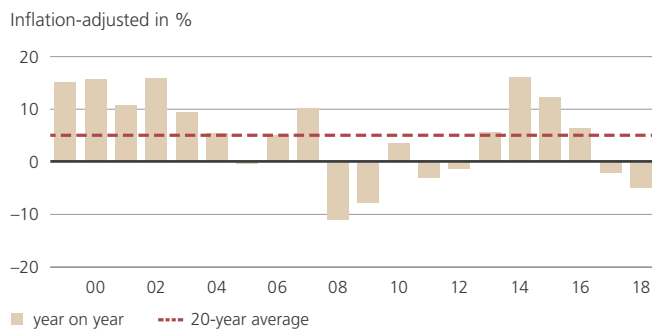
We expect the uptrend in property prices to slow in the near term. But a sharp correction seems unlikely, given the pent-up investment demand and ongoing low mortgage rates. Price volatility also has to be taken into account: in such a speculative market environment macro-economic uncertainty, e.g. on Sino-US trade or on the RMB, can weight on sentiment at any time. Moreover, further regulatory tightening is a threat to the overheated market.

London



Price erosion

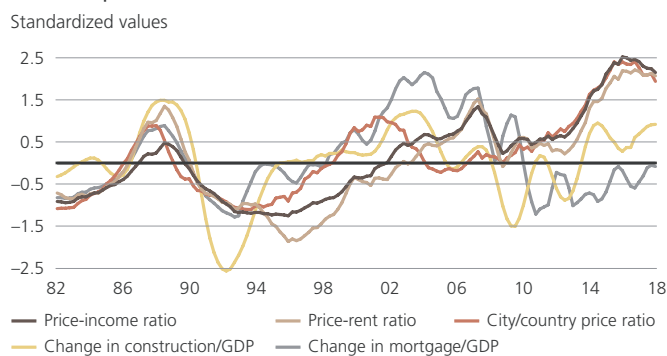
Annual house price growth rates



The *UBS Global Real Estate Bubble Index* score for London declined for the second straight year but remains in the **bubble-risk** zone. Overall, inflation-adjusted prices are more than 10% higher than in 2007, when the last bubble burst, while rents have stayed roughly stable and real incomes have gone down by 10%.

House prices in London have lagged the nationwide average and dropped by 5% in inflation-adjusted terms since mid-2017. The relative weakness of the city's housing market can be attributed to a few causes. First, housing remains unaffordable for London's citizens. Buying a 60m² (650 sqft) flat near the city center costs 15 yearly incomes, which means that government programs to help first-time buyers are less effective in London than elsewhere in the country. Second, the prime segment is hurt by higher stamp duties for luxury and buy-to-let properties. Third, inflation continues to erode the purchasing power of local residents. So market weakness was more pronounced in the prime boroughs.

Development of sub-indices



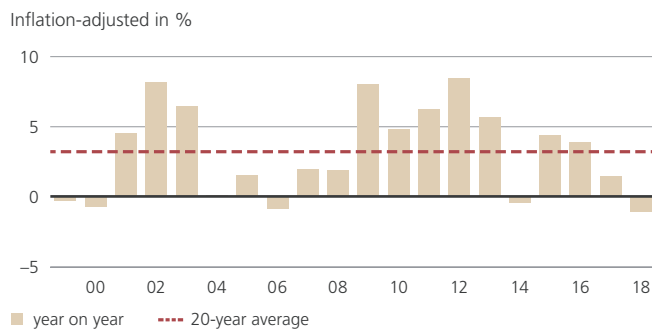
From the perspective of foreign investors, house prices in USD terms have fallen by 10% since 2015 and could constitute an attractive buying opportunity. We expect prices to stabilize but still advise caution given high market valuations and marked political uncertainty.

