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A Long Run House Price Index: The *Herengracht* Index, 1628–1973

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This article introduces a biennial historic index of real estate values for the period 1628 through 1973. This index is based on the transactions of the buildings on the Herengracht, one of the canals in Amsterdam. Since its development, the quality of the buildings on this canal has been on a constant, high level, which makes the Herengracht a unique sample to base a long run house price index upon. The index is a hedonic repeated-measures index and is estimated in real terms. An index is also constructed in nominal terms. The average real price increase after World War II is about 3.2% per annum. Nevertheless, the real value of the index in 1973 is only twice as high as it was in 1628.

Compared to stocks, little is known about the long run performance of real estate. This is because indices of real estate returns are fundamentally different from stock indices. It is relatively easy to construct a long run stock index, since stock prices are public information, and for most countries, these prices have been published since the establishment of the stock market. For real estate, prices are not public. This makes exact information about real estate performance a scarce commodity for the present, let alone for the distant past.

Three types of indices have been proposed as measures for real estate values: appraisal-based, property share-based and transaction-based indices. The first two types are hardest to expand into the past. Appraisal-based indices have various drawbacks which have been well documented in the literature (see, for example, Firstenberg, Ross and Zisler 1988 and Fisher, Geltner and Webb 1994). Most of these are related to the lack of independence between observations. To make a long term appraisal-based index, a problem of intertemporal consistency in the appraisal method is added to this: if appraisal methods change over time, the outcomes become incomparable. So, while historic series of real estate appraisals are probably available in countries where property taxes have been levied, indices based on these appraisals would have major drawbacks.

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This is reflected in the literature: the available appraisal-based real estate indices generally do not have a very long history. Sirmans and Sirmans (1987) review the literature in this area and find that Ibbotson and Fall (1979) go back furthest in history. They use appraisal-based returns data from 1947 for two types of United States real estate: residential and farm real estate. Goetzmann and Ibbotson (1990) use residential and farm real estate returns from the same sources. However, they note that the farm price data is available from 1913. They report appraisal-based commercial real estate returns from 1960. For the Netherlands, Eichholtz and Tates (1993) report average annual appraisal-based returns and standard deviations of a mixed portfolio of Dutch real estate from 1945.

The second index-type, which is based on property share returns, can only go back as far as the first public listing of a property company. In the U.S. this was in the early 1960s, when the first real estate investment trust was established. In other countries property companies have been established earlier. In the Netherlands, for example, the first such company is from 1929 (Van Gool, Weisz and Van Wetten 1993). However, over the long run, the investment portfolios of these companies have changed substantially, so their shares represent different real estate in different times. This hampers intertemporal comparability. These problems are also reflected in the literature. For the U.S., the property share-based index with the longest history is the one constructed by Gyourko and Siegel (1994). It starts in 1962.

The index-type that can probably be best expanded to the past is the transactions-based index. For these indices, data is often available in records in the land registers, or in municipal archives. For a historic transactions-based index to be viable, one has to find a sample of properties of which the quality level has been relatively stable in time. This can be very difficult, especially for indices concerning urban real estate. Moreover, the further one wants to go back in history, the more difficult it becomes to find the necessary transactions data. Going back very far can even be impossible. For the U.S., for example, cities are relatively young, and very old historic data on urban real estate are therefore not available.

European cities have more to offer in this regard, and historic information on real estate transactions is often available. In the Netherlands, the two studies on the historic performance of real estate that go back furthest, Kruijt (1977) and Van Arnhem (1991), both use transaction data from Amsterdam. Kruijt presents a series of average annual auction prices of Amsterdam real estate from 1877. Van Arnhem calculates the unweighted annual average of

a sample of transactions prices of real estate in Amsterdam in an unpublished study. His series goes back to 1650. A problem with both studies is that they do not adjust transaction prices for cross-sectional differences in quality. Their series do not represent appreciation very well, since the characteristics of the houses sold may have changed from period to period.

