American Economic Review, forthcoming

No Price Like Home:

Global House Prices, 1870 – 2012 *

Katharina Knoll† Moritz Schularick‡ Thomas Steger§

Abstract

How have house prices evolved over the long run? This paper presents annual house prices for 14 advanced economies since 1870. We show that real house prices stayed constant from the 19th to the mid-20th century, but rose strongly and with substantial cross-country variation in the second half of the 20th century. Land prices, not replacement costs, are the key to understanding the trajectory of house prices. Rising land prices explain about 80 percent of the global house price boom that has taken place since World War II. Our findings have implications for the evolution of wealth-to-income ratios, the growth effects of agglomeration, and the price elasticity of housing supply.

Keywords: house prices, land prices, national wealth.

JEL Classification: N10, O10, R30, R40

*We wish to thank Klaus Adam, Christian Bayer, Benjamin Born, Jacques Friggit, Volker Grossmann, Riitta Hjerppe, Thomas Hintermaier, Mathias Hoffmann, Carl-Ludwig Holtfrerich, Òscar Jordà, Philip Jung, Marvin McInnis, Christopher Meissner, Alexander Nützenadel, Thomas Piketty, Jonathan D. Rose, Petr Sedladcek, Sjak Smulders, Kenneth Snowden, Alan M. Taylor, Daniel Waldenström, Nikolaus Wolf, and three anonymous reviewers for helpful discussions and comments. Schularick received financial support from the Volkswagen Foundation. Part of this research was undertaken while Knoll was at New York University. Miriam Kautz, Hans Torben Löfflad and Thilo Albers provided excellent research assistance. All remaining errors are our own.

†University of Bonn. Email: katharina.knoll@uni-bonn.de.

‡Corresponding author. University of Bonn, CEPR, and CESifo. University of Bonn, Institute for Macroeconomics und Econometrics, Adenauerallee 24-42, D-53113 Bonn, Tel: +49-(0)228-737976, Fax: +49-(0)228-739189, Email: schularick@uni-bonn.de.

§Leipzig University, CESifo, and IWH. Email: steger@wifa.uni-leipzig.de.

1 Introduction

For Dorothy there was no place like home. But despite her ardent desire to get back to Kansas, Dorothy probably had no idea how much her beloved home cost. She was not aware that the price of a standard Kansas house in the late 19th century was around 2,400 dollars (Wickens, 1937) and could not have known whether relocating the house to Munchkin Country would have increased its value or not. For economists there is no price like home – at least not since the global financial crisis: fluctuations in house prices, their impact on the balance sheets of consumers and banks, as well as the deleveraging pressures triggered by house price busts have been a major focus of macroeconomic research in recent years (Jordà et al., 2015; Mian and Sufi, 2014; Shiller, 2009). In the context of business cycles, the nexus between monetary policy and the housing market has become a rapidly expanding research field (Adam and Woodford, 2013; Goodhart and Hofmann, 2008; Del Negro and Otrok, 2007; Leamer, 2007). Houses are typically the largest component of household wealth, the key collateral for bank lending and play a central role for long-run trends in wealth-to-income ratios and the size of the financial sector (Jordà et al., 2016; Piketty and Zucman, 2014). Yet despite their importance to the macroeconomy, surprisingly little is known about long-run trends in house prices. Our paper fills this void.

Based on extensive historical research, we present house price indices for 14 advanced economies since 1870. A considerable part of this paper is devoted to the presentation and discussion of new stylized facts that we unearthed from more than 60 different primary and secondary sources. Houses are heterogeneous assets and when combining data from a variety of sources great care is needed to construct long-run indices that account for quality improvements, shifts in the composition of the type of houses and their location. Controlling for quality changes and shifts in the overall quality-mix of transacted houses is arguably the main challenge for the construction of house price indices over extended periods. We go into considerable detail to corroborate the plausibility and test the robustness of the trends we identify using additional historical sources. However, researchers using our data should be aware of these caveats. In addition to house price data, we have also assembled corresponding long-run data for construction costs and farmland prices.