Zurich



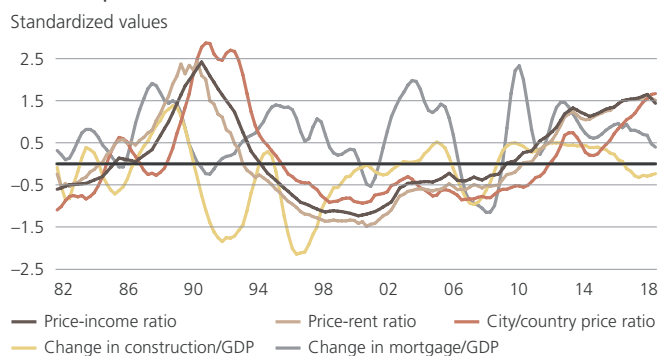
Valuations remain stable

Annual house price growth rates



Residential market valuation remained virtually unchanged over the past year, with the housing market continuing to occupy moderately **overvalued** territory, according to the index. Apartment prices in Zurich fell 2% over the last four quarters, slightly less than the nationwide average. Pressure on prices can be attributed to ongoing weak demand for high-end properties. In the lower-tier market, favorable financing conditions and rising incomes are keeping demand for home ownership buoyant, and prices have continued to increase. The relatively strict bank lending rules not only curb price appreciation but limit mortgage growth, which has fallen below income growth in recent quarters.

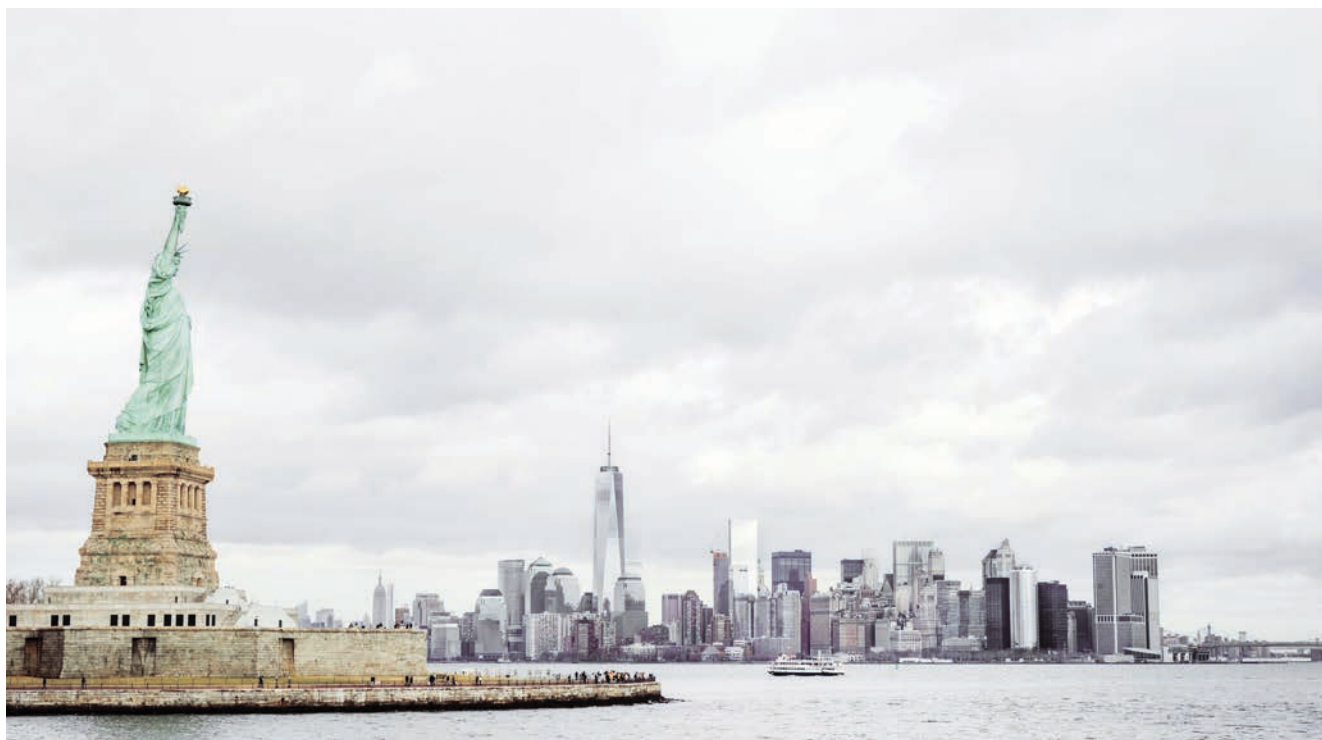
Development of sub-indices



The housing market is characterized by a relatively fast expansion and renewal of the housing stock. More than 10% of all housing units have been built within the last 10 years – roughly three times more than in Geneva. Recently, construction activity fell off somewhat within the city while accelerating in the agglomerations. The slowly rising vacancy rates for rental apartments lead us to expect that market rents will remain under pressure.