In this paper, the performance of real estate is studied in the long run. The paper involves the construction and analysis of a biennial house price index that starts in the year 1628. This index is based on the transactions of the buildings on the *Herengracht*, one of the canals in Amsterdam, and uses data from the same source as Van Arnhem (1991). The data will be discussed in the first section. In the next section, the literature on transactions-based real estate returns indices is briefly reviewed and the index is constructed using the hedonic repeated-measures method. The index is then presented, both in nominal and real terms, and its characteristics are discussed along with a brief overview of its performance, in which the index is related to important social and economic events like wars, epidemics and financial crises. The paper ends with concluding remarks and some suggestions for further research.

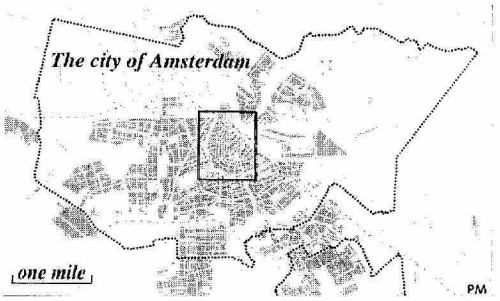
The Data

The *Herengracht* is one of three canals laid out in a half-circle around the medieval city center of Amsterdam. These three canals were developed during the most prosperous age in Amsterdam's history: the so-called Golden Age. For illustration, Figure 1 provides a map of Amsterdam and a more detailed map of its center.

The *Herengracht* has been dug in three phases, of which the first was in 1585, the second in 1612, and the third in 1660. By 1680, nearly all the lots on the canal had been developed. The properties built during the first development phase between 1585 and 1612 were relatively small and insignificant, but from the second construction phase in 1612, the *Herengracht* was meant to be the most fashionable and beautiful of all the canals in Amsterdam. It has been Amsterdam's finest location until present times.

Nearly all the properties on the *Herengracht* were for residential use, but, although the practice of trades was prohibited, many also contained the office of the owner. In the twentieth century, the buildings along the canal have been increasingly put to use as offices, especially in the more expensive areas. The first building specifically constructed for office use dates from

Figure 1 ■ This figure provides two maps of Amsterdam; the small one of the city as a whole, and the larger one of the city center. The location of the *Herengracht*, on which this study is based, can be seen on the map of the city center.



1858, while the first time an existing building was transformed into an office was in 1808. In the first half of the twentieth century many properties were transformed into offices. For all properties, ownership of the building and the land on which it stands go together.

The number of properties has gradually decreased over time. Originally, there were 614 lots, but already during the first development phase, lots were combined to allow for the construction of bigger buildings. This has continued until the present, and there are now some 487 properties.[1]

Although the properties on this canal are an obvious sample for investigations into the long term characteristics of real estate, no serious research has been undertaken to date. Especially the stable quality of the buildings is unique, and makes the *Herengracht* pre-eminently suitable for the construction of a long term real estate value index. Moreover, a data source exists which makes it relatively easy to develop such an index.

In 1975, Amsterdam celebrated its 750th anniversary. For that reason a monumental book was published, called *Vier eeuwen Herengracht* (*Four centuries Herengracht*). This book is completely devoted to the history of the *Herengracht*. Besides a general history, it contains drawings on a scale of 1 to 200 of the fronts of all the buildings on the canal,[2] as well as a complete history of each individual building, including all known transactions and transaction prices, the names of the owners and inhabitants, all known refurbishments, and the uses to which the building has been put. The historic house price index which is the core of this article is based on the information included in this book.

Between 1628 and 1973, 5583 transactions have taken place. Unfortunately, prices are not available for all of them. There are 4252 transaction prices for the period 1628 through 1973, which amounts to an average of 12.3 transactions per year.[3] However, this average does not hold for all time

[1] It is not possible to give the exact number of properties. Groups of adjacent buildings may be joined into one larger unit, but still be separate properties officially.

[2] According to the situations in 1770 and 1945.