Using the new dataset, we are able to show that since the 19th century real house prices in advanced economies have taken a particular trajectory that, to the best of our knowledge, has not yet been documented. From the last quarter of the 19th to the mid-20th century, house prices in most industrial economies were largely constant in real (CPI-deflated) terms. By the 1960s, they were, on average, not much higher than they were on the eve of World War I. They have been on a long and pronounced ascent since then, giving rise to a hockey-stick pattern of house prices in the long run.

While house prices have increased in all countries over the past 140 years, we also find considerable cross-country heterogeneity. Australia has seen the strongest, Germany the weakest increase in real house prices since 1870. House prices have broken out of their historical range in almost all countries in the second half of the 20th century. Yet cross-country differences also extend to the timing of the surge of house prices. In most countries, it occurred in the 1960s and 1970s, in some countries the trajectory began to change already shortly after World War II, and in some others only after 1990. Japan is the only country in which house prices fell significantly over the past two decades.

We then study the driving forces of this hockey-stick pattern of house prices. Houses are bundles of the structure and the underlying land. An accounting decomposition of house price dynamics into replacement costs of the structure and land prices demonstrates that rising land prices hold the key to understanding the upward trend in global house prices. While construction costs have flat-lined in the past decades, sharp increases in residential land prices have driven up housing values. Our decomposition shows that more than 80 percent of the increase in house prices between 1950 and 2012 can be attributed to land prices. The results of this decomposition exercise are sensitive to assumptions about the land share in the value of housing. As a baseline, we assume a land share of 50 percent, but even for land shares as low as 25 percent, the land component still accounts for more than 70 percent of the house price increase. The pronounced increase in residential land prices in recent decades contrasts starkly with the period from the late 19th to the mid-20th century. During this period, residential land prices remained, by and large, constant despite substantial population and income growth. We are not the first to note the upward trend in land prices in the second half of the 20th century (Glaeser and Ward, 2009; Case, 2007; Davis and Heathcote, 2007; Gyourko et al., 2006). But to our knowledge, it has not been shown that this is a broad based, cross-country phenomenon that marks a break with the previous era.

This finding challenges the view that in the long run the price elasticity of housing supply is high as additional land for construction may not be readily available at constant cost (Shiller, 2009, 2007; Grebler et al., 1956). Through agglomeration spillovers rising land prices may also have positive effects on economic growth (Davis et al., 2014). Moreover, our findings have important implications for much-debated trends in national wealth and its distribution (Piketty and Zucman, 2014). Bonnet et al. (2014) have stressed that the late 20th century surge in wealth-to-income ratios in Western economies is largely due to increasing housing wealth. Our paper traces the surge in housing wealth in the second half of the 20th century back to land price appreciation. This price channel is conceptually different from the capital accumulation channel stressed by Piketty (2014) as an explanation for rising wealth-to-income ratios. Higher land prices can push up wealth-to-income ratios even if the capital-to-income ratio stays constant. The critical importance of land prices for the trajectory of wealth-to-income ratios evokes Ricardo's famous principle of scarcity: Ricardo (1817) argued that, over the long run, economic growth profits landlords disproportionately, as the owners of the fixed factor. Since land is unequally distributed across the population, Ricardo reasoned that market economies would produce rising inequality (Piketty, 2014).

The structure of the paper is as follows: the next section describes the data sources and the challenges involved in constructing long-run house price indices. The third section distills new stylized facts from the long-run data: real house prices have risen in advanced economies, albeit with considerably cross-country heterogeneity, and virtually all of the increase occurred in the second half of the 20th century. These observations are robust to a number of additional checks relating to quality adjustments and sample composition. In the fourth part, we use a parsimonious model of the housing market to decompose changes in house prices into changes in replacement costs and land prices. We show that land price dynamics are key to understanding the observed long-run house price dynamics. In the fifth section, we discuss the economic implications of our results. The final section concludes and outlines avenues for further research.

