Institute for Real Estate Studies

Real Estate Research @ Penn State: Issue #3

Welcome to the third issue of Real Estate Research @ Penn State, a publication of the Institute for Real Estate Studies in the Smeal College of Business. As the focal point for Penn State's "Research with Impact" in the real estate industry, the Institute publishes this periodic Report to highlight recent scholarship sponsored by the Institute.

This issue features two reports. The first, titled "Do Bubbles Always Pop?" by Brent Ambrose, Piet Eichholtz at Maastricht University and Thies Lindenthal at MIT, summarizes a paper that was recently accepted for publication in the Journal of Money, Credit and Banking. This article uses 350 years of data on rents and prices from Amsterdam to investigate issues associated with "bubbles". One of the implications from this study is that it is decidedly difficult to know when, or even if, an asset price bubble will collapse.

The second report, "Strange Days Indeed" by Brent Ambrose, is a market commentary that highlights the impact of the recent financial crisis on the link between traditional measures of financial risk and return and commercial property capitalization rates. In contrast to the period from 2001 to 2005 where the negative relation between commercial property cap rates and future Sharpe Ratios (a measure of risk/return tradeoff) holds, this study shows that in the subsequent period between 2006 and 2009 there is almost no relation between cap rates and future Sharpe Ratios. Thus, it appears that historical pricing patterns from the commercial real estate market may have broken during and following the financial crisis.

I hope that you find these articles interesting and intellectually stimulating.

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Strange Days Indeed

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One of the fundamental principles of modern finance is the concept of risk and expected return. Investors require a higher expected return in order to hold greater risk.

However, something odd has happened during the recent financial crisis and subsequent recession that appears to have altered the paradigm: real estate valuations appear to be out of line with historic risk premiums.

Measuring Historic Investment Performance

William Sharpe derived a concept for expressing an asset's return over some benchmark in relation to the volatility in the asset's return. This measure became known as the "Sharpe Ratio" and when applied ex post, it provides a simple measure of the historic average return for an asset per unit of historic volatility. For example, comparing Sharpe Ratios across investments will tell you which investment had the highest average return over a benchmark relative to its average volatility. In other words, the Sharpe Ratio provides a convenient method for showing the risk/reward tradeoff that investors experienced.

More formally, the Sharpe Ratio (SR) is defined mathematically as

$$SR_t = \frac{\frac{1}{T}\sum_{t=1}^{T}[r_t - r_{f,t}]}{\sigma_r}$$

Where rt represents the return on the asset in period t, rf,t represents the return on the benchmark asset (in the following example, we will use the return on the 10-year Constant Maturity Treasury (CMT) as the reference, or benchmark asset), and σr is the standard deviation of the asset return for the historic period from t=1 to T. Thus, by dividing the average return difference over the standard deviation of the return, we have a simple measure of the ex post risk/return tradeoff.

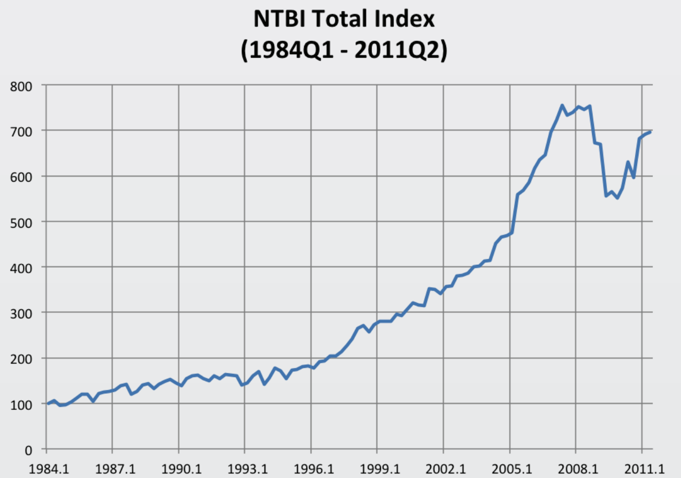

Figure 1: NCREIF NTBI Index (1984-2011) (100 = 1984Q1)

For example, let's consider the historic performance of the all core NCREIF net transactions based property index (NTBI). Figure 1 shows the historic NTBI index values over the period from 1984Q1 to 2011Q2 and Figure 2 shows the historic NTBI quarterly returns for the same period. The NCREIF NTBI represents the historic performance on institutional grade commercial real estate. The figures clearly show that the recent recession of 2008/2009 produced significant negative returns to real estate holdings.