[3] Apart from transactions for which prices are not known, some transactions were deleted from the sample. All transactions from World War II which involved the homes of Jewish citizens were deleted. They were forced to sell their homes for very low prices. Furthermore, transactions in which several buildings were sold at the same time were deleted.

periods. Especially in the seventeenth century, the average number of annual transactions is rather small. From 1628 through 1699, there are 371 transaction prices, or an average of 5.2 per year. For the eighteenth century, the average is 10.1, for the nineteenth century it is 15.1, and for the twentieth century through 1974, the annual average number of available transaction prices is 18.9. This increase is caused by the rising frequency of transactions as a whole and the percentage for which information is available. This could imply that the estimated index is not very accurate for the time periods for which there are few transaction prices. Moreover, transaction prices are not available at all for 1629, 1633 and 1673. In 1945, only office transactions have taken place, so a house price index value for that year cannot be constructed. These are the two reasons why the index is estimated on a biennial basis.

Method

Based on real estate transactions data, there are three ways to make a constant quality real estate value index. The first is the repeat sales method, which was pioneered by Bailey, Muth and Nourse (1963) and revitalized by Case and Shiller (1987, 1989). The second is the hedonic method, on which early work has been done by Griliches (1971), Halvorsen and Pollakowski (1981) and Linneman (1980), among others. Thirdly, various hybrids of the two have been proposed, for example by Case and Quigley (1991), Case, Pollakowski and Wachter (1991) and Shiller (1993).

The repeat sales method has important advantages over hedonic regression. It is based on appreciation of individual properties, and therefore does not require the property characteristics data needed for the hedonic method. In principle, only sale price and year of sale are needed to build an index. However, the method also has some disadvantages.

First, the repeat sales method wastes data, since only repeated transactions can be used. However, the relevance of this issue is inversely related to the length of the sample period. In the sample used here, all transactions repeat, and thus the problem is not very important.

The second disadvantage is that the sample of repeat transactions may not be representative of all transactions. Houses that sell often may be lemons or starter homes (Clapp and Giaccotto 1992). Again, this problem is especially relevant for short sample periods, but it may still be the case that lemons and starter homes dominate the transactions in the sample. However,

the buildings in the dataset here are of high quality and quite homogeneous cross-sectionally, so this is probably not the case.[4]

The third disadvantage of the straight repeat sales method is that it does not control for changes in property characteristics between sales. Especially when the interval between transactions is long, as is often the case in the sample used here this could be a problem. However, it can be overcome by using a hedonic repeated-measures approach, as proposed by Shiller (1993). In this method, the repeat sales estimator takes care of all the property characteristics that have remained constant between transactions, while the hedonics take care of the characteristics that have changed.

The only changing hedonic about which good information is available is the use of buildings. Beginning in the last century, but especially in the 1920s and 1930s, many of the buildings along the *Herengracht* were changed into offices. This has increased the values of these buildings. Since the goal of this study is the construction of a house price index, the office effect is filtered out. Therefore, a repeat sales approach is used, with one hedonic added: changes in use.

The following model is estimated:

$$y = x\gamma + z\lambda + \epsilon \tag{1}$$

in which y is the vector of real log price differences of the transactions pairs, x is a matrix of time dummy variables, z a matrix of building-use dummy variables, γ and λ are coefficient vectors, and ϵ is the vector of regression error terms. The coefficient vector γ is the basis of the index. To calculate real transactions prices, a time-series of consumer prices that goes back to 1620 is used.[5] The 4252 transaction prices provide a total of 3623 transaction pairs that are used to estimate the model.

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[4] In a previous version of this paper, the buildings in the sample were grouped into six different area groups, in which the buildings differ from each other with regards to year of development, lot size, existence of a garden and angle to the sun. These groups were used as a basis for locational dummies which were included in a hedonic regression. The coefficients of these dummies were not statistically different from each other.

[5] This series has three different sources. For the period 1628–1800, the data is from Nusteling (1985), for 1800–1913, it is from Van Riel (1995), and for 1913–1973, the data is from the Central Bureau of Statistics (1959, 1979 and 1994).

The x matrix is designed as in the Bailey, Muth and Nourse (1963) and Case and Shiller (1987) specification, with the estimated regression coefficients tracing out the real log index level. In this setup, the time dummy variables equal minus one for the period of the first transaction, plus one for the period of the second transaction, and zero otherwise.