2 Data

This paper presents a novel dataset that covers residential house price indices for 14 advanced economies over the years 1870 to 2012. It is the first systematic attempt to construct house price series for advanced economies since the 19th century on a consistent basis from historical materials. Using more than 60 different sources, we combine existing data and unpublished material. The dataset reaches back to the early 1920s (Canada), the early 1910s (Japan), the early 1900s (Finland, Switzerland), the 1890s (U.K., U.S.), and the 1870s (Australia, Belgium, Denmark, France, Germany, The Netherlands, Norway, Sweden). Building such a comprehensive data set required locating and compiling data from a wide range of scattered primary sources, as detailed below and in the appendix.

2.1 House price indices

An ideal house price index captures the appreciation of the price of a standard, unchanged house. Yet houses are heterogeneous assets whose characteristics change over time. Houses are also sold infrequently, making it difficult to observe their pricing over time. Four main challenges are involved in constructing consistent long-run house price indices. These relate to differences in the geographic coverage, the type and vintage of the house, the source of pricing, and the method used to adjust for quality and composition changes.

Table 1: Overview of house price indices.

Country	Years	Geographic Coverage	Property Vintage & Type	Method
Australia	1870–1899	Urban	Existing Dwellings	Median Price
	1900–2002	Urban	Existing Dwellings	Median Price
	2003–2012	Urban	New & Existing Dwellings	Mix-Adjustment
Belgium	1878–1950	Urban	Existing Dwellings	Median Price
	1951–1985	Nationwide	Existing Dwellings	Average Price
	1986–2012	Nationwide	Existing Dwellings	Mix-Adjustment
Canada	1921–1949	Nationwide	Existing Dwellings	Replacement Values (incl. Land)
	1956–1974	Nationwide	New & Existing Dwellings	Average Price
	1975–2012	Urban	Existing Dwellings	Average Price
Denmark	1875–1937	Rural	Existing Dwellings	Average Price
	1938–1970	Nationwide	Existing Dwellings	Average Price
	1971–2012	Nationwide	New & Existing Dwellings	SPAR
Finland	1905–1946	Urban	Land Only	Average Price
	1947–1969	Urban	Existing Dwellings	Average Price
	1970–2012	Nationwide	Existing Dwellings	Mix-Adjustment, Hedonic
France	1870–1935	Urban	Existing Dwellings	Repeat Sales
	1936–1995	Nationwide	Existing Dwellings	Repeat Sales
	1996–2012	Nationwide	Existing Dwellings	Mix-Adjustment
Germany	1870–1902	Urban	All Existing Real Estate	Average Price
	1903–1922	Urban	All Existing Real Estate	Average Price
	1923–1938	Urban	All Existing Real Estate	Average Price
	1962–1969	Nationwide	Land Only	Average Price
	1970–2012	Urban	New & Existing Dwellings	Mix-Adjustment
Japan	1913–1930	Urban	Land only	Average Prices
	1930–1936	Rural	Land only	Average Price
	1939–1955	Urban	Land only	Average Price
	1955–2012	Urban	Land only	Average Price
The Netherlands	1870–1969	Urban	All Existing Real Estate	Repeat Sales
	1970–1996	Nationwide	Existing Dwellings	Repeat Sales
	1997–2012	Nationwide	Existing Dwellings	SPAR
Norway	1870–2003	Urban	Existing Dwellings	Hedonic, Repeat Sales
	2004–2012	Urban	Existing Dwellings	Hedonic
Sweden	1875–1956	Urban	New & Existing Dwellings	SPAR
	1957–2012	Urban	New & Existing Dwellings	Mix-Adjustment, SPAR
Switzerland	1900–1929	Urban	All Existing Real Estate	Average Price
	1930–1969	Urban	Existing Dwellings	Hedonic
	1970–2012	Nationwide	Existing Dwellings	Mix-Adjustment
United Kingdom	1899–1929	Urban	All Existing Real Estate	Average Price
	1930–1938	Nationwide	Existing Dwellings	Hypothetical Average Price
	1946–1952	Nationwide	Existing Dwellings	Average Price
	1952–1965	Nationwide	New Dwellings	Average Price
	1966–1968	Nationwide	Existing Dwellings	Average Price
	1969–2012	Nationwide	Existing Dwellings	Mix-Adjustment
United States	1890–1928	Urban	New Dwellings	Repeat Sales
	1929–1940	Urban	Existing Dwellings	Hedonic
	1941–1952	Urban	Existing Dwellings	Median Price
	1953–1974	Nationwide	New & Existing Dwellings	Mix-Adjustment
	1975–2012	Nationwide	New & Existing Dwellings	Repeat Sales