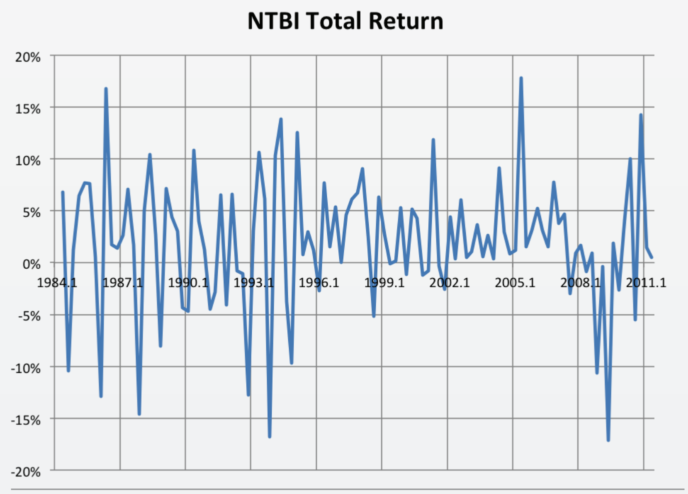

Figure 2: NCREIF NTBI Returns (1984 – 2011)

Using a 10-year investment horizon (40-quarters), we can calculate a Sharpe Ratio for each quarter starting in 1994 and moving forward in time to 2011. Figure 3 plots the quarterly rolling Sharpe Ratios for the NTBI. The figure shows that during the mid-1990s, direct real estate investment earned a negative return over the 10-year CMT. However, by the mid-2000s, direct real estate investments had produced substantial risk-adjusted returns. We also see that starting in 2007 risk-adjusted commercial real estate returns fell dramatically during the financial crisis of 2008 and 2009, such that the historic real estate Sharpe Ratio is now back to approximately 2002 levels.

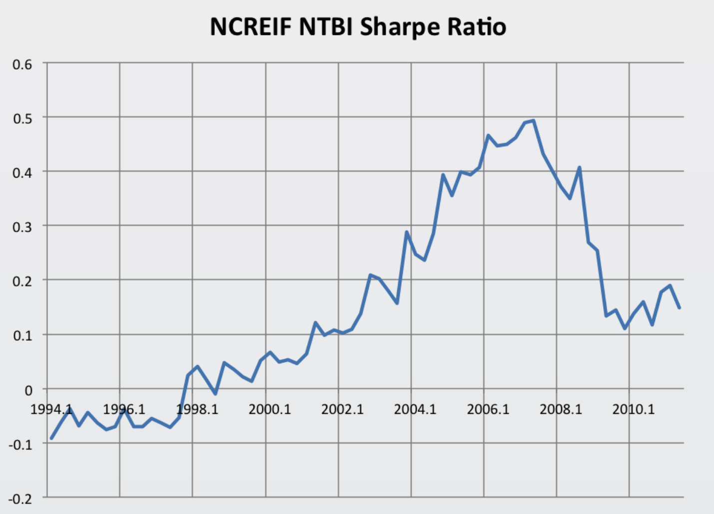

Figure 3: NCREIF NTBI Sharpe Ratio (1984-2011)

Comparing Historic Performance with Current Prices

Of course, the Sharpe Ratio as defined above is an ex post or historic performance measure. It tells us about the risk-adjusted performance of commercial real estate over time. While it is often comforting to know how well (or poorly) an investment performed, investment decisions today are based on expectations about future performance. For real estate investors, one common metric often employed to give a sense for the value (or price) of real estate is the capitalization rate (or cap rate). The cap rate (R) is simply defined as next period's expected cash flow (net operating income or NOI) divided by today's (current) value or price:

$$R = \frac{NOI_{t+1}}{V_t}$$

To gain a perspective on the changing value of commercial real estate, Figure 4 shows the Real Capital Analytics (RCA) all core cap rate and cap rate spread (the cap rate less the 10-year Constant Maturity Treasury yield) for the period from 2001 to 2011. During the period from 2001 to 2007 the average all core property capitalization rate declined almost 300 basis points, implying a 46% increase in the market value per dollar of cash flow generated by commercial real estate. At the same time, the real estate spread over Treasury, which is a rough proxy for the real estate risk premium, fell by 300 basis points. Then during the financial crisis, real estate risk premiums returned to 2001/2002 levels.

