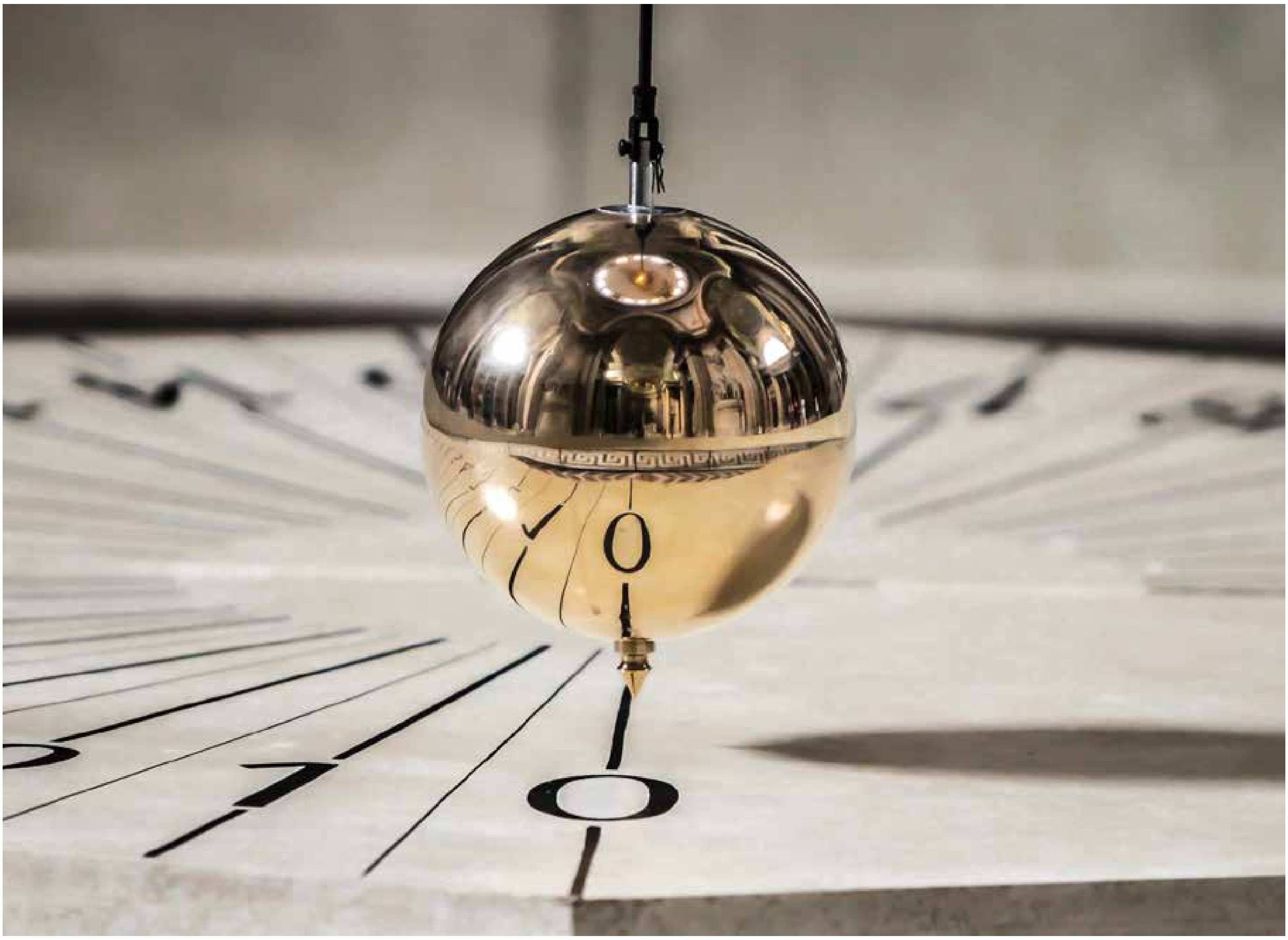
September 2019
Chief Investment Office GWM
Investment Research

UBS Global Real Estate Bubble Index

2019



Content

UBS Global Real Estate Bubble Index
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A Foucault pendulum is installed at Pantheon de Paris. It clearly demonstrates the rotation of the earth.
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Editorial

Dear reader,

In the past, owning residential property in global cities has been a sure road to wealth accumulation. Property values have risen much more than inflation in most advanced economies post-1950 despite periods of long and persistent downswings. In major cities the long-term appreciation has been even greater as prices have risen faster than countryside properties over the past few decades.

But real price appreciation can no longer be taken for granted. The underlying factors favoring city properties, including urbanization, the digital revolution and artificial supply constraints, still hold good. But prices have by far outpaced incomes in recent years. Low affordability already poses one of the biggest risks to property values in urban centers. If employees cannot afford an apartment with reasonable access to the local job market, the attractiveness and growth prospects of the city in question drop. Regulatory interventions to curb further appreciation have often followed.

Such regulatory measures have already triggered market corrections in the most overheated cities. Real prices in all four top-ranking cities in the 2016 *UBS Global Real Estate Bubble Index* have fallen. On average they are down by 10% from their respective peaks. This year's edition reveals where stretched affordability makes further market corrections likely, but also where record low interest rates may drive future capital gains.

This report considers a broader range of urban centers, adding Madrid, Moscow, Dubai and Tel Aviv to the selection. These cities have come to investors' attention in recent years, although each for different reasons.

We wish you an engaging read.

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Key results

Low rates fuel Eurozone bubble

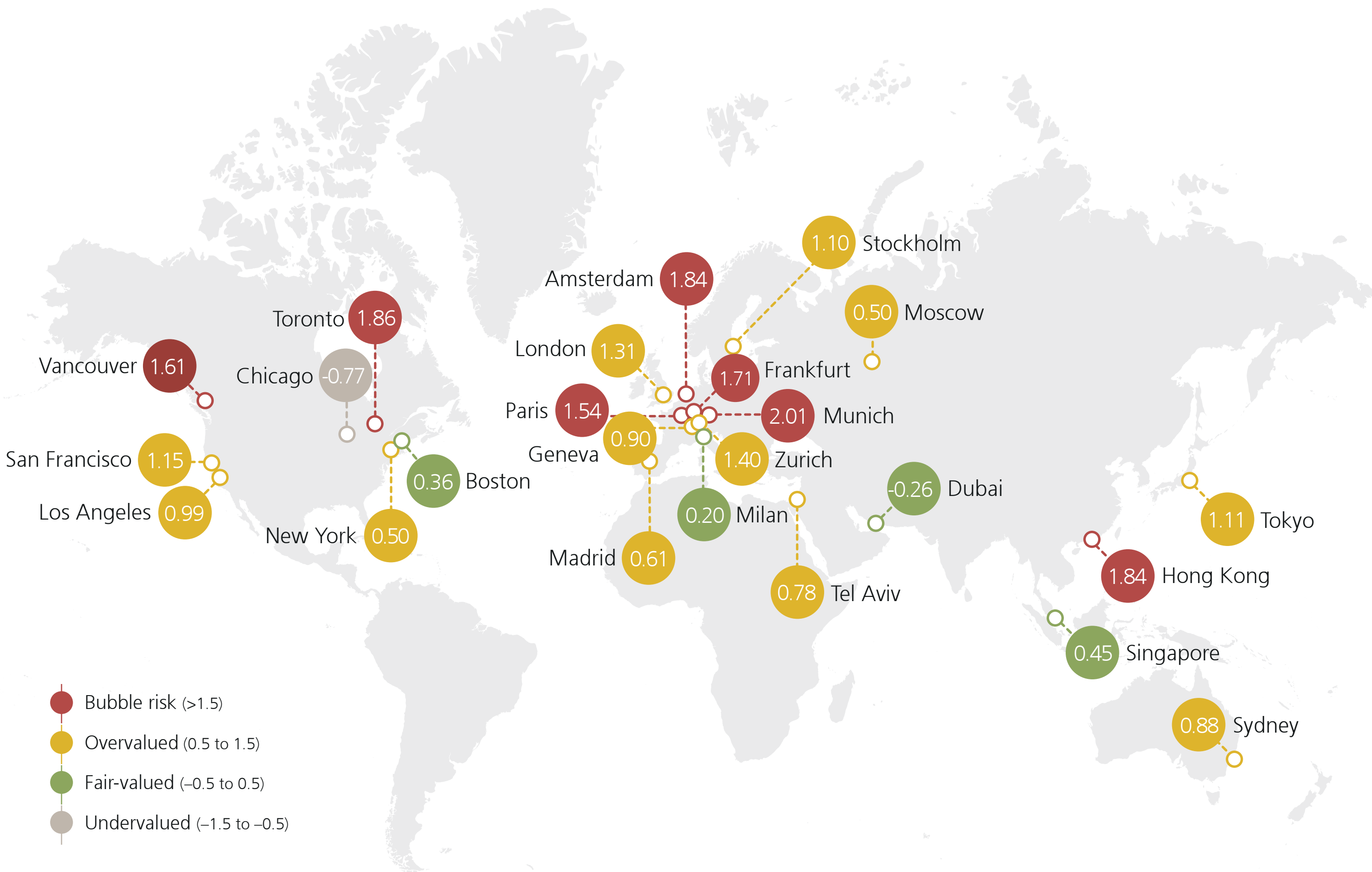
Index scores have increased in all cities within the Eurozone, driven by low interest rates. Paris and Frankfurt are now in bubble-risk territory.

Lower risk scores overall

The average index scores have declined slightly. Frankfurt and Moscow recorded the steepest increase last year. Valuations declined the most in Sydney and Tel Aviv.

End of the boom

Price growth rates have continued to slow in a majority of cities. Average price growth has come to a standstill for the first time since 2012.



Affordability remains a key risk

The median price-to-income ratio has increased from 5 to 7 years in the cities over the last decade. Affordability has worsened the most in Hong Kong and London over this period and improved the most in Singapore.

No lending boom

Currently, lending growth is on par with GDP growth. This is in contrast to the run-up to the Great Financial Crisis, when outstanding mortgage volumes increased up to 2.5% faster than GDP.