In the z matrix for the hedonic variable, the dummies depend on the use of properties when sold. If a building is bought and sold as a house, the corresponding row of the matrix has all zeros. If a building was bought as a house and sold as an office, the dummy variables equal plus one for the year of the sale, and zero otherwise. If a building was bought as an office and sold as a house, the dummy variables equal minus one for the buy period, and zero otherwise. If a building is bought and sold as an office, the dummy variables equal minus one for the buy period, plus one for the sale period, and zero otherwise.

For periods in which only housing transactions have taken place, the corresponding columns of the z matrix include only zeros, which would make z singular. To avoid this, these columns are deleted from the matrix.

The correction for heteroskedasticity in the regression error terms follows that employed by Case and Shiller (1987). This amounts to a three-stage weighted repeat sales procedure, in which the first stage is an ordinary least squares regression estimate of (1). Next, the squared errors from this regression are themselves regressed on a constant and the time between transactions. The third stage involves a generalized least squares regression, where the stage-one regression is repeated after dividing each observation by the square root of the fitted value of the second stage.

The results of this regression are given in Table 1. The F-statistic for the hedonic variable is 5.60, which implies significance at the 1% level. The constant and slope coefficient of the second stage regression are both significant, but the correlation between the first and third stage regressions is 0.99. This means that the weighted least squares correction does not alter the results of the first regression very much. The R^2 of the regression in about 0.40. This is somewhat lower than previously found in the literature. For example, Case and Shiller (1987) find R^2s between 0.44 and 0.83.

The Index

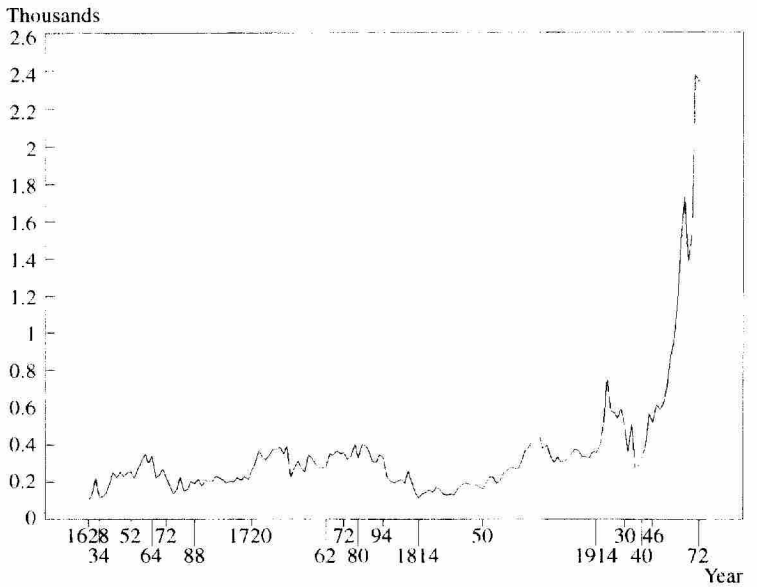
As noted before, the vector of γ coefficients in Equation (1) represent the real price-index level. However, since logarithms of transaction prices were used, this index is logarithmic, and the exponents of the coefficients are

Table 1 ■ Regression results.

Number of Transaction Pairs	3623
F-statistic	5.60
Stage I, R^2	0.41
Stage II, Constant	0.19
	(16.1)
Stage II, Coefficient	0.001
	(2.9)
Stage III, R^2	0.40
Correlation (I, III)	0.99

The F-statistic tests for the significance of the hedonic variables in the regression. Correlation (I, III) is the correlation coefficient of the indices that are obtained in the first and the third stage regression. t-Stats of the constant and the coefficients of the second stage are denoted in parentheses.

Figure 2 ■ This figure provides a graph of the levels of the *Herengracht* index. The index has biennial observations from 1628 through 1973 and is in nominal terms. Only years of historic significance are printed on the x-axis.