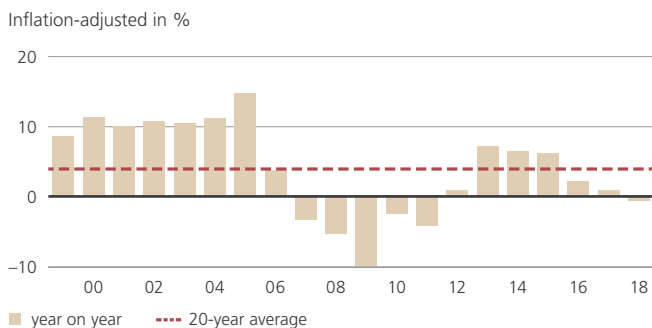
Buying a medium segment property in Zurich only pays off after more than 36 years – tantamount to the lowest rental yields of all cities in this report. So home prices in Zurich are highly sensitive to interest rates: a rate rise has a greater effect on purchase prices when yields are low.

New York



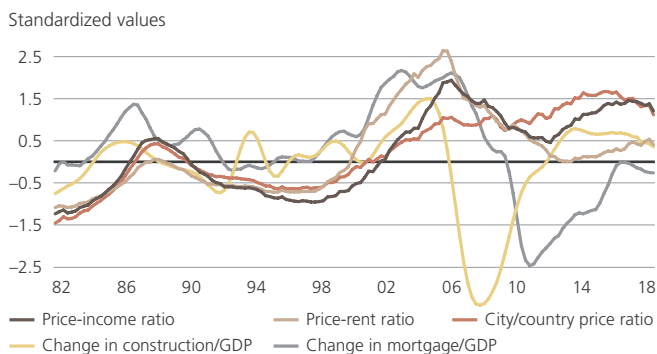
Slipping into the red

Annual house price growth rates



New York's score in the *UBS Real Estate Global Bubble Index* decreased marginally over the last four quarters, but the city remains slightly **overvalued***. Since 2012 inflation-adjusted prices are up by 25%, rents by 15% and incomes by less than 10%. But annual inflation-adjusted prices fell 2% over the last four quarters, the first decline in several years. Demand weakness in the region stems from multiple factors. First, rising mortgage rates have inflated usage costs. Second, net population migration is negative. Finally, passage of last December's Tax Cuts and Jobs Act of 2017 significantly limited the deductibility of state and local taxes for many homeowners and contributed to a higher tax burden.

Development of sub-indices



In Manhattan the market weakness was even more pronounced. Real prices fell 5% compared to the previous year and in the luxury segment even more. The city's housing market is already one of the world's most unaffordable – a skilled service worker needs 10 years' salary to buy a 60m² (650 sqft) flat – so higher financing costs and taxes take a larger toll than they do elsewhere. Moreover, inventories are up as a result of the much greater number of completed units last year, combined with the numerous new building permits issued.

* We changed the price index for New York City relative to last year. The S&P/Case-Shiller Condo Price Index, in our view, represents the housing market of New York City better than the FHFA index that models the change in single-family house prices.

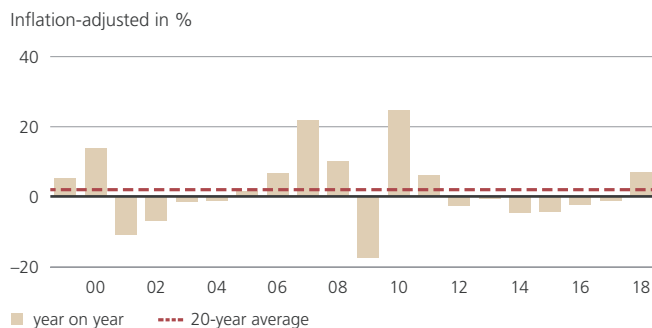
Should the US Federal Reserve continue its tightening policy, prices may fall further in the coming quarters. Luxury units could stay on the market for longer if foreign demand for them continues to wane. This would likely lead to added pressure on new and existing property prices alike.