Long-term economic strength matters

While real prices have risen by more than 150% in Paris, Vancouver, Hong Kong and Stockholm since 2000, in Milan and Chicago they have increased by less than 20%. This reflects differences in how these cities' economies have fared.

Bubble risks shift towards the Eurozone

The greatest risk of a real estate bubble currently exists in Munich, followed by Toronto, Hong Kong and Amsterdam. Frankfurt and Paris are new additions to the bubble risk zone. In London, by contrast, the bubble risk has fallen after further price corrections, as a result of which the city is now only in the overvalued category. Valuations in Vancouver, San Francisco, Stockholm and Sydney have fallen sharply. New York and Los Angeles are lower as well, while Singapore is almost unchanged.

Lowest price increases since 2012

On average, in the cities analyzed, inflation-adjusted price increases have practically come to a standstill in the last four quarters. Residential property only appreciated markedly in Moscow, Boston and the cities in the Eurozone. Frankfurt was the only city to see double-digit price increases, which were common globally in previous years. By contrast, there were corrections of over 5 percent over the previous year in Sydney, Vancouver and Dubai. New regulatory measures and lower economic growth globally have hit prices in the owner-occupied housing markets. The more overheated a market, the easier it is to trigger a correction.

Correction phase emerging

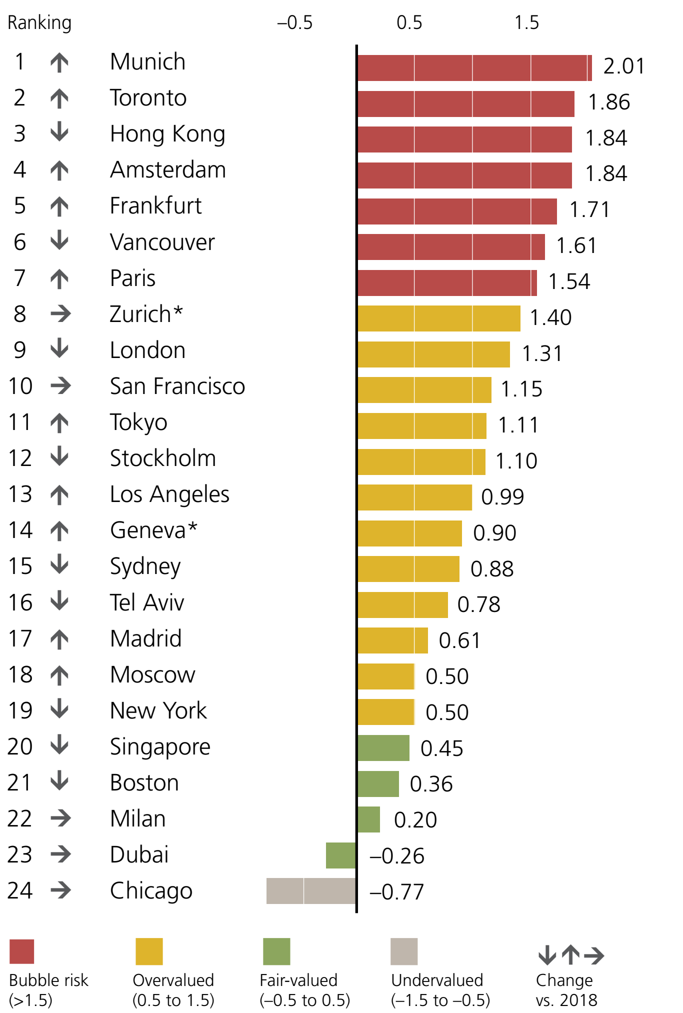
Despite the worldwide collapse in interest rates, the negative trend in home prices will probably continue. Mortgage interest rates in many cities had already ceased to be the bottleneck in recent years when it came to buying a home. Rather, many households lacked the funds required to buy a home or meet banks' financing criteria. Amortization payments also tend to place a greater burden on household budgets than mortgage interest. Furthermore, economic uncertainty in a recessionary environment more than outweighs the positive contribution of falling interest rates on demand growth.

Rewards for investors with staying power

Anyone who acquired residential property in the last 40 years, even at the height of a local price bubble, has nevertheless enjoyed long-term capital gains in most centers. We see three key reasons for this. First, the technology-driven economic boom in many major centers led to an explosion in residential demand. Second, growth in the number of wealthy households has generated ongoing excess demand for the best locations. Third, real estate values benefited from a decline in real interest rates from the mid-1990s. Where the demand boom has

UBS Global Real Estate Bubble Index

Index scores for the housing markets of select cities, 2019



Source: UBS * Index altered due to data source revision.
For explanation see the section on Methodology & data on page 24.

Identifying a bubble

Price bubbles are a 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.

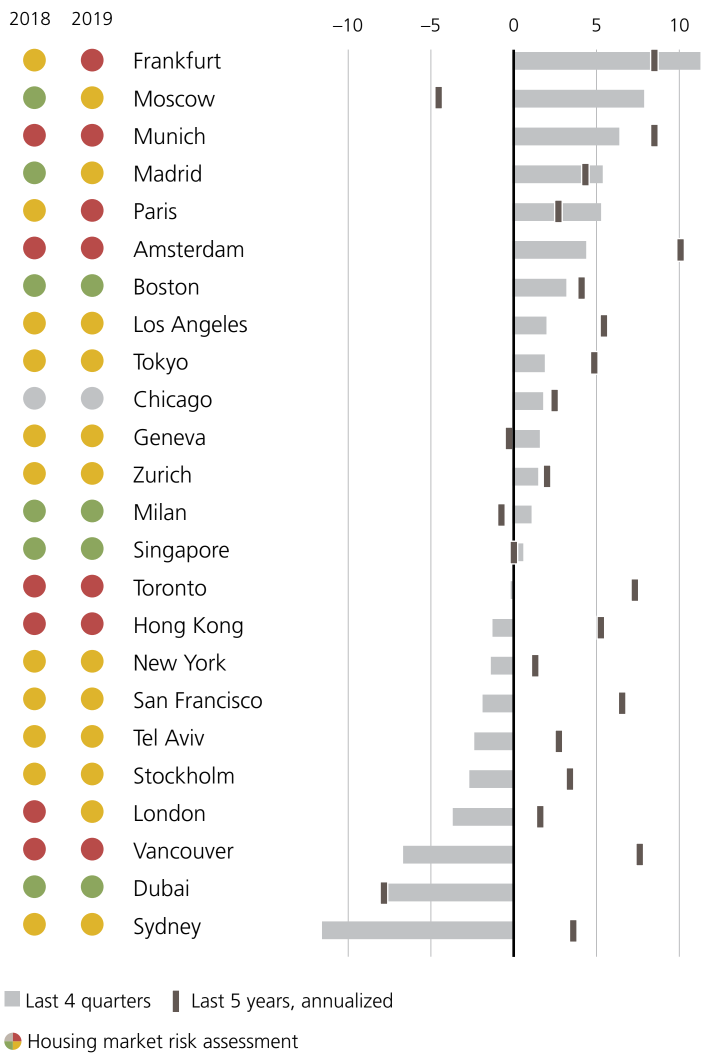
not triggered a local construction boom – due to building restrictions for example – ground prices and rents have skyrocketed.

However, where these preconditions have been absent, home prices in the best case have stagnated over the price cycle. For example, in Chicago or Milan real prices are at the same level they were about 20 years ago due to weak economic development. And the continuing expansion in supply has left prices in Dubai currently at a level scarcely higher than 2000 despite the greatest population growth by far of all of the cities in the study.

City homes are no guarantee of capital gains
The general trend toward urbanization as well as rising demand for top locations is no guarantee of capital gains. The decoupling of home prices from local incomes clouds the picture. In the long term, the absence of economic viability leads to a deterioration in many cities' attractiveness and favors a shift in jobs to the suburbs. Hence, the potential for political intervention in the housing market increases and so does the risk of negative consequences for investors. Consequently, those who buy a city apartment at the currently high valuations are likely to have to adjust to a lengthy lean period in our view. While historical evidence suggests that, over the long term, property in global cities can be expected at a minimum to preserve capital in inflation-adjusted terms, economic growth in the region is crucial for the flourishing of the local housing market.

Price growth has slowed in majority of cities

Inflation-adjusted price growth rates, in %



Source: see page 25

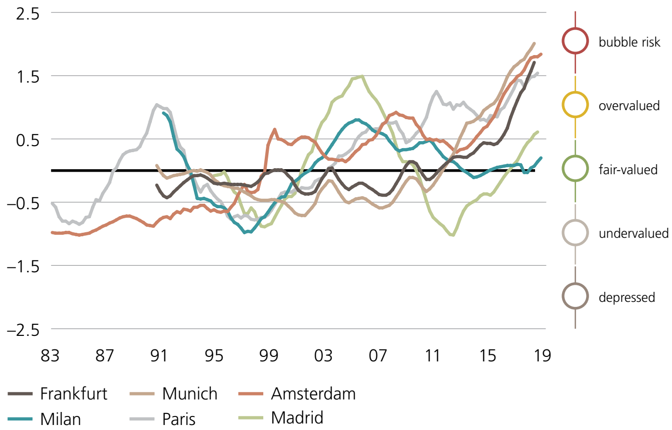
Regional cycles

Eurozone

With the exception of Milan, Eurozone cities exhibited the strongest price growth of all cities in this study over the last four quarters, driven by strong economic growth in the past year and low interest rates. Consequently, the index scores of these Eurozone cities have all increased further. Valuations in Munich, Amsterdam, Frankfurt and Paris are now in bubble-risk territory and have reached all-time highs. The housing market is recovering in Madrid and Milan, but still appears to be at an earlier stage of the cycle. Overall, the effect of lower mortgage rates will be diluted by stretched affordability in most cities. The expected economic slowdown – in particular in Germany – will test current price levels.