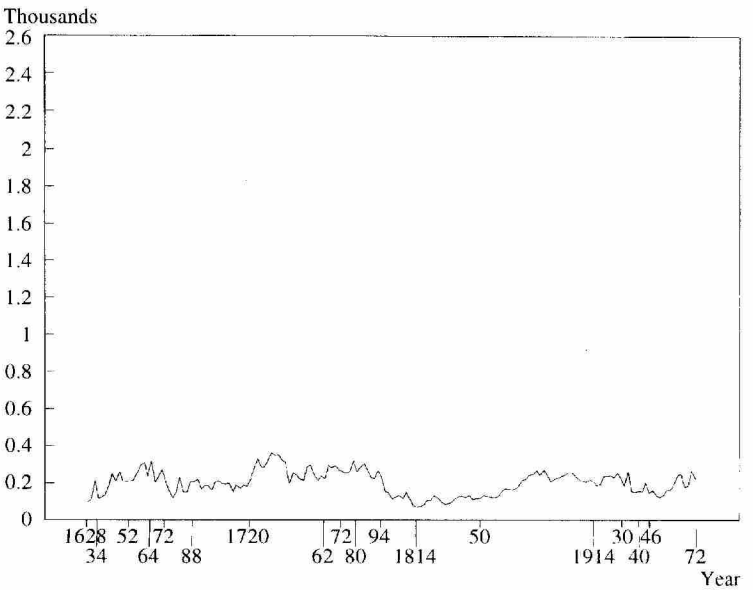


taken to get a linear index. Using the same consumer price data used to calculate the real transactions prices, an index was also constructed in nominal terms. In graphic form, the nominal index is presented in Figure 2, and the real index in Figure 3. The Appendix provides the numbers for both indices.

Although the nominal value of the properties in the sample has risen more than twentyfold between 1628 and 1973, there has hardly been a structural increase in value until the Second World War. It is striking to see that the index has been subject to decreasing trends for long periods of time. The end of the eighteenth and beginning of the nineteenth century is he most notable example of this. The index, with a base value of 100 in 1628–1629, varies between 100 and 700 until the 1950s. Only after the Second World War have the nominal values of the properties in the sample shown a structural increase. However, this increase has largely been caused by inflation, as seen in Figure 3.

Most striking in this graph is the fact that the appreciation of the index almost disappears when expressed in real guilders. The real average biennial

Figure 3 ■ This figure provides a graph of the levels of the *Herengracht* index. The index has biennial observations from 1628 through 1973 and is in real terms. Only years of historic significance are printed on the x-axis.



increase of the index is very low, and the index level in 1972–1973 is 218.7. However, it should be noted that this value is very dependent on the choice of the base period. For example, if 1632–1633 had been used as the base, there would have been virtually no real increase in index value.

It can also be seen that inflation had a very limited influence on the value of real estate in the seventeenth, eighteenth and nineteenth centuries, and that the strong increase in nominal real estate values after the Second World War was to a large extent inflation-driven. From Figure 3, one can conclude that the buildings in the sample have kept their real value in the long run but have not increased in value.

To get a better feel for the behavior of the index in history, the means and standard deviations of the biennial logarithmic differences in the index level were calculated, both in nominal and real terms. Table 2 provides these statistics for the full period and for selected sub-periods. Between the 1628–1629 and 1972–1973 periods, the average biennial logarithmic increase in value was only 1.8% in nominal guilders. In real terms, this was a mere 0.5%. The overall standard deviation of the logarithmic changes of the index value is 17.3% in nominal terms and 18.5% in real terms. However, different time periods give very different pictures, both in terms of price changes and of volatilities.

The 1630s were a turbulent era for Amsterdam. From 1634 through 1637, the city was hit by the infamous Tulipmania and a pest epidemic. Between 1632 and 1634, house prices on the *Herengracht* decreased almost 50%. The tulip market only crashed in 1637, when house prices were rising again. Therefore, the sudden end of Tulipmania has probably had only a limited effect on the Amsterdam real estate market. The epidemic probably had more impact on house values. In 1636 alone, 14% of the Amsterdam population died of the pest. This probably had a negative effect on the demand for housing space.

The period between 1628 and 1688 is characterized by high volatility in house prices. For that period the import and export of goods from Amsterdam is also very volatile. Trade played a predominant role in the wealth of Amsterdam in this era, and during the fifty years after 1628, trade was disrupted for some periods (Westermann 1948). The Netherlands were involved in the first Anglo-Dutch War (1652–1654), the Nordic War (1659) and the Second English War (1664–1667), which were all waged at sea. The Anglo-Dutch wars severely disrupted Amsterdam's trading routes. As a consequence, trading was restricted and house prices decreased

Table 2 ■ Means and standard deviations of price changes of the *Herengracht* index.