Singapore



Regulator keeps the market on a leash

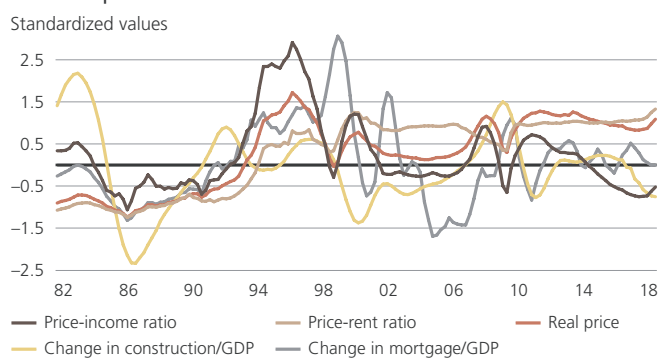
Annual house price growth rates



Inflation-adjusted prices staged a fulminant recovery in the last four quarters after six years of correction, rising by 9%. Nonetheless, the market remains **fairly valued**. Prices are 5% below their 2011 peak and the price-income ratio is still shy of its long-term average.

Vacancy rates declined until the middle of this year, but the long-term supply is well-stocked. Housing permits surged in anticipation of the transaction market recovering further after bottoming out in the second half of last year. The surprise regulatory policy tightening announced in July should dampen investor appetite. Additional buyer stamp duties (ABSD) have been targeted specifically at developers to limit land price speculation. Purchasers of investment properties have also been slapped with higher ABSD. So we expect speculative buying to decline and price growth to decelerate by the end of the year. Rising interest rates limit the upside as well. Overall, the consequent stalling of any price rebound by the government prevents the emergence of speculative tendencies in the real estate market.

Development of sub-indices



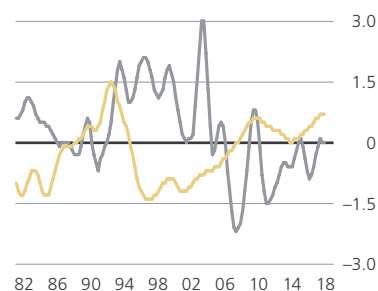
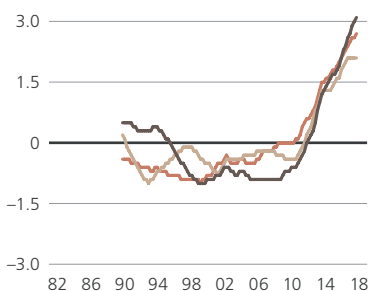
Private market housing remains barely affordable: the price-to-income ratio for a 60m² (650 sqft) flat is around 12 (public housing, however, represents 80% of the total market). But Singapore is one of this study's few cities whose affordability has improved over the past decade.

Select cities

Munich



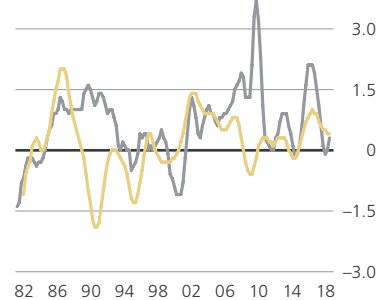
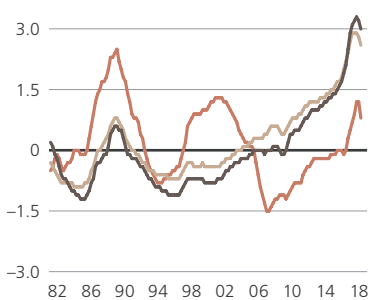
Real prices have doubled in the last 10 years and seem to be continuing on an explosive trajectory. Nominal rents jumped 9% last year, reflecting record low vacancies, so affordability goes on deteriorating. Purchasing a 60m² (650 sqft) flat requires of a skilled services employee an all-time high of eight accumulated years of income. Construction has already risen significantly in recent years. Should mortgage rates pick up, a correction seems likely.



Toronto



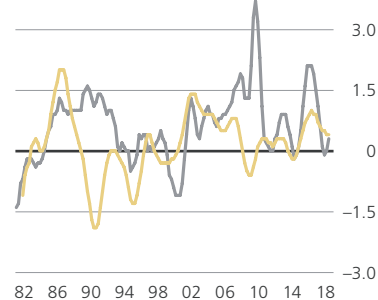
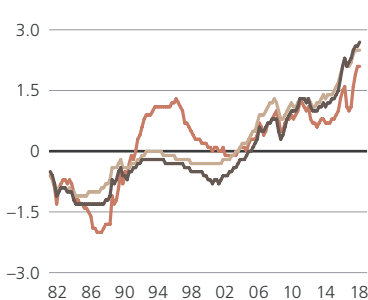
Since the waning of the housing frenzy in the middle of last year, prices have stabilized over the past four quarters. In inflation-adjusted terms, they are 50% higher than five years ago. Last year's "fair housing plan," which imposed taxes on foreign purchases and vacant apartments and implemented stricter rent controls, probably contributed to the cooling. Higher mortgage costs and tighter lending standards should limit the upside for the time being. But a short-term weakening of the Canadian dollar may again attract foreign buyers.