Eurozone

UBS Global Real Estate Bubble Index



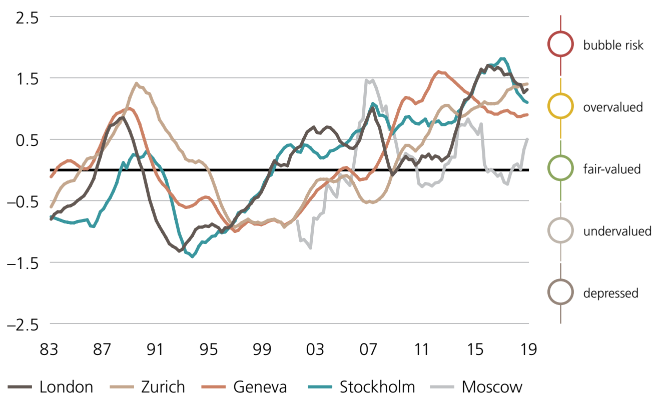
Rest of Europe

In contrast to their Eurozone counterparts, London and Stockholm's index scores have declined over the last year. While affordability issues, political uncertainty and less favorable tax treatment are putting pressure on house prices in London, Stockholm's property prices have suffered from stricter rules on mortgage amortization. In Zurich, record low mortgage rates and a booming economy have driven up valuations. Both on price and index score Zurich has now surpassed Geneva. However, we expect strict lending rules and rising rental market vacancy rates in the periphery to limit the price prospects in Switzerland overall.

Moscow house prices came under strong pressure after reaching bubble-risk territory in 2007. Then, just as prices had started to recover in 2013, falling oil prices and sharp ruble deprecation affected the market negatively once more. By the end of 2017, the real price level was 40% lower than 10 years earlier. But after a strong recovery from this low point, the market is now back in overvalued territory.

Rest of Europe

UBS Global Real Estate Bubble Index



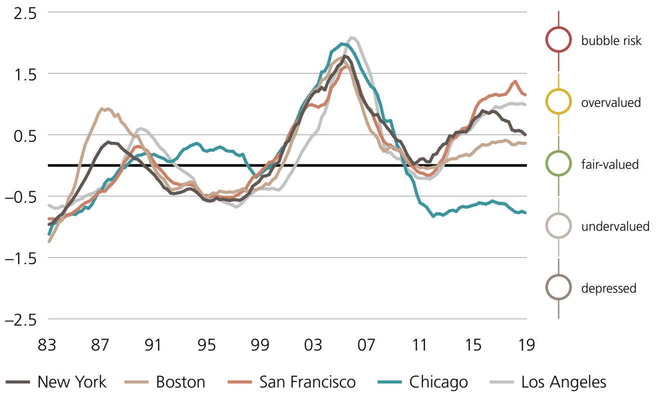
United States

Index scores have not risen in any of the US cities in our study for the first time since 2011. The variation in valuations among cities reflects their relative economic strength over the last couple of years. For example, strong employment and income growth over the last decade have underpinned price increases in California.

Affordability issues, trade tensions and diminishing foreign demand have capped price growth in San Francisco and Los Angeles for now. Boston's housing market benefited from its good affordability and economic appeal for businesses and high income earners. The local housing market is still in fair-valued territory. Weakening support from the financial industry and an unfavorable tax treatment have led valuations to decline in New York. Chicago continues to lag far behind given its increasing fiscal challenges.

United States

UBS Global Real Estate Bubble Index

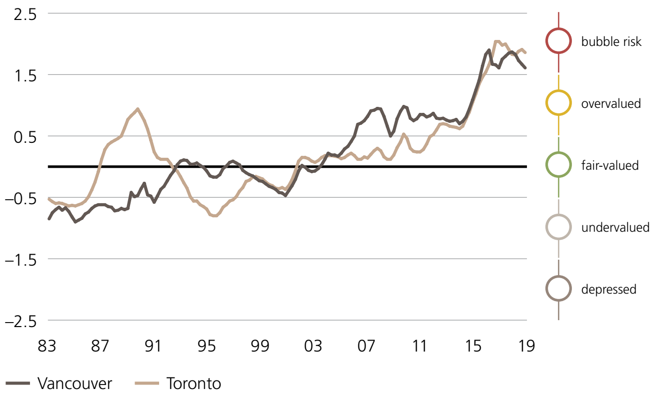


Canada

Between 2000 and 2018 real home prices in the Canadian cities in our study rose almost unabated by more than 5% per year. But the housing frenzy seems to be over for now. Over the last four quarters price growth has stalled and a correction set in. The introduction of taxes on foreign buyers, vacancy fees and stricter rent controls seem to have taken effect. While the average price level in Toronto has remained broadly unchanged from last year, prices in Vancouver are down by 7%. Overall, property valuations in Canadian cities are still highly elevated, with Toronto surpassing Vancouver in terms of bubble risks. Lower mortgage rates are supportive, but cannot outweigh lower economic growth. Further housing market weakening is likely.

Canada

UBS Global Real Estate Bubble Index



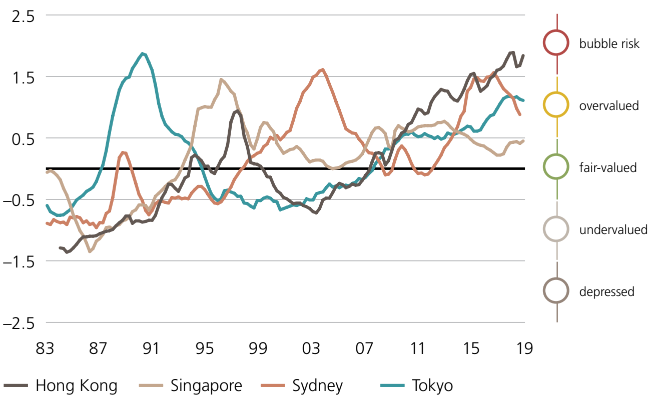
APAC

The bubble index scores have not increased in APAC cities over the last four quarters. In Hong Kong, momentum has abated and prices have fallen slightly since mid-2018. Nevertheless, although the city is still in bubble-risk territory, given that prices have doubled over the last 10 years, there is no fundamental trend reversal in sight. Still, higher price volatility is likely over the next few quarters. Singapore's housing market in contrast has been remarkably stable over the last few years. Regulatory tightening has proved effective and curbed excessive price growth. Real prices are basically on the same level as in 2012, such that the city remains in fair-valued territory.

In Sydney, a city that was in bubble-risk territory only two years ago, prices are plunging. They corrected by a double-digit number within a year, lowering the index score significantly. Lower foreign buying activity and tighter mortgage lending continued to mute overall demand. In contrast, prices in Tokyo have climbed by 5% annually since 2014, decoupling from the rest of the country. As a consequence, the market has joined the group of highly unaffordable cities and valuation has increased.

APAC

UBS Global Real Estate Bubble Index



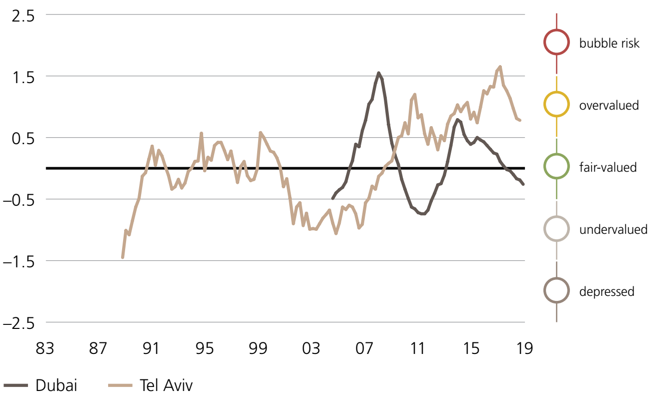
Middle East

Dubai's property market is highly correlated to the oil price. The market previously peaked in 2008 and 2014. Since the last peak, prices have fallen by almost 35% and the index value has declined sharply. Overall, ongoing strong housing supply growth limits any long-term capital gains, offsetting the positive price effects of high population growth.

Over the last 30 years, Tel Aviv has seen some of the highest price growth among the cities we cover in this report. Prices rose nearly constantly between 2003 and 2017. Consequently, the market entered bubble-risk territory. Stretched affordability and rising mortgage rates have now ended the party. Valuations have thus normalized somewhat as real prices have declined by a double-digit percentage.

Middle East

UBS Global Real Estate Bubble Index



Global cities' benchmarks

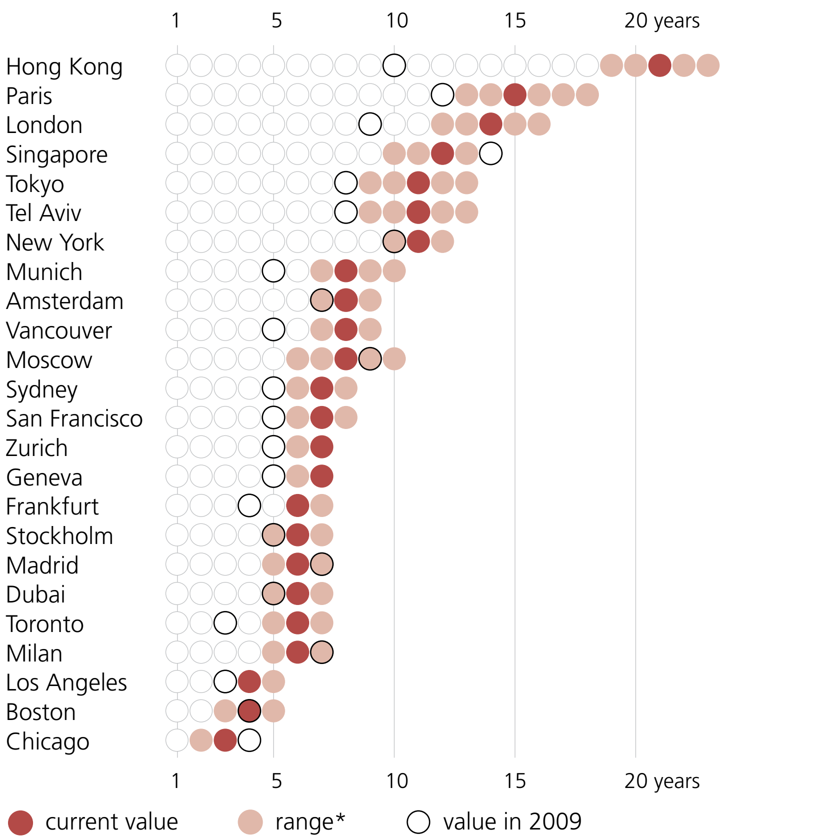
Price-to-income

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 Paris, London, Singapore, Tokyo, Tel Aviv and New York, 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 increases and long-term appreciation prospects shrink.