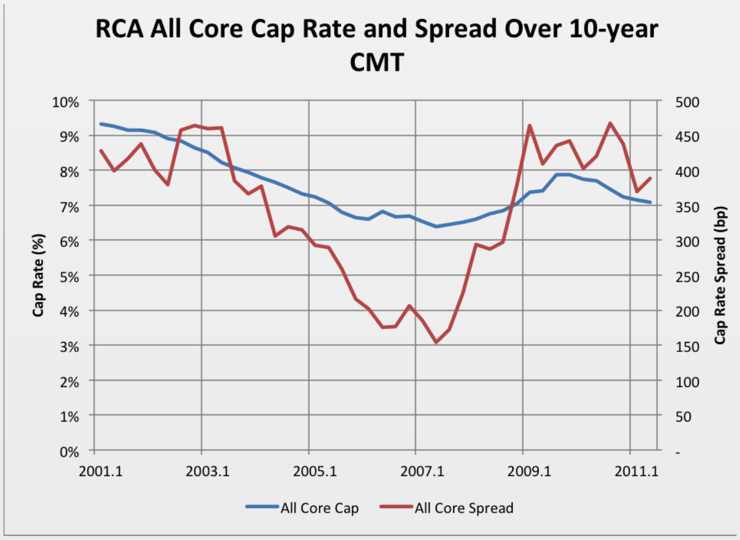

Figure 4: RCA All Core Cap Rate and Spread

However, the change in real estate risk premiums shown in Figure 4 reflects changes in investor perceptions of real property values (i.e. changes in the cap rate) and changes in yields in the Treasury market. Since 2007, the Federal Reserve and the U.S. Treasury have engaged in a series of market interventions designed to stabilize the economy and counter the effects of the financial crisis. Thus, changes in the cap rate spread may also reflect these market interventions.

In Figure 5, we plot the quarterly NCREIF NTBI Sharpe Ratios against the quarterly RCA all core commercial real estate cap rates. The solid line represents the linear trend line and the dashed lines represent the 99% confidence interval. Figure 5 has two noticeable features. First, the downward sloping trend line corresponds to the observation that investors are willing to pay higher prices (lower cap rates) during periods following historically high risk-adjusted returns (high Sharpe Ratios). The quarters corresponding to the peak of the market (2006 and 2007) have the highest Sharpe Ratios and the lowest cap rates. In contrast, the quarters just after the 2001/2002 recession have the lowest Sharpe Ratios and highest cap rates.

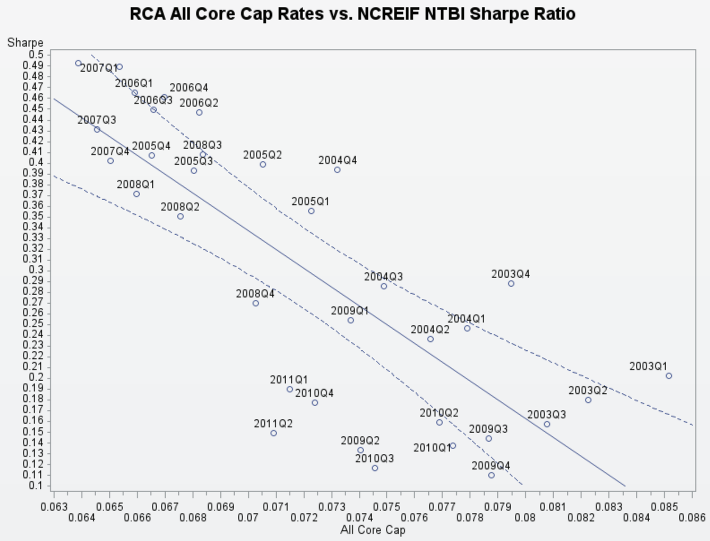

Figure 5:

The second noticeable feature in Figure 5 is the cluster of quarters corresponding to the financial crisis period (2009, 2010, and 2011) located significantly below the trend line. For example, note that the Sharpe Ratios in 2003Q3 and 2011Q2 are roughly the same, yet cap rates in 2011 are approximately 100 basis points lower than in 2003. This difference in cap rates implies a 14% difference in market value per dollar of cash flow between 2011 and 2003. However, the historical return performance is virtually the same. Strange days indeed!