Period		Nominal Index		Real Index	
		Mean	Std. Dev.	Mean	Std. Dev.
Full Sample	1628–1973	1.8	17.7	0.5	18.5
17th Century	1628–1699	2.0	23.2	1.3	26.3
18th Century	1700–1799	0.1	14.9	−0.2	16.3
19th Century	1800–1899	0.9	12.6	1.0	13.8
20th Century	1900–1973	5.3	20.2	−0.2	17.9
Pre Napoleontic Period	1628–1807	0.7	18.4	0.1	20.8
Post Napoleontic Period	1814–1973	3.8	15.7	1.5	14.6
Interbellum	1920–1939	−6.3	27.8	−2.6	22.5
Post World War II	1946–1973	11.6	15.5	3.2	18.2

The table gives means and standard deviations of biennial logarithmic price changes of the *Herengracht* index for the full sample period and selected sub-periods.

simultaneously. For the periods 1654–1655 and 1663–1664, this was reinforced by pest epidemics which influenced the demand for housing space.

Between the wars, trade flourished. During the Anglo-Spanish War of 1655–1660 the commerce of Amsterdam reached its zenith, since England, its main competitor in world trade, was largely out of business. This is reflected in the index. In real terms, house prices reached their seventeenth century peak in 1660–1661. The real index has a value of 306.7 for these years. Thereafter, England again had its hand free for competition. Trade declined, and house prices along with it.

However, the wealth of the city of Amsterdam was affected most severely by the events that took place between 1672 and 1674, the Third Anglo-Dutch War. In 1672, England and France almost simultaneously declared war on the Republic. The English attacked the returning Dutch Levant convoy in the Channel, and the French invaded the Netherlands. By early summer, they stood a mere 15 miles from Amsterdam. What followed was a deep financial crisis, and a near-civil war (Israel 1995). These developments are also reflected in the *Herengracht* index. In real terms, it declined from a level of 268.6 in 1670–1671 to 117.5 in 1676–1677.

The turbulence which characterized this era is also reflected in the standard deviation of the annual price changes of the index. For the seventeenth century as a whole this standard deviation is 23.2% for the nominal index

and 26.3% for the real index. Compared to the volatilities observed in later centuries, this is quite high.

The eighteenth century was less volatile. The real index shows a standard deviation of 16.3%. During this century, Amsterdam gradually changed from a trading city into a financial center. This development is traceable in the index. The Fourth Anglo-Dutch War, 1780–1784, did influence trade, but real estate values were not affected very much. By that time, Amsterdam had changed from a trading city into a financial center. On the other hand, financial crises seem to have had some influence on house values in the eighteenth century. There were three such crises in this century: in 1720, 1763 and 1773. Prior to the 1720 crisis, and simultaneously with the famous South Sea Bubble in the United Kingdom, Amsterdam was under the influence of a short-lasting financial bubble. The crisis did not have lasting effects on real house values. This also holds for the other two crises.

In the nineteenth century, Amsterdam was not characterized by specific major events, but by a long and deep economic crisis. Amsterdam's pre-eminence, already gone as a trading city, had now also vanished as a financial center. The city did not partake in the early developments of the industrialization. House prices, which had decreased substantially during the foundation of the Batavian Republic (1795), remained at low levels during the first 50 years of the nineteenth century. For 1814–1815, the real index has a level of 76.8. Only during the second half of the nineteenth century, when Amsterdam started industrializing, house prices gradually improved. Another driving force behind this increase in values could have been the growth of the Amsterdam population. Between 1849 and 1880, the population of Amsterdam went from 224,000 to 320,000. This growth probably caused an increase in housing demand, and since the supply of housing was more or less constant during this period, house prices increased.

In real terms, house prices gradually decreased from the last decade of the eighteenth century through to the Second World War. During the First World War, in which the Netherlands were neutral, but which affected the Dutch economy, house prices decreased more than 13%. The index had a real value of 182.2 in 1916–1917, while it had been at 212.7 in 1912–1913. After the war, house prices recovered.