In contrast, housing is affordable in Chicago, Boston, Los Angeles and Milan, which limits the risk of a price correction in these cities. Given relatively high incomes, purchasing an apartment is also relatively feasible for residents of Frankfurt, Zurich, Geneva or San Francisco.

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, elevated purchase prices can be sustained easily, without the need for full mortgage amortization and low interest rates, for example 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 24. * Uncertainty range due to differing data quality

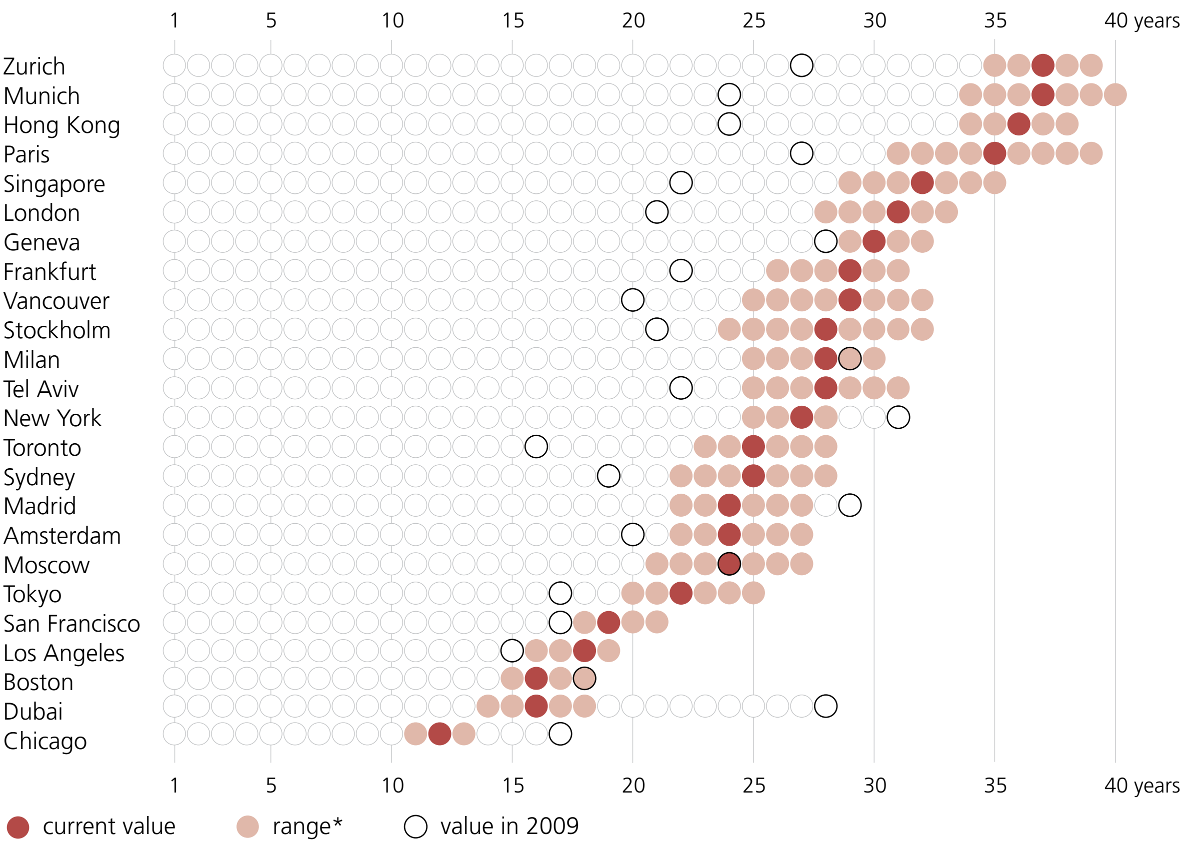
Price-to-rent

Zurich, Munich and Hong Kong have the highest price-to-rent ratios, followed by Paris and Singapore. Extremely high multiples indicate an undue dependence of housing prices on low interest rates. Overall, almost half of the covered cities have price-to-rent multiples above or close to 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 mainly in the US cities in our study – San Francisco, Los Angeles, Boston and Chicago. Their low multiples reflect, among other things, higher interest rates and relatively mild regulations of the 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 also expectations of rising prices, for example in Hong Kong and Munich. Investors anticipate being compensated with capital gains for very low rental yields. If these 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



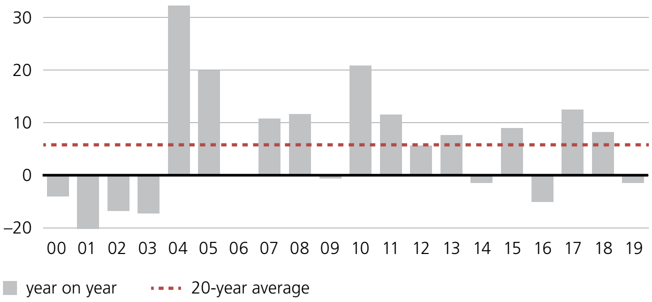
Source: UBS. Remark: For explanation see the section on Methodology & data on page 24. * Uncertainty range due to differing data quality

Hong Kong

Weaker momentum

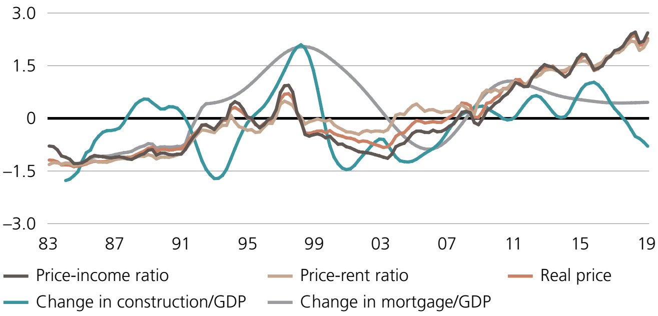
Annual house price growth rates

Inflation-adjusted in %



Development of sub-indices

Standardized values



Fueled by strong investor demand, general positive sentiment and the fear of missing out on capital gains, the real price level in Hong Kong more than doubled between 2008 and 2018. Recently, however, momentum in this red-hot property market has stalled. Although growth rates recovered in the first half of the year, real prices are 2% below last year's all-time high value. Household incomes and rents have declined slightly in the past four quarters. Overall, the *UBS Global Real Estate Bubble Index* score has crept down, but the market remains firmly in **bubble-risk** territory.

The weaker economic outlook has cooled residential buyer sentiment. Primary residential transactions dropped by about 40% over the summer months. We expect home prices to fall over the next few quarters, erasing part of the year's gain in residential prices.

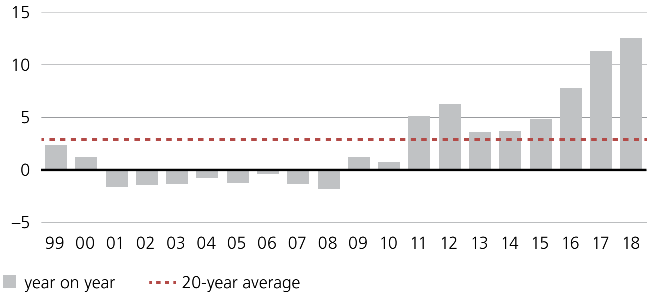
A deep market correction or crash seems unlikely, though prices may be volatile if political and trade tensions persist. A greater government focus on public housing will likely limit the number of new private flats coming to market in the years ahead. It should also, along with strong underlying housing demand, cap downside risk for the time being. But Hong Kong's housing market remains the least affordable of the cities that we analyze. Even skilled service-sector workers cannot afford to purchase a medium-sized flat.

Frankfurt

Through the roof

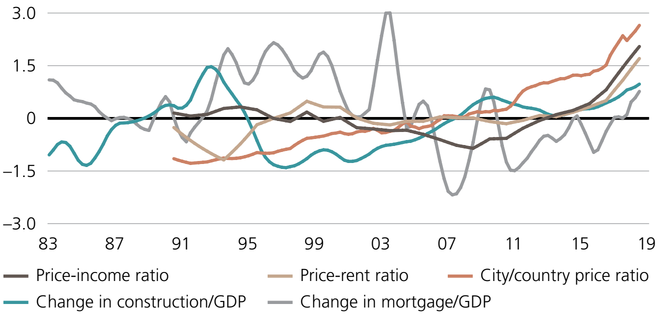
Annual house price growth rates

Inflation-adjusted in %



Development of sub-indices

Standardized values



Frankfurt's housing market over the last 10 years has been characterized by accelerating price growth which has outpaced the country average annually. Cumulative real price growth in that time has been 80%. Last year real prices soared 11%, the highest rate among the cities covered in this report. New construction prices are up 15%. This rise, along with the recent uptick in mortgages granted in Germany, has pushed the city into **bubble-risk** territory, according to the *UBS Global Real Estate Bubble Index*.

Frankfurt has cemented its position as one of Europe's leading financial centers with solid employment growth. It has added almost 17% to its population in the last 10 years. Construction permits have picked up in response and building activity reached a record high in 2017. The transformation of office buildings into apartments has added further living space. New supply, however, has been outstripped by population growth, pushing housing prices and rents up.

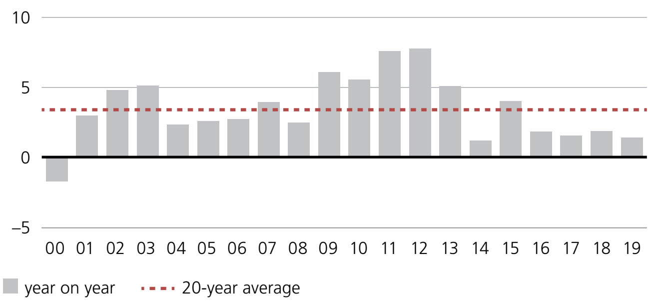
Despite last year's solid economy and record-low unemployment numbers, local income growth could not keep pace with residential price growth, rendering housing in the city increasingly unaffordable. Rent is eating up more and more household income. The current weaker economic outlook for Germany may have repercussions for the local market, especially through diminishing demand. The large current building backlog will ultimately relieve the market in the medium term.