Comparing Current Prices with Future Performance

Of course, looking at historic Sharpe Ratios versus current capitalization rates may not be that informative. Cap rates are a measure of value based on expectations, not historic performance. As a result, while the comparison of backward looking Sharpe Ratios and forward looking cap rates may be interesting, such analysis does not give a good metric for today's investment opportunities. Thus, as a preliminary effort to compare the forward looking cap rate with a Sharpe Ratio based on returns associated with that cap rate, I calculated the Sharpe Ratio using the returns over the two-years (eight quarters) following the cap rate. In other words, the Sharpe Ratio now captures the two-year risk/return performance for an investor who purchased commercial real estate at the market cap rate. Figure 6 shows the plot of the cap rates and these forward looking Sharpe Ratios.

The most striking feature of Figure 6 is the breakdown in the relation between cap rates and future risk/return after 2005. In the period from 2001 to 2005 (the blue dots), we find the expected negative relation between current cap rates and future Sharpe Ratios. That is, investors appear to earn higher risk/return tradeoffs as prices increase (cap rates decline). However, this relation appears to breakdown starting in the third quarter of 2006. During the period from 2006 to 2009 (the red dots), we find almost no relation between cap rates and future Sharpe Ratios. Thus, it appears that following the financial crisis in 2007, the expected relation between risk and reward fell apart as cap rates remained at low levels but properties were unable to provide returns to justify those valuations. Strange days indeed!

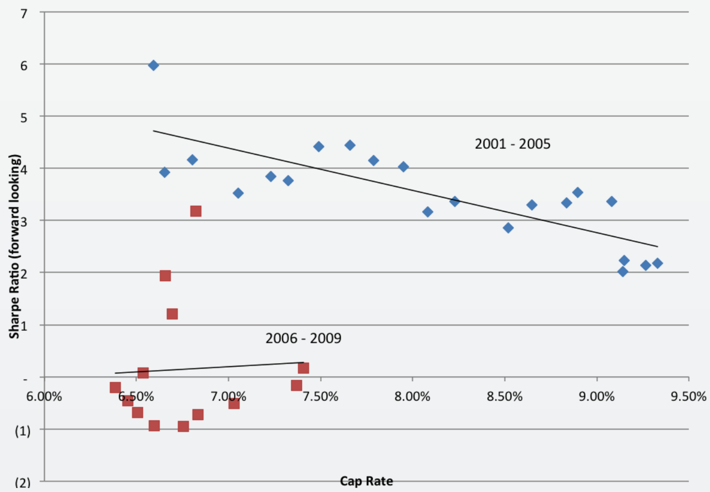

Figure 6: RCA Cap Rates versus Forward Looking NTBI Sharpe Ratio

Do Bubbles Always Pop?

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Many economists and policy makers worry that asset price bubbles may quickly turn into busts, resulting in economic contraction. The last few years appear to justify such fears. For example, house prices in the U.S. increased over 5 percent per year from 2000 to 2006 with some local markets experiencing increases of more than 20 percent per year. Then, from 2007 to 2009, the U.S. witnessed a significant correction to the housing market with aggregate real housing values declining 26 percent. The same holds for other countries. Spain and Ireland, for example, saw average house price increases between 1997 and 2007 of nearly 190 percent and 240 percent, respectively, followed by a rapid fall in house values. More recently, the dramatic rise in property values in China has raised concerns of a bubble forming there. However, the housing market that experienced one of the biggest rises of all, South Africa, has merely stabilized.

Although much of the popular press takes for granted that the recent house price increases seen around the world are evidence of a "bubble" in housing markets, economists note that actually recognizing an asset price bubble prior to a price crash is notoriously difficult. In fact, a number of academic studies conducted in the early 2000s found that the cost of home ownership rose moderately relative to the cost of renting, even though larger deviations from fundamentals occurred in some markets.