Vancouver



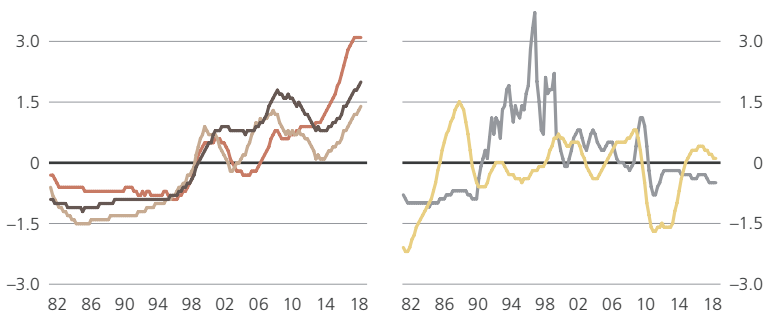
Imbalances increased again as house prices rose in the past four quarters at a double-digit rate in real terms. Real prices have doubled in 12 years. The imbalances are mitigated somewhat by income growth and above-average rental growth of 5–7% in nominal terms over the last four quarters. As the government tries to contain speculation, the tax burden is rising for high-end property buyers and foreign purchasers. The already strained affordability will become an acute issue if mortgage rates rise further, one that may halt the local market boom.



Amsterdam



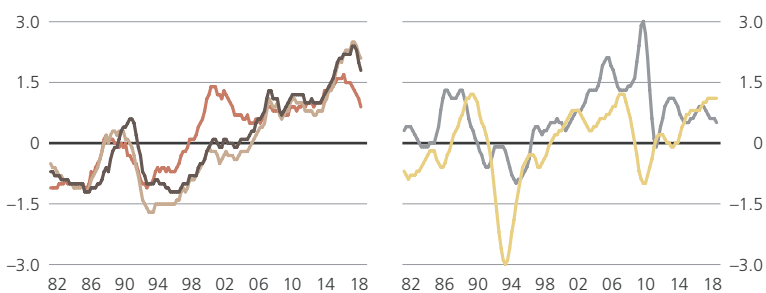
In the last four quarters prices climbed by 12% in inflation-adjusted terms. They are now 60% higher than in 2013. Their ongoing explosive growth was fueled by the strongest income increase since 2013 among all cities and attractive financing conditions. The city's housing price rise has more than doubled nationwide averages in the last five years. Given the highly strained affordability, a tightening of lending conditions might end the boom rather abruptly.



Stockholm



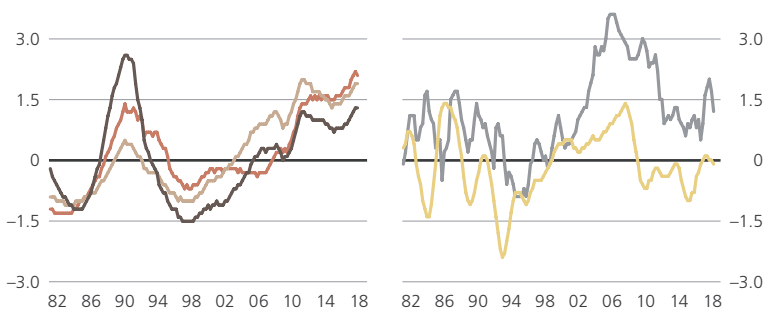
Inflation-adjusted prices climbed 60% between 2007 and 2017, which clearly outpaced income and rental growth. The boom stemmed from marked population growth in the city center area. But prices have been dropping since the middle of last year and are off 7% from their peak, despite continued attractive financing conditions. The correction seems to be the direct consequence of an exaggerated price surge in recent years that strained affordability and triggered stricter amortization requirements.