Zurich

Pivotal negative rates

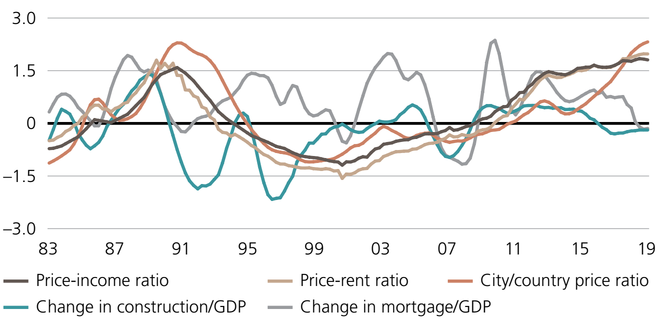
Annual house price growth rates

Inflation-adjusted in %



Development of sub-indices

Standardized values



* We have changed the price index we use for Zurich, which is now based on asking and transaction prices.

Residential market valuations in Zurich have inched up over the past year. The market remains highly **overvalued***, according to the *UBS Global Real Estate Bubble Index*, with apartment prices up by 2% over the last four quarters as prices nationwide have stagnated. The greatest price increases occurred in the median segment. Rising top incomes and optimistic long-term price expectations have also led to a recovery of demand for high-end properties.

Ultra-low and still-falling financing costs have underpinned demand, as has robust economic growth in the Zurich area and in Switzerland as a whole. The yields on buy-to-let investments have fallen to record lows. Buying a medium segment property in Zurich only pays off after 37 years – the lowest rental yield of any of the cities in this report. Negative interest rates are key to maintaining the willingness of buyers to pay for property at current levels. Slowly rising vacancy rates for rental apartments in the agglomeration will continue to pressure local rents.

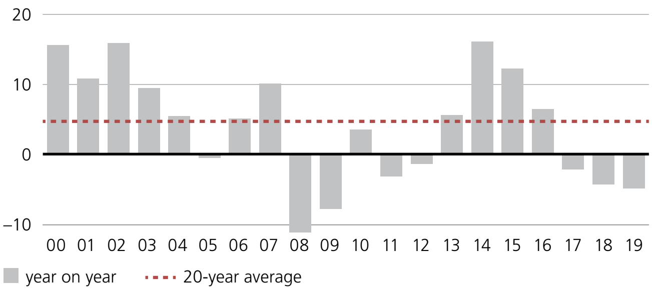
The city's housing market has been characterized by relatively fast expansion, which has partially mitigated the price pressures from buoyant demand growth. Lately, the number of building permits for new structures has been declining. Construction activity has shifted to replacing and renewing the housing stock. Overall, existing mortgage market regulations and an expected slowdown of the local economy should keep price growth in check for the next few quarters.

London

Trapped in uncertainty

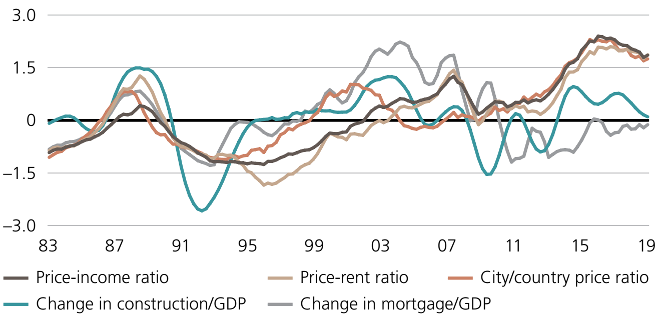
Annual house price growth rates

Inflation-adjusted in %



Development of sub-indices

Standardized values



The London housing market boom is over. The years when prices soared by 50% (2012-16) are long gone. Inflation-adjusted prices have been trending downward for a while. They are off 10% since their mid-2016 peak, almost 4% alone in the last four quarters, with no turnaround in sight. According to the *UBS Global Real Estate Bubble Index*, the city's housing market has left bubble-risk territory but remains **overvalued.**

The broad housing market weakness can be attributed to growing affordability issues – income growth has failed to keep up with price increases – accentuated by an uncertain economic outlook. Despite the recent price decline, even a highly skilled employee needs to work 14 years to buy a 60m^2 (650 sqft) flat near the city center. According to Nationwide, first-time buyers in London spend more than half of their income on mortgage payments despite attractive financing conditions.

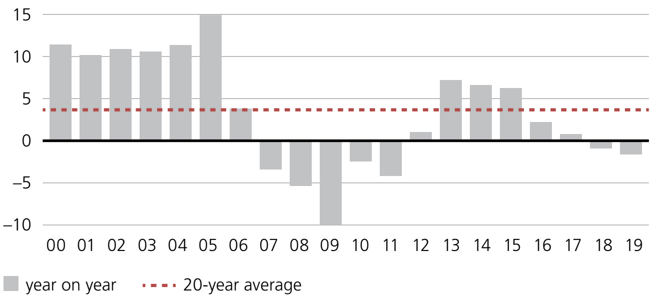
The prices of prime properties have come under even more pressure than the overall market. Increased stamp duties and a less favorable tax environment have taken their toll on the sentiment of wealthy investors. Political uncertainty about Brexit has made investors cautious. But we consider further downside limited unless the UK plunges into a severe recession. The ongoing depreciation of the pound, along with lower house prices, may make London's prime property appear an attractive buying opportunity for foreign investors.

New York

Political interference

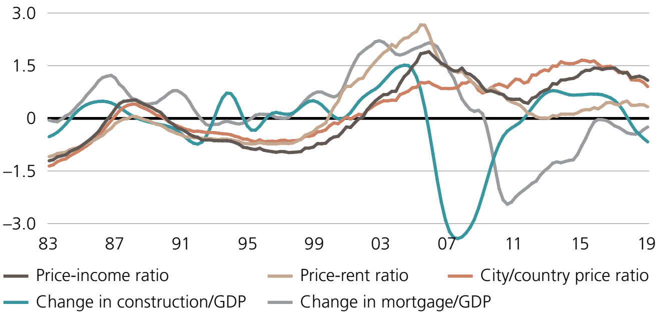
Annual house price growth rates

Inflation-adjusted in %



Development of sub-indices

Standardized values



Regulatory changes and affordability issues have caused home prices in the region to lag the countrywide average. In inflation-adjusted terms, prices in New York have fallen slightly since the middle of last year, but the housing market remains in the **overvalued** category, according to the *UBS Global Real Estate Bubble Index.*

Overall, the real price level is now 10% lower than in 2006, when the market peaked. Since then rents have increased by almost 60% in inflation-adjusted terms, with income growth also surpassing inflation. But despite the improved affordability, a price rebound seems unlikely in the short term as the financial center in Manhattan lacks economic stimulus.

Housing completions reached a 50-year high in 2018, and the number of permits issued remains elevated as well. The limited deductibility of state and local real estate taxes has also increased the tax burden on New Yorkers. The weaker economic momentum may offset the positive impact that Federal Reserve easing is having on financing costs.

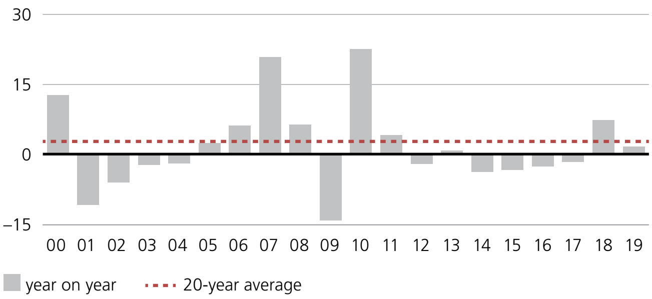
Housing in Manhattan remains unaffordable. Even a highly skilled worker needs to toil for more than 10 years – the most for inhabitants of any North American city – to afford a 60m^2 (650 sqft) apartment near the city center. The recent introduction of a progressive "Mansion Tax" and several new, tighter rent regulation bills currently being discussed are evidence of a political backlash that pose longer-term risks to investors.

Singapore

Stable again

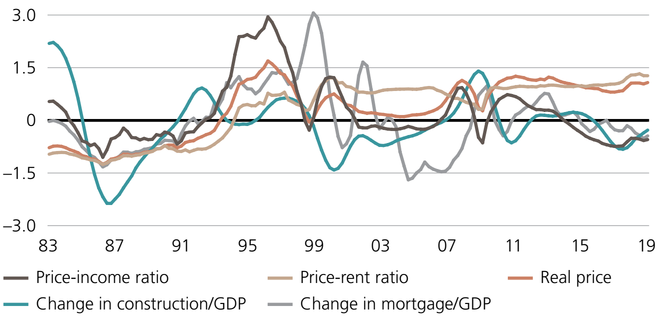
Annual house price growth rates

Inflation-adjusted in %



Development of sub-indices

Standardized values



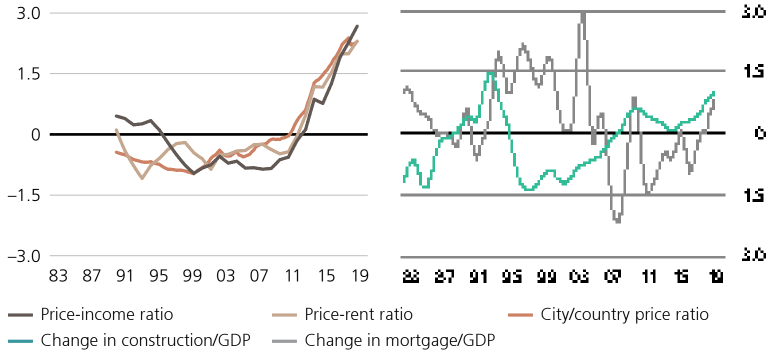
The brief housing boom between mid-2017 and mid-2018 is over. Prices have stagnated since and the number of transactions fallen. The *UBS Global Real Estate Bubble Index* score for Singapore remains in the **fair-valued** zone. The market slowdown is attributable to several factors.