One problem with identifying the presence (or lack thereof) of bubbles in asset markets is the lack of sufficiently long-term data that would allow researchers to identify cases where asset prices significantly deviate from fundamental values. Furthermore, market price deviations from fundamental values over a short time period do not guarantee that market prices will decline – the often-predicted bubble crash. Rather, it may be possible that bubble conditions are sustained, followed by gradual restoration of the equilibrium relationship.

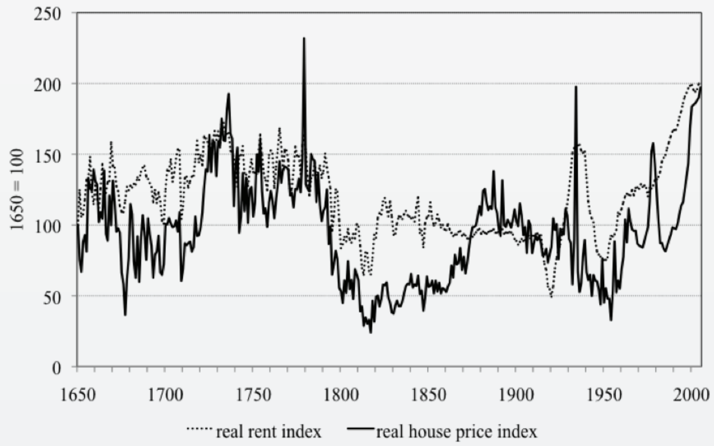
We examine this problem using a time series of real house prices and rents from Amsterdam to investigate the behavior of house prices relative to fundamentals spanning a time period of 355 years. We create a repeat-sales housing market index for Amsterdam covering the period from 1650 through 2005. The dataset covers all transactions of dwellings on the Herengracht, one of the central canals in Amsterdam that was constructed between 1585 and 1660. By 1680, most of the lots on the canal were developed and from 1616 until the present day, the Herengracht has remained one of the most prestigious addresses in Amsterdam.

We next created a rental index using data from multiple sources. For the first 200 years, from 1650 through 1850, we use data for a broad set of rental houses, varying in location and structural quality, and owned by the institutional investors of that time: orphanages, hospitals, and poor-relief boards. In all, this dataset covers 7,670 market rent observations for 1,055 properties scattered across an area that is currently the center of Amsterdam. The market rents are observed at the beginning of new rent contracts. For the period 1851 through 1913 the tax authorities in The Netherlands estimated the potential rental income that could be generated from owner occupied residential real estate, since the imputed rents were treated as income and taxed. The rent capacity is not a percentage of the value of the house, which would make the rent index a direct function of prices. Instead, the average rent of comparable houses in the vicinity was taxed, providing information on the development of market rents. The second dataset spans the remaining period 1914 through 2005, and is based on a range of publications from the Dutch Central Bureau of Statistics.

Overall, these price and rent series provide a yearly picture of the developments and growth in the Amsterdam housing market over a 355-year period from 1650 to 2005. In order to make adjustments for the cost of living, we use a long-run consumer price index, again based on different sources.

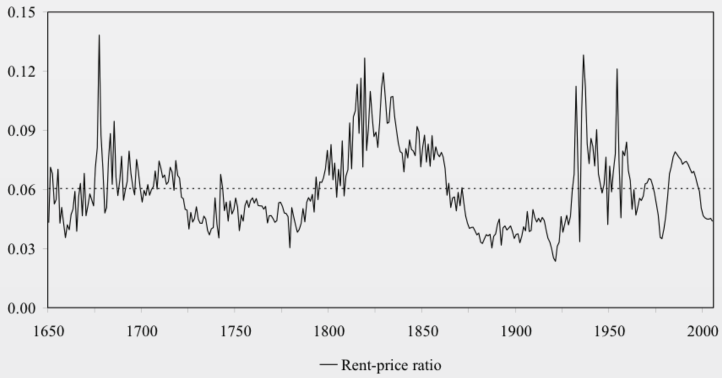
Figures 1 and 2 show the house price and rent indices, in real terms and the rent-price ratio. The indices follow each other closely over time, especially in their long-run movements. The series appear both stationary and volatile in the 17th and 18th century, showing a downward trend in the late 18th and early 19th century, and are rather stable throughout the remainder of that century. The 20th century is most volatile for both series, with large swings in real rents and prices, especially during the two world wars and in the inter-war period.