Paris



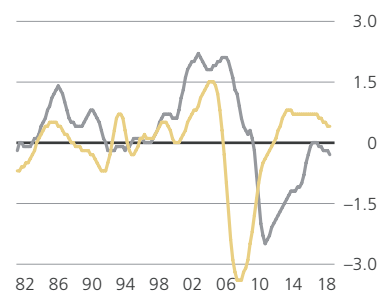
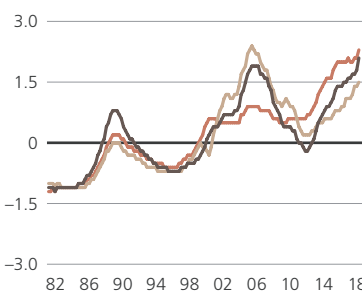
House price growth accelerated in recent quarters on the back of attractive financing conditions, improving economic sentiment and "Brexit-gain" fantasies. The market looks increasingly overvalued as incomes and rents stagnate in real terms while prices set all-time highs, leaving Paris with the worst housing affordability in continental Europe. Further significant price increases appear highly unlikely.



San Francisco



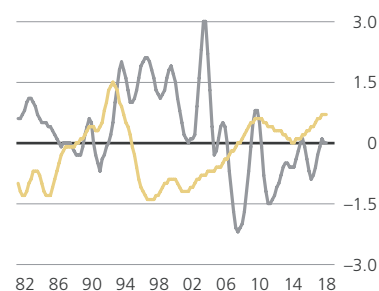
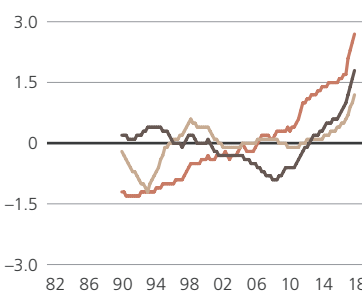
In the midst of a thriving local economy, significant non-cash earnings by many technology employees and buoyant foreign demand, real house prices have increased by 80% in the last six years. Price growth has accelerated again in recent quarters, up 12% in the past 12 months. Though city inhabitants enjoy the greatest income growth among residents of the US cities in the study – inflation-adjusted incomes rose by 20% in the last decade – affordability has worsened in both the ownership and rental markets.



Frankfurt



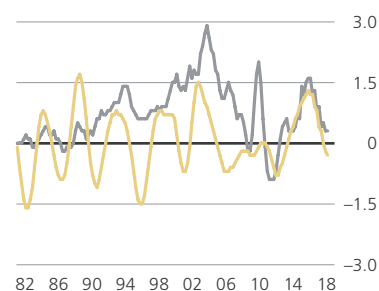
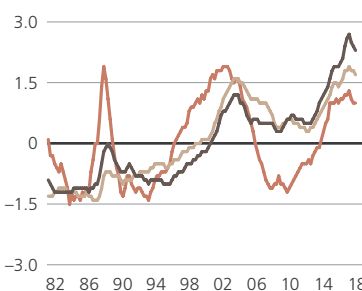
House prices have climbed almost 15% in the last year, far higher than the country average. The rate of price growth accelerated for the fourth year in a row and is clearly not sustainable. Last year Frankfurt exhibited the fastest house price appreciation of the cities in this study. Demand is supported by a dynamic economic environment and prices by a “Brexit gains” narrative. Affordability and price-to-rent multiples still leave scope for more appreciation, but the city is rapidly approaching bubble-risk territory.



Sydney



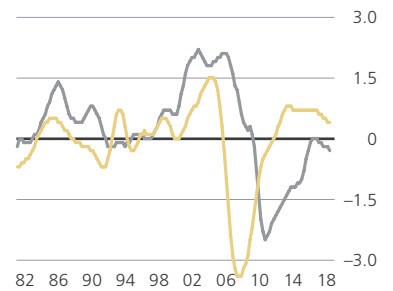
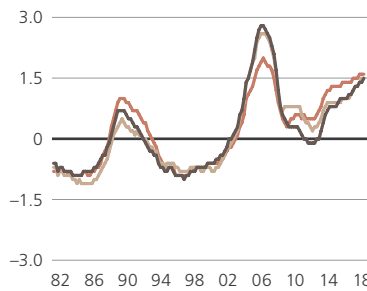
Prices peaked last summer and have slid moderately since as tighter lending conditions diminished overall affordability. To curb foreign demand, the land tax surcharge has also been more than doubled and a vacancy fee has recently been introduced. So the high end of the market has suffered most. The vacancy rate on the rental market has climbed amid higher supply. Overall, inflation-adjusted prices remain 50% higher than five years ago, while rents and incomes have grown only at a single-digit rate.