The government is keeping the market on a leash. The additional buyer stamp duties (ABSD) for developers and purchasers of investment properties introduced last year have put a lid on the price upside and curbed speculative demand. Population growth has also declined notably in the past two years. Finally, economic momentum is expected to deteriorate, limiting the willingness to pay. Overall, we expect prices to remain at current levels over the coming few quarters.

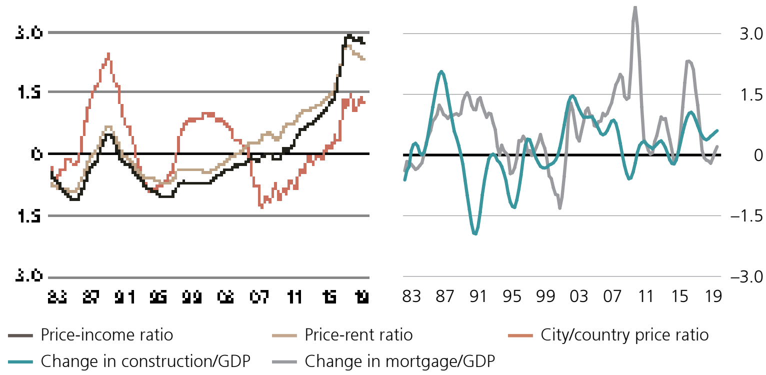
However, while regulatory measures still cap price growth expectations, the risk of a price correction is limited by sound market fundamentals, including a declining vacancy rate, good affordability, and a healthy employment market. The Singapore housing market is one the few among those we cover in which private housing affordability has improved in the last 10 years. Current prices are similar to those in 2008 while household incomes have climbed by 20%. Nonetheless, affordability is still stretched. It takes 12 annual incomes to buy a 60m^2 (650 sqft) apartment on the private market.

Select cities

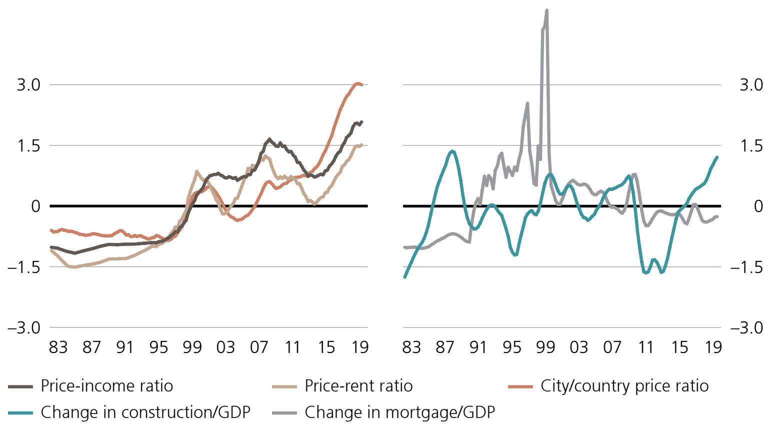
Munich
Housing market valuations have soared thanks to the strong and well-diversified local economy, solid population growth and insufficient new supply. Real prices have more than doubled over the last 10 years, while real rents have risen by 40%. Although real incomes have grown robustly, by roughly 15%, affordability has become increasingly strained: for instance, a skilled service sector employee needs to work for eight years to buy a 60m² (650 sqft) flat near the city center. As Germany's economic growth stalls, we expect an end to the housing market boom despite record low mortgage rates.



Toronto
Real housing prices in the city almost tripled between 2000 and 2017. As in Vancouver, local authorities introduced a foreign-buyers' tax, rent controls and tighter mortgage standards to tackle worsening affordability. Eventually, the housing frenzy abated and inflation-adjusted prices have stagnated over the last four quarters. However, a major price correction seems unlikely in the short term given improving mortgage conditions, a weakening Canadian dollar and falling supply.

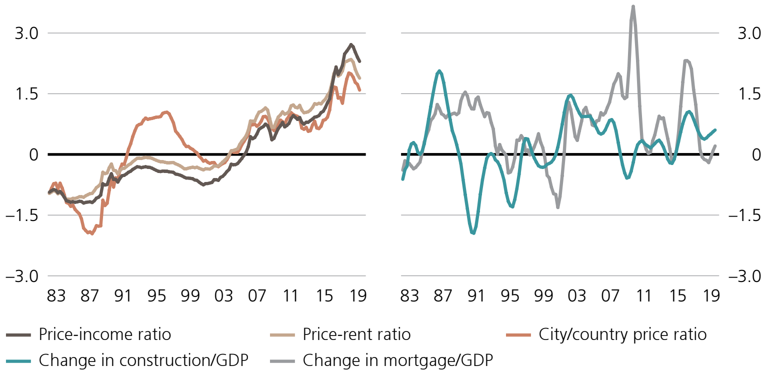


Amsterdam
Amsterdam has recorded the strongest price increase of all cities in the study since 2015. On average, real prices have increased by close to 10% a year, outpacing income growth by far. This spectacular rally in the housing market can be attributed to the very strong regional economy and rapidly loosening financing conditions amid a wave of speculative buying. As housing in the city has become increasingly unaffordable, people are voting with their feet. Over the last four quarters, price growth has slowed to 5% and fallen below the national average for the first time since 2008. Should there be an economic recession, a correction seems very likely.



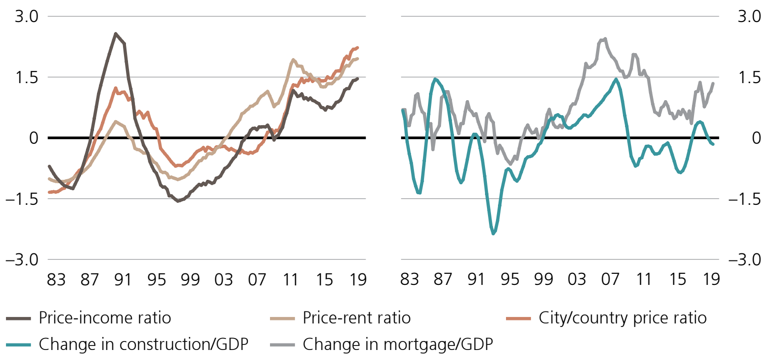
Vancouver

In just a couple of quarters, year-on-year price growth rates have reversed from over 10% to –7%. Sky-high valuations and overstretched affordability make the market vulnerable to even minor demand shifts. The trend reversal was triggered by the introduction of vacancy fees and a foreign-buyers' tax in 2016. Due to increasing regional housing supply, a turnaround is unlikely for now, especially as real prices are still 75% higher than a decade ago. However, downside risks are mitigated by still attractive financing conditions, as the Bank of Canada has lowered the qualifying mortgage rate for the first time since 2016.



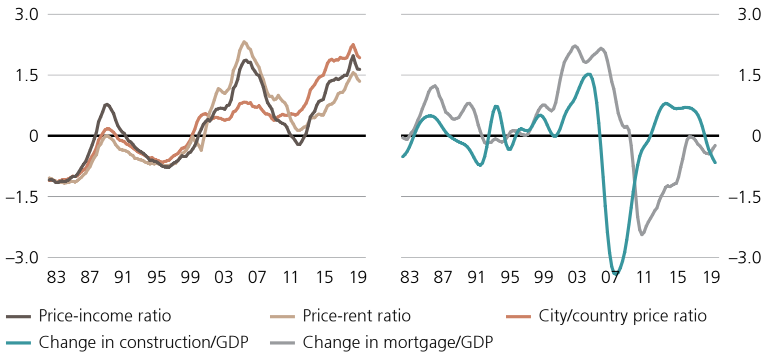
Paris

Real housing prices in the French capital have reached a new all-time high after a 5% increase in the last four quarters. As a result, the owner-occupied market has been decoupling increasingly from incomes and rent fundamentals. Furthermore, prices have been decoupling from the rest of the country since 2006. Consequently, the market has entered bubble-risk territory. Looking forward, low affordability will likely strain the prospect for housing prices. A skilled service-sector employee on average would need to dedicate almost 15 years of her income to be able to buy a 60m² (650 sqft) flat near the city center, making Paris the least affordable European city.



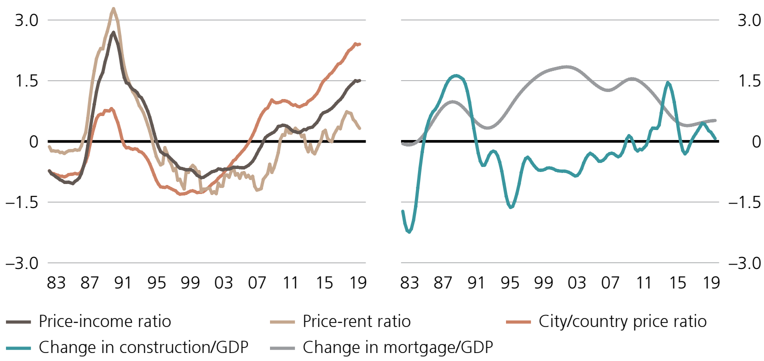
San Francisco

Real prices increased by 85% between 2012 and 2018, fueled by booming technology companies and a large amount of IPO money making its way into real estate. However, the housing frenzy is on hold for now. Real prices have dropped in recent quarters and are almost 5% below last year's peak. The weakness in the Bay Area's housing market is exacerbated by diminishing foreign demand and the historic low affordability for the working middle class. With the highest number of housing permits since the late 1980s, the supply shortage may start to ease and potentially accelerate the price correction.