Figure 1: Real rents and house prices, 1650-2005



Sources: Prices 1650-1965 (Eichholtz, 1997), 1965-2005 (NVM, 2008);
Rents 1650-1850 (Eichholtz and Theebe, 2007), 1851-1913 (Van Riel, 2006), 1914-2005 (CBS, see on-line appendix)

Figure 2: Rent-price ratio, 1650-2005



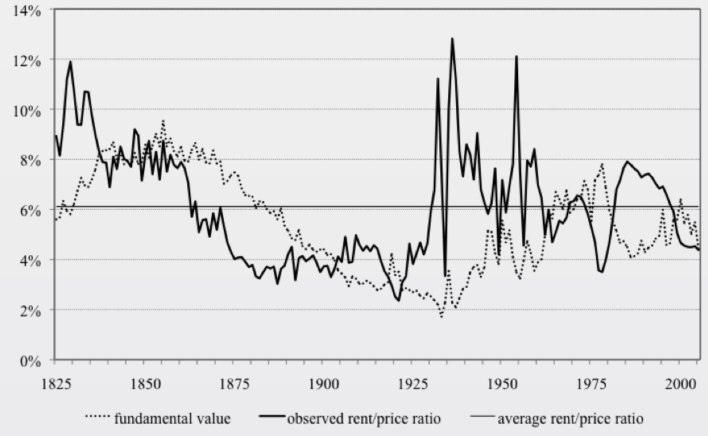
Notes: Information on both rents and prices are available for only very few houses and years at the same time in our sample, so we do not observe the rent-price ratio directly. We therefore rescale the aggregated rent-price ratio based on the rent and house price indices to 4.5 percent in 2001, which is the annual rental yield direct return on Dutch residential real estate as stated in the ROZ/IPD index for this year (ROZ, 2007).

One striking observation from Figure 1 is that neither the real price nor the real rent index increases dramatically in 355 years. The real price and rent indices, starting both at 100 in 1650, reach respective levels of 197.1 and 203.2 in 2005. However, for most of the sample period the indices vary around 100. However, the sub-period that had the strongest decline in real house prices and rents was from 1781 to 1814, which was the only extended period in Amsterdam's recorded history with a consistently declining population. During this period, real prices declined on average by 1.6 percent per year. In contrast to bubble periods, we see a 33-year period of sustained price declines, implying a market implosion. Interestingly real rents declined also, but at a slower 1.3 percent per year pace.

The evidence clearly contradicts the popular perception that house prices only go up, and that even if they do go down, it will only be for short periods. The upward climb of real rents and house prices only started in the 1950s; they have now both reached their highest levels ever.

Using a series of standard statistical techniques, we computed a theoretical rent-price ratio (the proxy for fundamental values) and compared it to the actual rent-price ratio. Figures 3 and 4 depict the difference between the rent-price ratio and its theoretical counterpart. These graphs show that prices (or rents) can deviate from fundamentals for extended periods of time. For example, throughout the second half of the 19th century, the pricing error was continuously negative, indicating that actual rents were lower or the actual prices higher than predicted by our model. Starting with World War I, a period of financial turbulences left its mark both on the actual rent-price ratio and on its fundamental counterpart. During World War I, The Netherlands first experienced a period of strong inflation, followed by deflation in the early 1920s and during the early 1930s, again followed by inflation in the late 1930s and 1940s. For both series, volatility shoots up, caused by huge swings in house prices and inflation. In these uncertain times, house prices seem to be more depressed than fundamentals suggest, indicating that investors attached a substantial discount to long term investments like housing.