In nominal terms, house prices reached a peak in the 1920s, only to fall substantially during the depression years from levels of over 700 to less than 300. This is not very surprising, but in real terms, the index did not decrease dramatically during the depression. This is contrary to other assets like stocks, which fell substantially in real terms. For the Interbellum as a whole,

between the 1920–1921 and 1938–1939 periods, the nominal index shows an biennial decrease in value of 6.3%. The real index depreciated by an average 2.6% per two years. The volatility of the index is very high during this period. Standard deviations are 27.8% for the nominal and 22.5% for the real index.

During the Second World War, real house prices increased again. After the war, the nominal index started increasing to unprecedented levels. From 1946, the annual increase in value averaged 11.6%. In real terms, the annual increase was still 3.2%. Compared to the historical returns reported in this article, these averages are very high. This indicates that data from the post World War II era is very likely to give an overstated impression of the performance of real estate. This is a problem since most performance studies of real estate are based on data from that period.

Conclusion

In this article, a long-run hedonic repeated-measures index of real estate values is constructed based on the transactions of a sample of high quality properties in Amsterdam. The index is biennial and runs from 1628 through 1973. In nominal terms, it increases more than tenfold over the sample period, but this increase all but disappears when the index is calculated in real terms. During the years after World War II, which is the period most real estate performance studies focus on, the index shows a nominal biennial increase of 11.6% and a real increase of 3.2%. For the period 1628 through 1974, these figures are 1.8% and 0.5%, respectively. This indicates that most existing studies of real estate may well overstate its long run performance.

Therefore, to obtain a better understanding of real estate performance, more historic research is needed. For North America and Western Europe, the post World War II period has been the most prosperous and stable era in history, and empirical research based on data from that period probably leads to optimistic outcomes. Looking at real estate performance in more turbulent and less prosperous times can give valuable new insights.

The long run real estate data this paper is based upon is therefore ideally suited to address important research questions like the volatility of real estate prices and land values, and the efficiency of the housing market. Another possible extension of this research involves construction methods for transaction-based real estate indices. Due to the length of the dataset, all properties trade more than once. This makes the dataset ideally suited for a comparative study on the repeat sales versus the hedonic method of index

construction, since the repeat sales are not a potentially biased subsample of all transactions.

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Appendix

The Herengracht index, Biennial, 1628–1629 and 1972–1973.

Year	Nominal Index	Real Index	Year	Nominal Index	Real Index	Year	Nominal Index	Real Index
1628/9	100.0	100.0	1686/7	202.0	201.4	1744/5	273.6	251.8
1630/1	131.2	110.7	1688/9	190.8	201.7	1746/7	310.6	239.7
1632/3	218.0	212.7	1690/1	213.7	219.2	1748/9	279.7	218.3
1634/5	117.0	113.5	1692/3	176.5	168.0	1750/1	250.5	212.1
1636/7	121.4	124.4	1694/5	210.6	182.0	1752/3	342.5	285.2
1638/9	140.9	136.8	1696/7	201.9	183.0	1754/5	325.6	290.2
1640/1	193.8	188.9	1698/9	201.5	158.8	1756/7	294.6	238.2
1642/3	250.5	250.2	1700/1	229.2	201.7	1758/9	274.0	211.2
1644/5	221.8	210.3	1702/3	221.1	209.0	1760/1	274.9	235.3
1646/7	250.8	256.1	1704/5	208.6	194.6	1762/3	279.1	219.0
1648/9	230.2	210.6	1706/7	194.8	191.7	1764/5	349.1	289.4
1650/1	247.2	206.2	1708/9	202.1	195.2	1766/7	342.3	276.0
1652/3	254.3	209.8	1710/1	199.2	151.4	1768/9	367.9	288.6
1654/5	218.7	211.2	1712/3	221.0	186.6	1770/1	349.6	266.5
1656/7	266.2	250.8	1714/5	208.4	169.5	1772/3	356.3	258.4
1658/9	310.8	289.0	1716/7	230.3	187.8	1774/5	320.7	247.1
1660/1	349.2	306.7	1718/9	211.9	180.7	1776/7	338.7	259.6
1662/3	297.1	234.5	1720/1	260.9	219.7	1778/9	402.9	317.9
1664/5	339.1	314.3	1722/3	296.2	272.3	1780/1	326.5	257.6
1666/7	220.1	203.0	1724/5	366.9	327.3	1782/3	398.0	282.6
1668/9	235.1	228.6	1726/7	331.7	282.0	1784/5	394.7	300.2
1670/1	267.8	268.6	1728/9	316.3	282.7	1786/7	366.4	272.9
1672/3	218.1	201.6	1730/1	344.6	325.3	1788/9	306.4	226.1
1674/5	184.2	160.7	1732/3	376.5	358.7	1790/1	304.5	221.9
1676/7	137.8	117.5	1734/5	371.3	343.1	1792/3	347.1	265.4
1678/9	159.7	151.8	1736/7	386.4	345.9	1794/5	329.2	230.3
1680/1	224.7	230.0	1738/9	348.8	317.3	1796/7	228.6	148.6
1682/3	151.7	150.2	1740/1	393.6	310.9	1798/9	207.8	147.6
1684/5	159.9	150.0	1742/3	224.4	192.2	1800/1	191.5	110.7