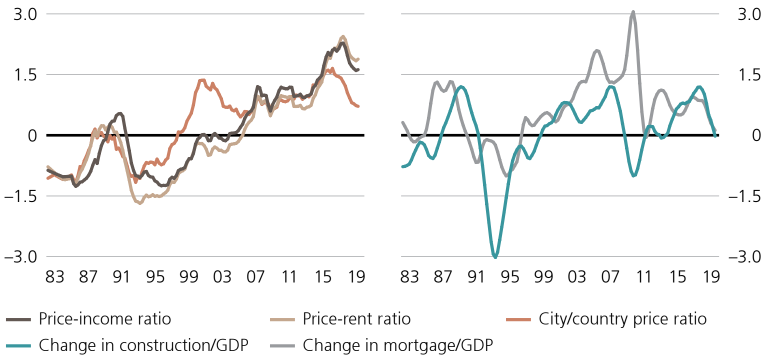
Tokyo

Although real prices for Japanese properties have been stagnating since 2014, prices in the capital city have increased by 5% a year. However, over the last four quarters, the rise has been below 2%. Despite being the only prefecture in Japan with a growing population, the increasingly strained affordability has started to limit demand for housing in the city. Still, ongoing large-scale redevelopment and infrastructure projects should ensure Tokyo's attractiveness and support the price level.



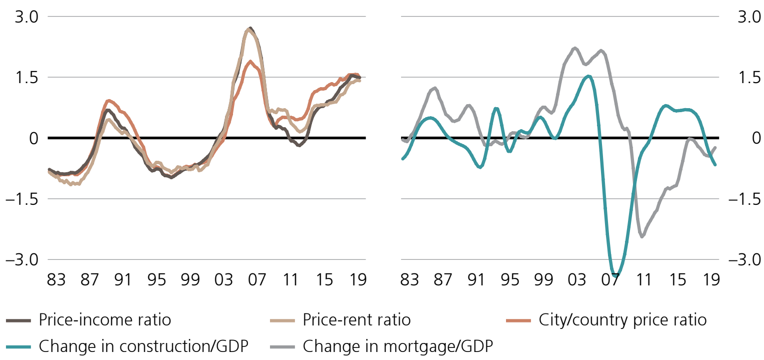
Stockholm

Strong population growth, coupled with attractive financing conditions and a structural supply shortage, fueled an unprecedented property boom between 2000 and 2017. Real prices rose by 130%, while incomes grew just 40%. Affordability thus became increasingly stretched. The introduction of tighter amortization requirements has cooled the market since then. The price level is now 10% below the peak reached two years ago. However, negative interest rates, coupled with limited supply growth and an unattractive overregulated rental market, limit the downside risks of homeownership over the medium term.



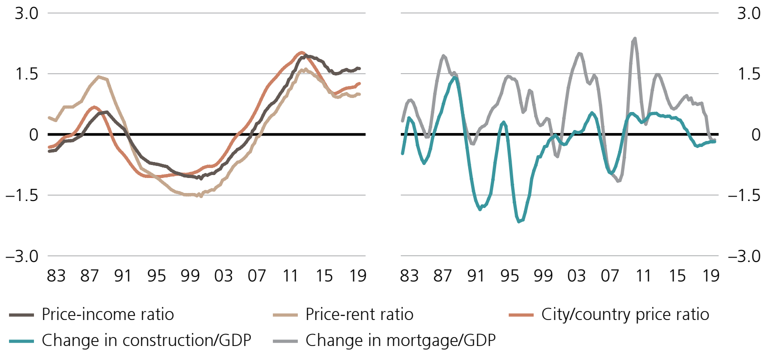
Los Angeles

Inflation-adjusted house prices have continued to rise, albeit at just 2% over the last four quarters. Despite a booming local economy, affordability has worsened as real prices have surged by more than 50% since 2012, surpassing real income growth. We expect demand to weaken in 2020 given the area's exposure to international trade. Unless there is a recession, a sharp house price decline seems unlikely, however, as even the high number of building permits currently may not ease the chronic housing undersupply anytime soon.



Geneva*

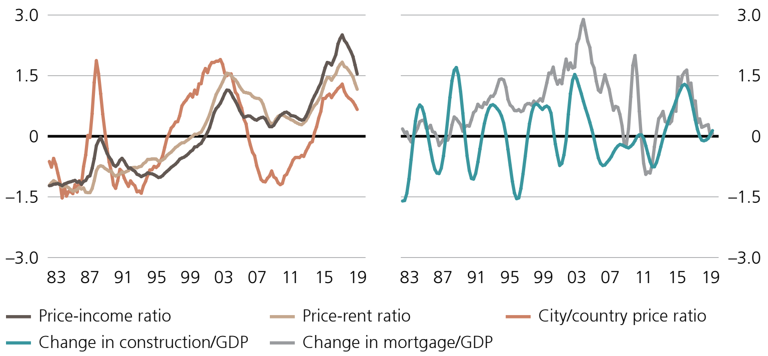
After a high single-digit price correction between 2013 and 2016, real prices have stagnated since then and remain below the last peak at the end of 2012. Demand has been supported by falling mortgage rates and an ongoing undersupply in recent quarters. However, the overall high living costs are hurting the city's long-term attractiveness. Yet Geneva continues to benefit from its international status and its stability in light of elevated political tensions across the world. Therefore, the current high price level is well supported over the medium term.



* We have changed the price index we use for Geneva, which is now based on asking and transaction prices.

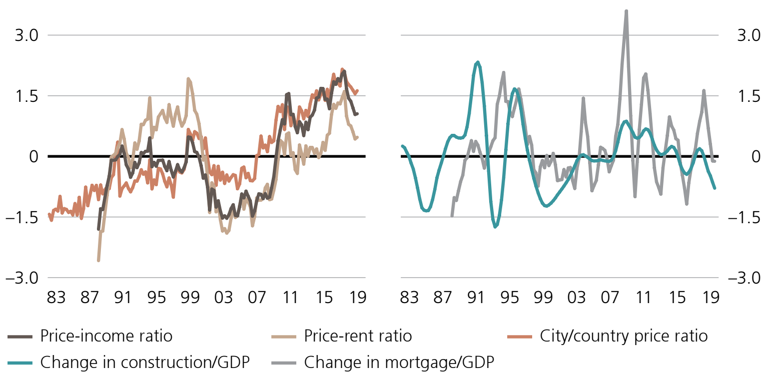
Sydney

Real prices increased by 80% between 2008 and 2017. But various cooling measures including a doubling of the land tax surcharge and a new vacancy fee soon ended the boom. The price decline has been accelerating since then. By the end of the first quarter of 2019, prices were 15% lower than at the peak, and credit growth for housing had reached an all-time low. The market should find a bottom soon, in our view, due to an easing of credit policies, an uptick in foreign demand and improving affordability.



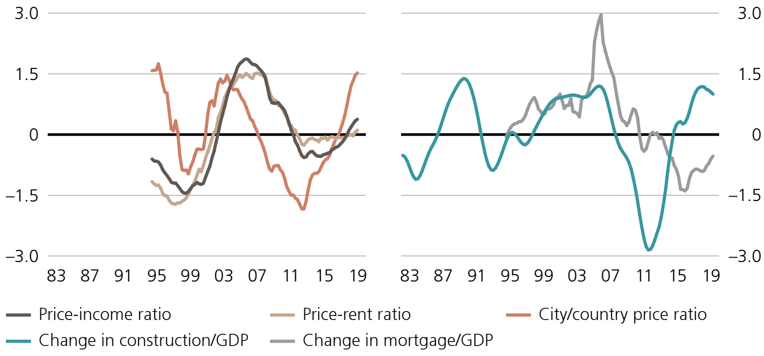
Tel Aviv

Strong economic growth, a supply shortage, more foreign buyers, declining mortgage rates and a government subsidized urban renewal program let prices skyrocket between 2003 and 2017. The city's house prices have decoupled from the rest of the country and the affordability of both owner-occupied and rental housing has decreased considerably. Yet the sharp increase in mortgage rates between 2015 to 2017 triggered a price drop by almost 10%. In recent quarters, prices have mostly stabilized. However, the government has introduced new purchase taxes and encouraged further construction, limiting upside in the medium term.



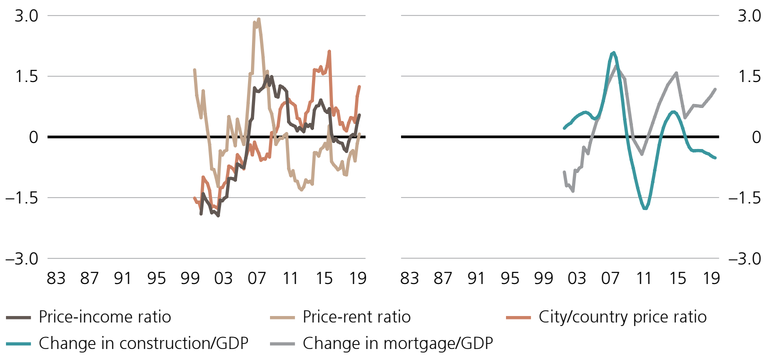
Madrid

After a long period of deleveraging, the market is benefiting from attractive financing conditions. Construction activity has accelerated. Real prices have increased by 30% since 2012 but remain some 25% below the peak of 2007. Although we expect price growth to continue, the additional supply and subdued income growth limit price and rental growth prospects. The average time to buy a medium-size flat near the city center by a skilled service-sector employee has already risen to six years.



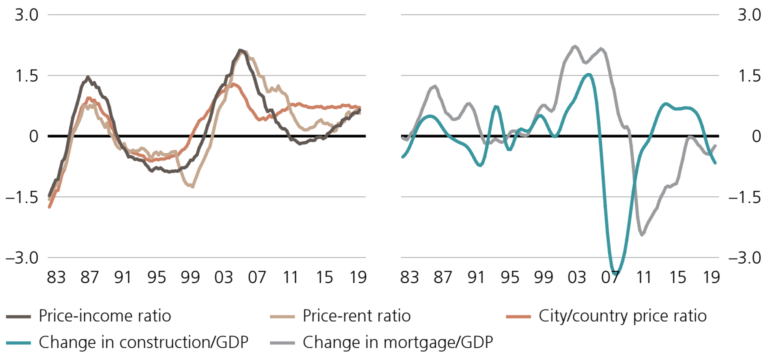
Moscow

Moscow's index score is a reflection of its shifting economic fortunes. Since troughing in 2017, property prices have recovered on average by 7% a year, supported by falling financing costs and strong demand. A recently introduced escrow account regulation is expected to further encourage buying. However, Russia's lackluster economic growth, the projected sharp slowdown in Moscow's population growth and the central bank's preventive tightening measures may hold back further significant price increases.