First, house price indices may either be national or cover several cities or regions (Silver, 2012). Whereas rural indices may underestimate house price appreciation, urban indices may be upwardly biased. Second, house prices can either refer to new or existing homes, or a mix of both. Price indices that cover only newly constructed properties may underestimate overall property price appreciation if new construction tends to be located in areas where supply is more elastic (Case and Wachter, 2005). Third, prices can come from sale prices in the market, listing prices or appraised values. Fourth, if the quality of houses improves over time, a simple mean or median of observed prices can be upwardly biased (Case and Shiller, 1987; Bailey et al., 1963). In Appendix A.1, we discuss different approaches to construct house price indices and the extent to which they deal with quality and composition changes over time in greater detail.

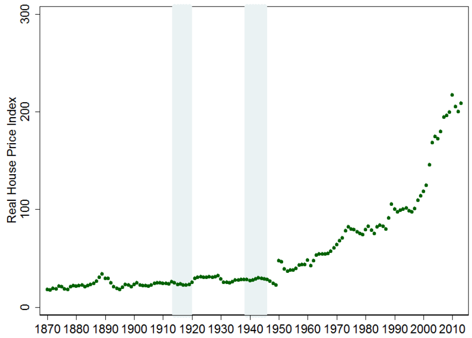
2.2 Historical house price data

Most countries' statistical offices or central banks began to collect data on house prices in the 1970s. Extending these back to the 19th century involved compromises between the ideal and the available data. We typically had to link different types of indices. As a general rule, we chose constant quality indices where available and opted for longitudinal consistency as well as historical plausibility.

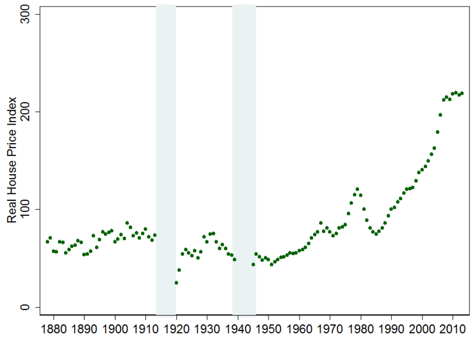
A central challenge for the construction of long-run price indices relates to quality changes. While homes today typically feature central heating and hot running water, a standard house in 1870 did not even have electric lighting. We aimed for the broadest possible geographical coverage and, whenever possible, kept the type of house covered constant over time. We normally chose data for the price of existing houses instead of new ones.

We are confident that the indices give a reliable picture of price developments in the 14 housing markets covered in this study. Yet we had to make a number compromises. Some series rely on appraisals, others on list or transaction prices. Despite our efforts to ensure the broadest geographical coverage possible, in a few cases – such as the Netherlands prior to 1970 or the index for France before 1936 – the country-index is based on a narrow

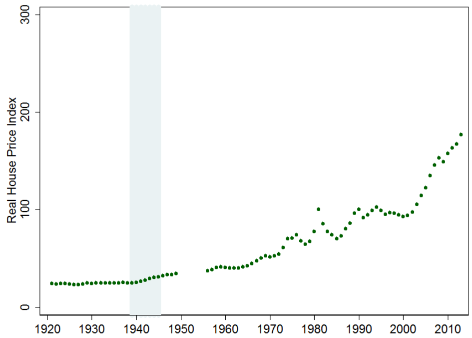
Figure 1: Historical house prices, 14 countries