Los Angeles



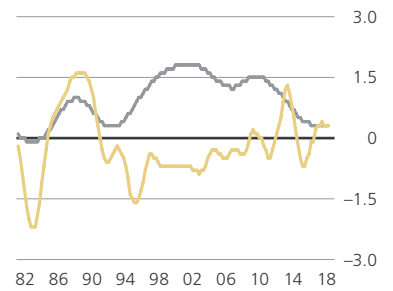
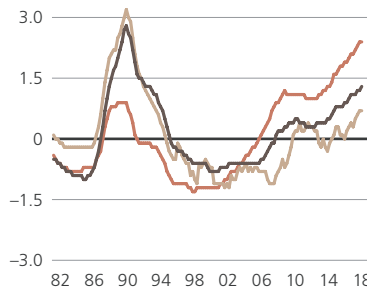
Inflation-adjusted house prices climbed 6% last year and are now 40% higher than in 2013. The prospering economy, particularly in technology, media, entertainment and manufacturing, is fueling demand. The lack of available for-sale supply in many submarkets has exacerbated the overheating. Although inflation-adjusted prices remain 14% below their 2006 peak, housing affordability is stretched and could lead to slower price growth in light of the rise in mortgage rates.



Tokyo



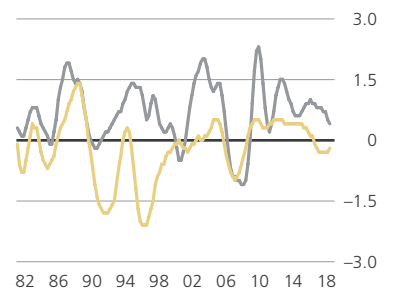
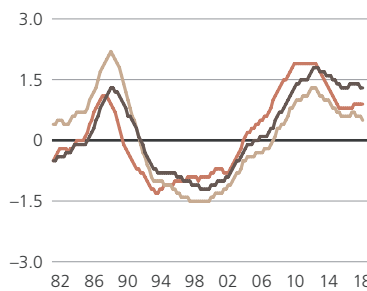
The city's housing market continues to decouple from the rest of the country's. Since 2015 prices in Tokyo are up 17%, while they are flat nationwide. The city's demographic outlook is relatively supportive as its population is expected to go on growing. Low interest rates are also sustaining the local boom, but housing is becoming increasingly unaffordable as income growth lags behind. Buying a 60m² house already requires 11 yearly salaries of a skilled service worker.



Geneva



Home prices in the Lake Geneva region remain lackluster. They have dropped slightly this year, returning to levels of three years ago. Strict lending rules are keeping them in check, as the city exhibits the lowest affordability in Switzerland. So the market has cooled further, in line with the broader Swiss housing market. Yet the city remains undersupplied because construction activity is low and population growth is moderate.



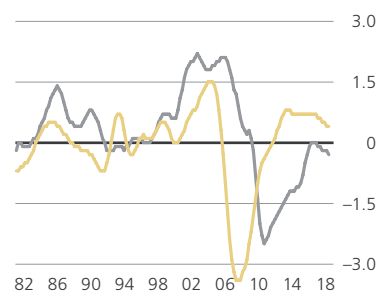
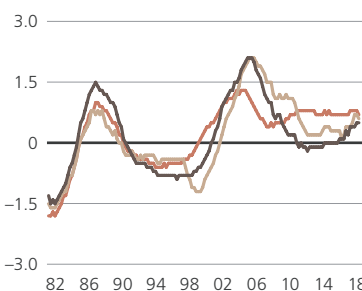
— Price-income ratio
 — Price-rent ratio
 — City/country price ratio

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

Boston



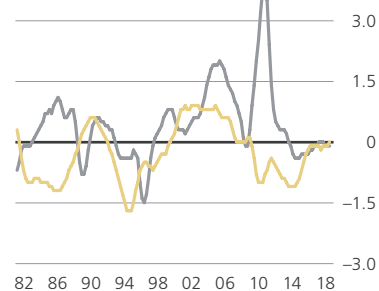
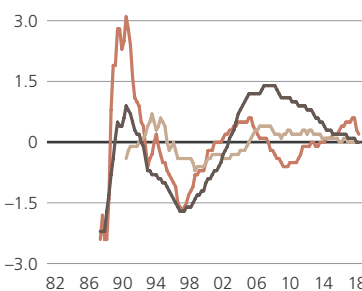
House prices have risen roughly in line with the national average despite the better growth of the regional economy and residents' incomes, and are now up 20% since 2015. The city recorded the highest rental growth (+15%) among the US cities in this study over the same time period. Overall, housing remains more affordable than in other financial centers. But slowing population growth and rising mortgage rates could limit price appreciation prospects.