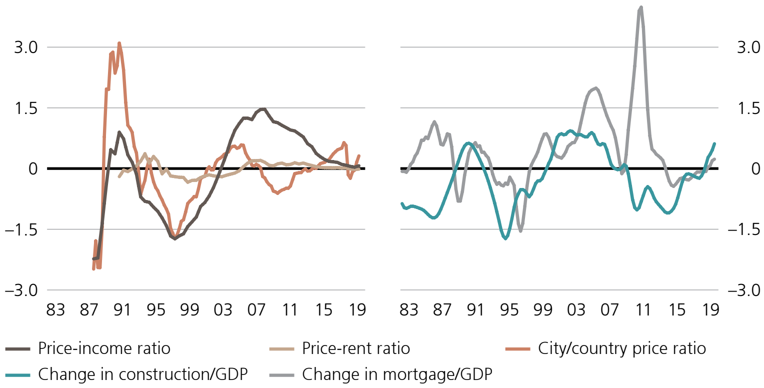
Boston

Prices have been increasing continuously since 2012, but growth rates have abated recently. Over the last four quarters, prices have risen by 3% in inflation-adjusted terms, in line with the national average. The economic appeal of Boston and a catch-up in price levels have triggered the relatively strong rise in prices. Housing demand has been underpinned by strong population growth in the city and relatively good affordability. Hence, market valuations are still not excessive. A further fall in mortgage rates may support extra price growth in the short to medium term.



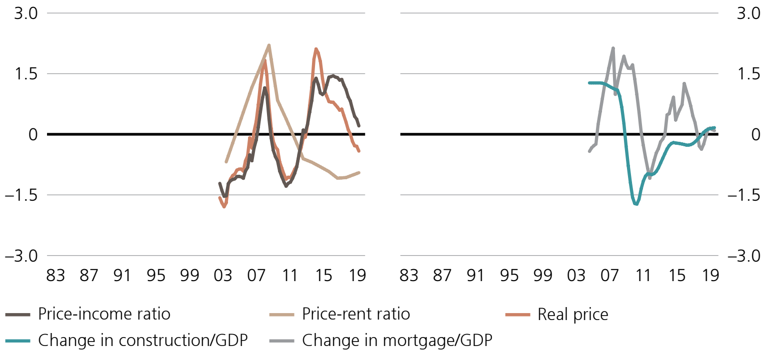
Milan

The housing market recovery is gaining pace, but is still at an early stage. Prices have begun to rise, with the time required to sell properties shortening markedly. Inflation-adjusted prices have been rising by about 1% but remain well below the 2007 peak. While the demographic trends in Italy remain sluggish, the population of the city of Milan and the wider metropolitan area continues to rise. In addition, a mixture of attractive financing conditions, increasing foreign investor interest and the best housing affordability among European cities is also supporting demand.



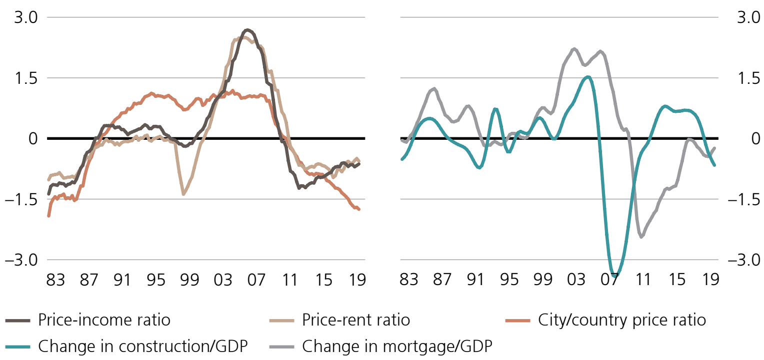
Dubai

The property market in Dubai boomed between 2010 and 2014, supported by strong economic growth driven by high oil prices. To curb the boom, the authorities introduced higher transaction fees and tighter mortgage standards. Consequently, real prices have fallen by almost 35% since mid-2014, paralleling the weakness in oil prices. Affordability has improved even though incomes have declined amid slower economic growth. Despite posting the strongest population growth among all cities in the study, the market remains oversupplied. Easier visa requirements and next year's Expo should support the market.



Chicago

Over the last four quarters real prices have risen by 2% and are now at least 15% higher than at the market trough in 2013. Nonetheless, prices are still more than 25% lower than in 2006. Overall, rental and income growth could keep pace with house price increases. The city's high indebtedness, sluggish employment growth and a declining population will likely continue to hinder significant price increases. The housing market has potential substantial upside given the good affordability, but only if economic prospects improve.



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, Hong Kong and Dubai 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 2004. 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 25.

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 and challenged on an annual basis. However, we also specify an uncertainty range due to the differing quality of our data sources.

Data sources

		Price Index	Rent Index	Income Index	Mortgage, Construction, GDP, Inflation
Amsterdam	2019Q2	CBS, Maastricht University, FED Dallas	NVM, UBS P&E	UBS P&E, CBS	DNB, CBS, EUKLEMS, Bloomberg
Boston	2019Q2	FHFA	CBRE, FED St. Louis	BEA	FED, BEA, Bloomberg
Chicago	2019Q2	FHFA	CBRE, FED St. Louis	BEA	FED, BEA, Bloomberg
Dubai	2019Q2	BIS	Reidin, Merrill Lynch, UBS P&E	Euromonitor International, Merrill Lynch, UBS P&E	Central Bank UAE, Dubai Statistics Center, Merrill Lynch, Bloomberg
Frankfurt	2018Q4	Bulwiengesa, FED Dallas	Bulwiengesa, OECD	Destatis, UBS P&E, OECD	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg
Geneva	2019Q2	Wüest Partner	Statistique Genève	FTA, FSO	SNB, SECO, BFS
Hong Kong	2019Q2	RVD	RVD	Census and Statistics Department Hong Kong, Bloomberg	Census and Statistics Department Hong Kong, HKMA, Macrobond, Bloomberg
London	2019Q2	Nationwide, Lloyds Banking Group	ONS, UBS P&E	ONS	BoE, ONS, EUKLEMS, Macrobond, Bloomberg
Los Angeles	2019Q2	FHFA	CBRE, FED St. Louis	BEA	FED, BEA, Bloomberg
Madrid	2019Q1	BoS	Idealista, UBS P&E	INE	INE, BoS, EUKLEMS, Bloomberg
Milan	2019Q2	Nomisma, FED Dallas	Nomisma, OECD	Dipartimento delle Finanze, UBS P&E	Banca d'Italia, Hypostat, Istat, EUKLEMS, Macrobond, Bloomberg
Moscow	2019Q2	Rosstat	Domofond, UBS P&E	Rosstat, UBS P&E	CBR, Rosstat, Bloomberg
Munich	2018Q4	Bulwiengesa, FED Dallas	Bulwiengesa, OECD	Destatis, UBS P&E, OECD	Deutsche Bundesbank, Destatis, EUKLEMS, Bloomberg
New York	2019Q2	FHFA, S&P/Shiller, Elliman	CBRE, FED St. Louis	BEA	FED, BEA, Bloomberg
Paris	2019Q1	BIS, CGEDD, FED Dallas	CGEDD, Clameur, UBS P&E	Insee, Bloomberg, UBS P&E	BdF, Insee, EUKLEMS, Macrobond, Bloomberg
San Francisco	2019Q2	FHFA	CBRE, FED St. Louis	BEA	FED, BEA, Bloomberg
Singapore	2019Q2	Government of Singapore	Government of Singapore, UBS P&E	Government of Singapore	Government of Singapore, Bloomberg
Stockholm	2019Q2	Statistics Sweden	Statistics Sweden, UBS P&E	Statistics Sweden, UBS P&E	Statistics Sweden, Bloomberg
Sydney	2019Q1	REIA, ABS, FED Dallas	REIA, NSW Government, UBS P&E	ABS, UBS P&E	ABS, RBA, Macrobond, Bloomberg
Tel Aviv	2019Q1	CBS, FED Dallas	CBS, UBS P&E	CBS, UBS P&E	BoI, Bloomberg
Tokyo	2019Q1	The Real Estate Transaction Promotion Center, Haver Analytics, FED Dallas	Miki Syoji, Official Statistics of Japan	INDB, Tokyo Metropolitan Government, UBS P&E	ESRI, EUKLEMS, Macrobond, Bloomberg
Toronto	2019Q2	Sauder School of Business UBC, Bloomberg, FED Dallas	Canadian Housing Observer, Sauder School of Business UBC	Statistics Canada	Statistics Canada, BoC, Bloomberg
Vancouver	2019Q2	Sauder School of Business UBC, Bloomberg, FED Dallas	Canadian Housing Observer, Sauder School of Business UBC	Statistics Canada, Government of British Columbia	Statistics Canada, BoC, Bloomberg
Zurich	2019Q2	Wüest Partner	Statistik Stadt Zürich	FTA, FSO	SNB, SECO, BFS

Benchmarking sources

	Earnings	Real Estate (prices and rents)
Amsterdam	UBS P&E, CBS	Globalpropertyguide.com, numbeo.com, funda.nl
Boston	BEA	Zillow, numbeo.com, CBRE
Chicago	BEA	Zillow, numbeo.com, CBRE
Dubai	Numbeo.com, guide2dubai.com	Numbeo.com, bayut.com
Frankfurt	UBS P&E, Destatis	Bulwingesa, globalpropertyguide.com, numbeo.com
Geneva	UBS P&E, FTA, 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, findproperly.co.uk, numbeo.com
Los Angeles	BEA	Zillow, numbeo.com, CBRE
Madrid	UBS P&E	Idealista, numbeo.com
Milan	UBS P&E, Dipartimento delle Finanze	Nomisma, immobiliari.it
Moscow	UBS P&E	Numbeo.com, globalpropertyguide.com
Munich	UBS P&E, Destatis	Bulwingesa, 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, thelocal.se
Sydney	UBS P&E, ABS	Globalpropertyguide.com, numbeo.com
Tel Aviv	CBS, numbeo.com, UBS P&E	Globalpropertyguide.com, expatistan.com, numbeo.com, UBS P&E
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, FTA, FSO	Wüest Partner

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