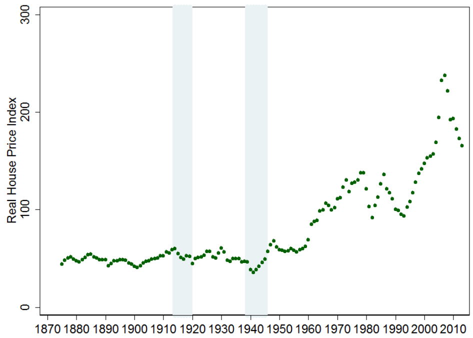
(a) Australia, 1870–2012



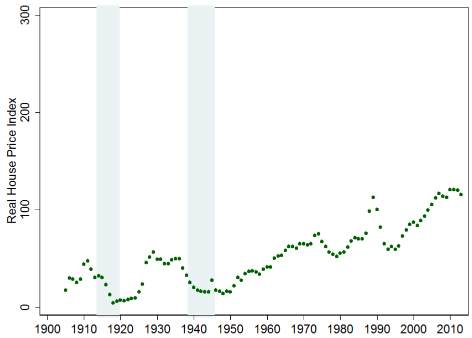
(b) Belgium, 1878–2012



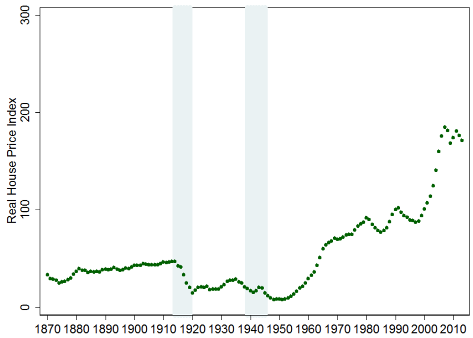
(c) Canada, 1921–2012



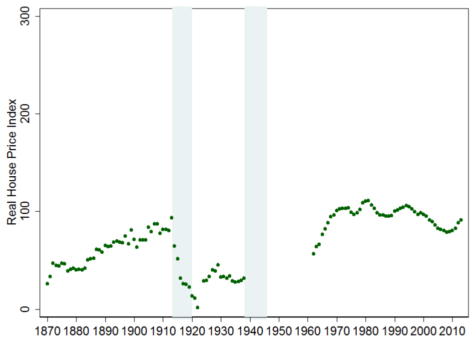
(d) Denmark, 1875–2012



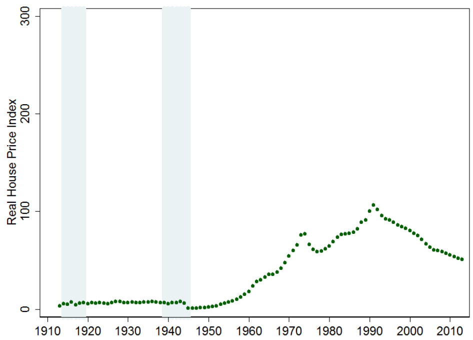
(e) Finland, 1905–2012



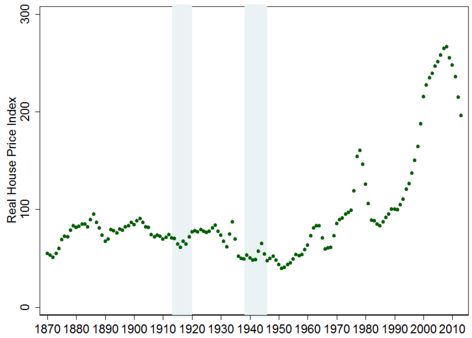
(f) France, 1870–2012



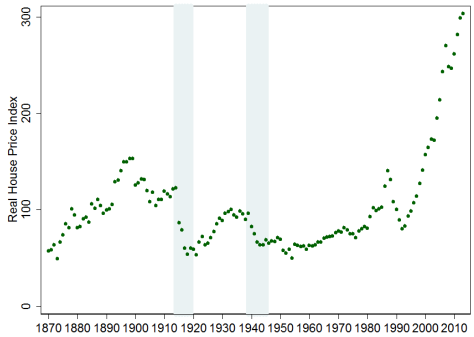
(g) Germany, 1870–2012



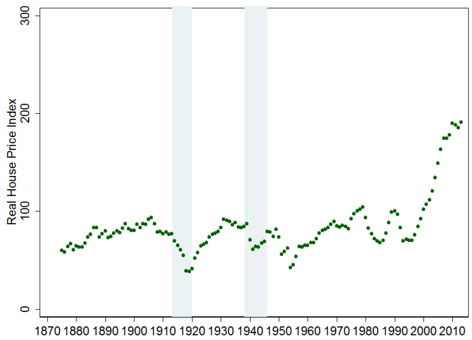
(h) Japan, 1913–2012



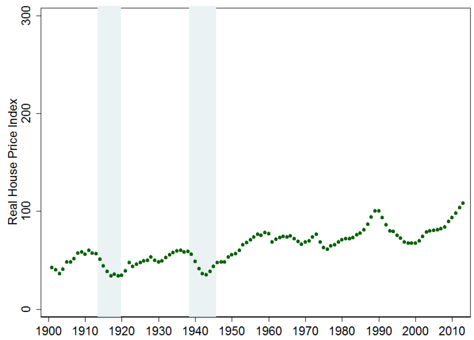
(i) The Netherlands, 1870–2012



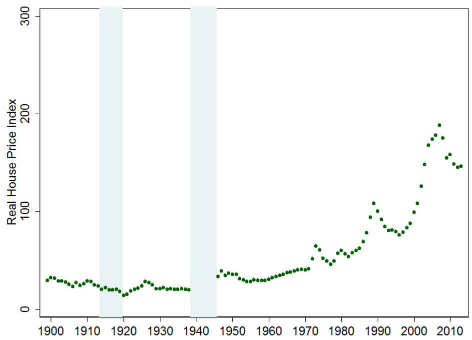
(j) Norway, 1870–2012



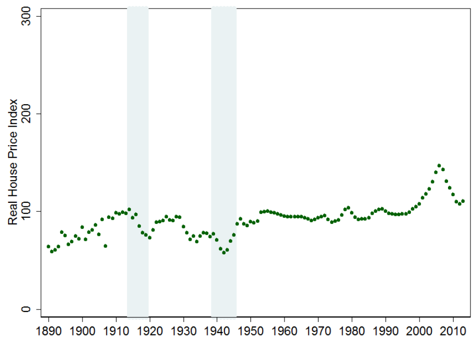
(k) Sweden, 1875–2012



(l) Switzerland, 1901–2012



(m) United Kingdom, 1899–2012



(n) United States, 1890–2012

geographical coverage. For certain periods no constant quality indices were available, and we relied on mean or median sales prices. We discuss potential biases arising from these compromises in greater detail below and argue that they do not systematically distort the aggregate trends we uncover.

To construct long-run house price indices for a broad cross-country sample, we partly relied on the work of economic and financial historians. Examples include the index for Amsterdam (Eichholtz, 1994) and the city-indices for Norway (Eitrheim and Erlandsen, 2004). In other cases we took advantage of previously unused sources to construct new series. Some historical data come from dispersed publications of national or regional statistical offices, such as the Helsinki Statistical Yearbook, the publications of the Swiss Federal Statistical Office and the Bank of Japan (1966).

We also drew upon unpublished data from tax authorities such as the U.K. Land Registry or national real estate associations such as the Canadian Real Estate Association (1981). In addition, we collected long-run indices for the price of residential land, the price of agricultural land, and construction costs to proxy for replacement costs.[1]

Table 1 provides a comprehensive overview of the house price series, their geographic coverage, the type of dwelling covered, and the method used for price calculation. The paper comes with an extensive data appendix that specifies the sources we consulted and discusses the construction of the individual country indices in greater detail. Figure 1 plots the historical house prices country by country.

3 Aggregate trends

How have house prices evolved over the long run? In this section, we describe the global run-up in house prices in the 20th century and its specific path over time. We show that real house prices in advanced economies have on average risen threefold since 1900 and that the overwhelming share of this increase occurred in the second half of the 20th century. The long-run