Figure 3: Rent-price ratio and theoretical counterpart based on fundamentals

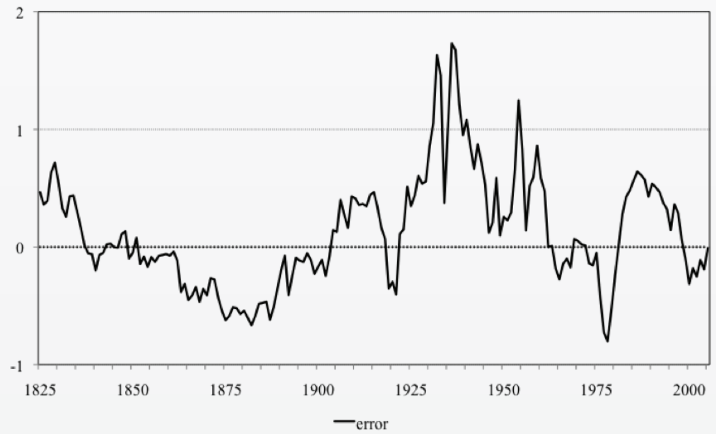


Notes: The theoretical rent-price ratio is expressed as

$$l_t - p_t = k + \sum_{\tau=1}^{\infty} \rho^{\tau-1} \hat{E}_t[i_{t+\tau}] + \sum_{\tau=1}^{\infty} \rho^{\tau-1} \hat{E}_t[\pi_{h,t+\tau}] - \sum_{\tau=1}^{\infty} \rho^{\tau-1} \hat{E}_t[\Delta l_{t+\tau}]$$

where $r_{h,t}$ is the log return to housing, p_t is the log house price, l_t is the log rent, Δl_{t+1} is $l_{t+1} - l_t$, ρ is defined as $1/\left(1+e^{(\overline{l-p})}\right)$ with $(\overline{l-p})$ the long-run average rent-price ratio, and k is a constant of linearization that equals $(1-\rho)^{-1}[\ln(\rho)+(1-\rho)\ln(1/\rho-1)]$. $\hat{E}_t$ is the conditional expectation computed from a τ-period VAR forecast.

Figure 4: Rent-price ratio error ε in logs, 1825-2005



Notes: The rent-price ratio error represents the price deviations from fundamentals and is calculated as

$$\varepsilon_t = (l_t - p_t) - \left(\tilde{k}_t + \tilde{i}_t + \tilde{\pi}_t - \Delta\tilde{l}_t\right),$$

Where $\tilde{k}_t, \tilde{\imath}_t, \tilde{\pi}_t, \Delta\tilde{l}_t$ denote our calculated approximations of the constant of linearization, the future real rate, future housing risk premium, and future rental growth, respectively.

Several lessons arise from our analysis. First, our analysis confirms that the same underlying fundamentals likely influence both house prices and rents. Second, our analysis of the rent-price ratio reveals sustained periods of "bubble" and "crisis" conditions that can continue without a corresponding correction (or crash). Third, our analysis shows that changes in house prices and rents are both mechanisms for "correcting" imbalances between prices and fundamentals. Between these, prices appear to have greater importance in correcting disequilibria.

Based on these findings, our investigation into the long-run developments of house prices and rents has implications for the ongoing debate concerning the recent price increases and subsequent corrections in many of the worldwide housing markets. Our study shows that bubble crashes are not always inevitable in the short run. While prices do revert back to fundamentals, this reversion may take decades with the move towards equilibrium more a fading out than a crash. As a result, markets like Amsterdam, Cape Town, and Paris that have been characterized by strong price gains in the last decade and were widely thought of as overvalued may not necessarily experience the free fall seen in other markets.

One of the implications of this analysis is that it is decidedly difficult to know when, or even if, an asset price bubble will collapse. The results suggest that it is unwise to use perfect hindsight to criticize lenders who originated mortgages at the peak of the market and subsequently suffered significant losses due to borrower defaults, since historical trends show that it is possible for price bubbles to slowly deflate over long periods such that the losses may not have occurred. Finally, our results imply that lengthy periods of little or no house price appreciation are also possible. Thus, those looking for a speedy recovery in the housing market after the crisis may be disappointed.

The Institute for Real Estate Studies is the focal point for Penn State's "Research with Impact" in the real estate industry. The Institute sponsors leading-edge scholarship on a wide variety of topics related to the real estate industry. Research findings are published in the top real estate, finance, and economic journals as well as in the Institute's Working Paper Series. The Institute actively sponsors research interaction between affiliated faculty and graduate and undergraduate students.

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