Appendix ■ (continued)

Year	Nominal Index	Real Index	Year	Nominal Index	Real Index	Year	Nominal Index	Real Index
1802/3	206.0	124.0	1860/1	207.7	124.1	1918/9	529.9	190.5
1804/5	212.6	129.1	1862/3	249.6	146.3	1920/1	754.5	231.7
1806/7	194.0	113.6	1864/5	265.6	166.3	1922/3	580.8	231.3
1808/9	259.6	151.4	1866/7	277.8	164.8	1924/5	570.2	233.4
1810/1	195.0	112.5	1868/9	272.5	160.1	1926/7	540.2	227.4
1812/3	139.3	76.8	1870/1	270.1	167.4	1928/9	591.0	248.8
1814/5	115.3	68.1	1872/3	306.6	178.1	1930/1	493.3	220.3
1816/7	135.7	72.5	1874/5	367.4	210.7	1932/3	360.4	183.1
1818/9	143.2	82.2	1876/7	387.1	219.3	1934/5	506.3	257.3
1820/1	160.9	103.7	1878/9	417.0	239.4	1936/7	277.5	148.7
1822/3	144.6	102.9	1880/1	418.4	241.4	1938/9	283.6	146.6
1824/5	172.5	131.4	1882/3	442.6	264.3	1940/1	335.3	153.2
1826/7	161.1	117.7	1884/5	378.1	237.8	1942/3	399.0	149.8
1828/9	132.9	96.8	1886/7	393.8	267.2	1944/5	566.0	198.6
1830/1	130.4	83.8	1888/9	344.6	242.6	1946/7	517.7	144.6
1832/3	134.9	90.0	1890/1	300.0	202.0	1948/9	611.5	158.1
1834/5	131.8	93.0	1892/3	331.8	218.3	1950/1	589.5	130.2
1836/7	163.3	115.0	1894/5	308.4	223.0	1952/3	618.8	122.0
1838/9	183.0	127.4	1896/7	308.4	231.0	1954/5	709.4	134.0
1840/1	192.0	125.7	1898/9	326.6	238.4	1956/7	876.3	159.0
1842/3	188.6	120.8	1900/1	351.6	252.5	1958/9	953.1	162.4
1844/5	182.2	130.4	1902/3	374.4	250.8	1960/1	1168.6	188.2
1846/7	182.0	108.3	1904/5	361.5	231.6	1962/3	1542.7	238.7
1848/9	178.0	113.9	1906/7	336.1	215.3	1964/5	1727.9	245.4
1850/1	163.5	114.1	1908/9	333.8	205.0	1966/7	1381.8	177.9
1852/3	191.2	130.6	1910/1	326.9	200.7	1968/9	1533.3	181.9
1854/5	224.6	125.9	1912/3	360.8	212.7	1970/1	2375.9	263.3
1856/7	225.5	121.6	1914/5	355.3	209.5	1972/3	2337.2	218.7
1858/9	194.8	116.8	1916/7	395.7	182.2			