Milan



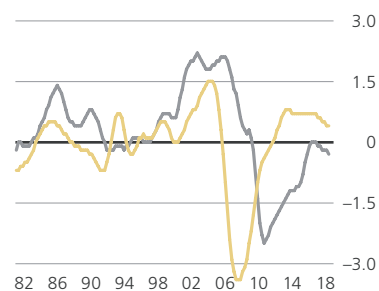
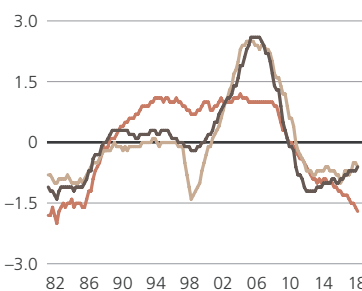
Prices have begun rising moderately in and around the central areas, with the time required to sell properties shortening markedly. Inflation-adjusted prices remain some 30% below their 2007 peak. Despite attractive financing conditions and the best housing affordability among European cities, the housing market recovery is in a very early stage. Unless the political situation in Italy turns more predictable and population growth accelerates, we do not expect demand to improve significantly.



Chicago



Inflation-adjusted prices have risen by 15% in real terms since the low point in 2013 but remain almost 30% below their 2006 peak. Inflation-adjusted rents declined last year and incomes stagnated. Declining population, sluggish employment, lackluster economic growth and a challenging fiscal outlook hinder a faster recovery of broad-based housing demand. We expect price growth to continue to lag the national average.



— 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 23.

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 60m² (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	2018Q2	CBS, Maastricht University	NVM, UBS P&E	UBS P&E, CBS	CBS, FED Dallas	DNB, CBS, EUKLEMS, Bloomberg
Boston	2018Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Chicago	2018Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Frankfurt	2017Q4	Bulwiengesa	Bulwiengesa, OECD	Destatis, UBS P&E, OECD	FED Dallas	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg
Geneva	2018Q2	Wüest Partner	Statistique Genève	FTA, FSO	Wüest Partner	SNB, SECO, BFS
Hong Kong	2018Q2	RVD	RVD	Census and Statistics Department Hong Kong, Bloomberg	RVD	Census and Statistics Department Hong Kong, HKMA, Macrobond, Bloomberg
London	2018Q2	Nationwide, Lloyds Banking Group	ONS, UBS P&E	ONS	Nationwide, Lloyds Banking Group	BoE, ONS, EUKLEMS, Macrobond, Bloomberg
Los Angeles	2018Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Milan	2018Q2	Nomisma	Nomisma, OECD	Dipartimento delle Finanze, UBS P&E	FED Dallas	Banca d'Italia, Hypostat, Istat, EUKLEMS, Macrobond, Bloomberg
Munich	2017Q4	Bulwiengesa	Bulwiengesa, OECD	Destatis, UBS P&E, OECD	FED Dallas	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg
New York	2018Q2	FHFA, S&P/Shiller, Elliman	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Paris	2018Q1	BIS, CGEDD	CGEDD, Clameur, UBS P&E	Insee, Bloomberg, UBS P&E	FED Dallas	BdF, Insee, EUKLEMS, Macrobond, Bloomberg
San Francisco	2018Q2	FHFA	CBRE, FED St. Louis	BEA	FHFA	FED, BEA, Bloomberg
Singapore	2018Q2	Government of Singapore	Government of Singapore, UBS P&E	Government of Singapore	Government of Singapore	Government of Singapore, Bloomberg
Stockholm	2018Q2	Statistics Sweden	Statistics Sweden, UBS P&E	Statistics Sweden, UBS P&E	Statistics Sweden	Statistics Sweden, Bloomberg
Sydney	2018Q1	REIA, ABS	REIA, NSW Government, UBS P&E	ABS, UBS P&E	FED Dallas	ABS, RBA, Macrobond, Bloomberg
Tokyo	2018Q1	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	2018Q2	Sauder School of Business UBC, Bloomberg	Canadian Housing Observer, Sauder School of Business UBC	Statistics Canada	FED Dallas	Statistics Canada, BoC, Bloomberg
Vancouver	2018Q2	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	2018Q2	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	Bulwingsa, globalpropertyguide.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	Bulwingsa, globalpropertyguide.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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