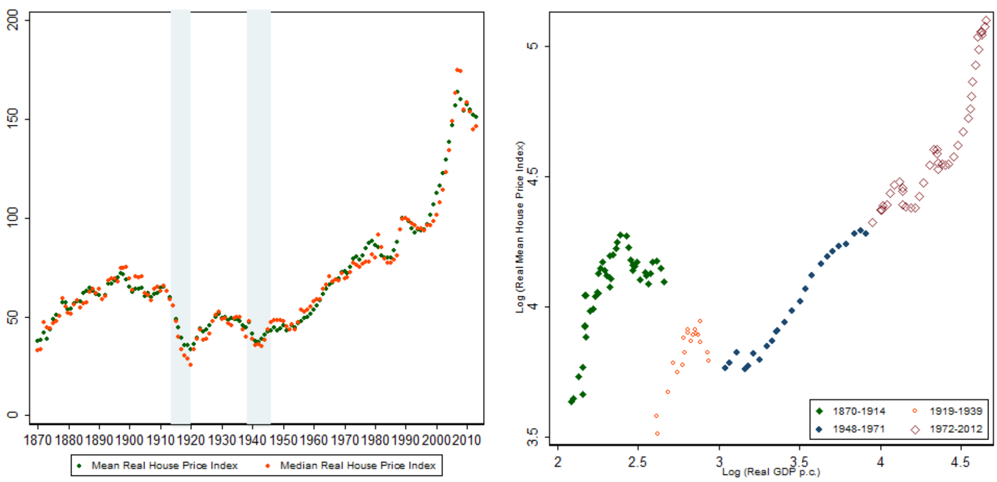
[1] For the sources and compilation of these time series, see Appendix B. All auxiliary macroeconomic and financial variables come from Jordà et al. (2016).

trajectory of global house prices displays a hockey-stick pattern: real house prices remained broadly stable from the late 19th century to World War II. They trended upwards in the postwar decades and have seen a particularly steep incline since the late 1980s.

3.1 A global house price index

The arithmetic mean and the median of the 14 house price series are displayed in the left panel of Figure 2. One recognizes that CPI-adjusted house prices stayed within a relatively tight range from the late 19th to the second half of the 20th century.[2] In subsequent decades, house prices have broken out of their long-run range and embarked on a steep incline, resulting in a hockey-stick pattern of long-run real house prices. This specific path of global house prices is robust to different weightings and across regional subsamples and a constant-coverage sample.

Figure 2: Aggregate Trends.



Notes: Index, 1990=100. The years of the two world wars are shown with shading.

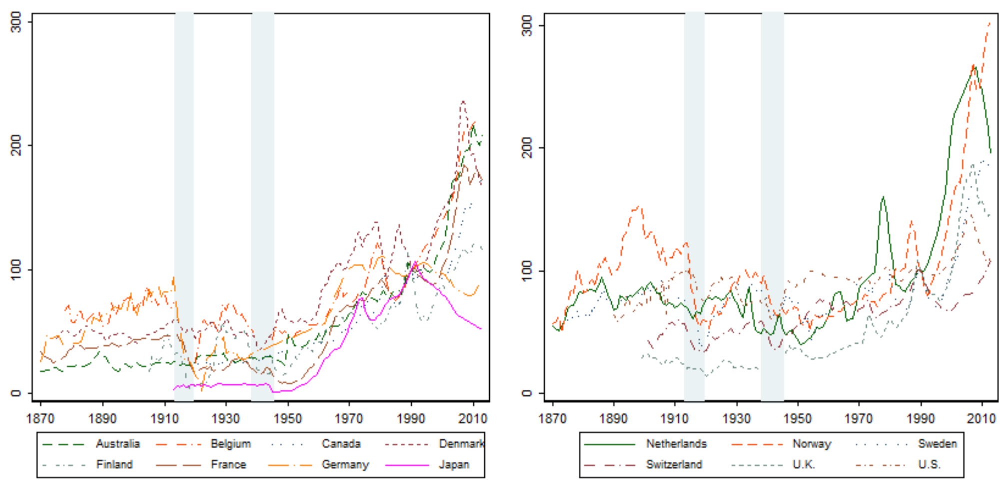
The relation between house prices and GDP per capita over the past 140 years exhibits a similar hockey-stick pattern. The right panel of Figure

[2]Real house prices by construction reflect ex-post returns. We also calculated real house price indices using average inflation in the preceding five years to proxy for adaptive inflation expectations (see Figure 14 in Appendix A.5).

2 shows that house prices remained, by and large, stable before World War I despite rising per capita incomes. In the final decades of the 20th century, house price growth outpaced income growth by a substantial margin.

Table 4 in Appendix A.5 puts numbers on these phenomena. It shows average annual growth rates of house prices for all countries and for two sub-periods. House price growth was about 1.5 percent in nominal and below 1 percent in real terms before World War II. After World War II, the average nominal annual rate of growth climbed to above 6 percent and to 2 percent adjusted for inflation.

Figure 3: Heterogeneity.



Notes: Index, 1990=100. The years of the two world wars are shown with shading.

The path of global house prices displayed in Figure 2 is based on an unweighted average of 14 country indices in our sample. Figure 3 and Table 4 in Appendix A.5 demonstrate that there is considerable heterogeneity in the cross-country trends. In the long-run, real house prices merely increased by 40 basis points per year in Germany, but by about 2 percent on average in Australia, Belgium, Canada and Finland. U.S. house prices have increased at an annual rate of a little less than 1 percent since the 1890s; both the UK and France have seen somewhat higher house price growth of 1 percent and 1.4 percent, respectively. Figure 3 also shows that Japan has been an important outlier. It is the only country in which house prices significantly fell during the past two decades. It is therefore important to look at both the mean and the median.

The cross-country heterogeneity also extends to the timing of the surge of real house prices in the second half of the 20th century. We identified structural breaks in the real house price series for individual countries using the methodology of Bai and Perron (2003). The structural break tests show that virtually all upward breaks occurred in the second half of the 20th century, but the exact year when the heel of the hockey stick is reached differs from country to country (see Table 3 in Appendix A.2). In 8 out of 14 countries, the structural break most likely took place in the 1960s and 1970s. In the U.S. and Switzerland, structural breaks in the series are dated in the 1950s, and in the 1990s or early 2000s in the cases of Belgium, the Netherlands, Norway and Sweden.[3]

3.2 Robustness checks

Now that we have explored the long-run path of global house prices, we subject it to additional robustness and consistency check. We address four issues: first, we demonstrate the robustness of these aggregate trends across different subsamples; second, we discuss if the aggregate trends could be distorted by a potential mis-measurement of quality improvements in the housing stock; third, the aggregate price developments could be an artifact of a compositional shift of the underlying indices from predominantly (cheap) rural to (expensive) urban areas over time; fourth, we ask if the strong rise in house prices was mainly driven by urban areas.

3.2.1 Subsamples

It is conceivable that small and land-poor European countries have a disproportionate influence on the aggregate trends outlined above. We calculated

[3]Bai and Perron (2003) provide a test for the null hypothesis that the mean of a time series is the same over all time intervals versus one (or more) changes in the mean. In Appendix Table 3, we flexibly allow for a maximum of three breaks. For some countries, the test signals more than one structural break, typically in the immediate post-World War II decades as well as in the 1990s or early 2000s.

population and GDP weighted indices (Appendix Figure 9).[4] It turns out that house price appreciation was somewhat stronger in the small European countries than it was in the large economies in our sample, i.e., the U.S., Japan, and Germany. Yet over the past 140 years, the overall trajectory is comparable. Data coverage starts at different dates for different countries. Appendix Figure 11 presents average trends for fixed country groups. Again, the aggregate trends discussed above are largely unaffected.

Finally, as our sample is Europe-heavy, the trends – in particular the stagnation of real house prices in the first half of the 20th century – may be driven by the shocks of the two World Wars and the destruction they brought to the European housing stock. However, trends are similar in countries that experienced major war destruction on their own territory and countries that did not (i.e., Australia, Canada, Denmark, and the U.S).

3.2.2 Quality improvements

A key challenge for the construction of long-run house price indices relates to changes in the quality of the housing stock. First, the quality of homes has risen continuously over the past 140 years. Indices that do not control for quality improvements will overstate the price increase over time.[5] The pre-World War II data warrant particular attention. The reason is that the most significant improvements in housing quality – such as running water and electricity – entered the standard home in the first half of the 20th century and some of our indices in this period are based on mean or median prices.[6] This could induce an upward bias to our house price series *before*

[4]We also tested if border changes systematically influence the picture (see Appendix Figure 10). Figure 10 also includes a GDP per capita weighted index.

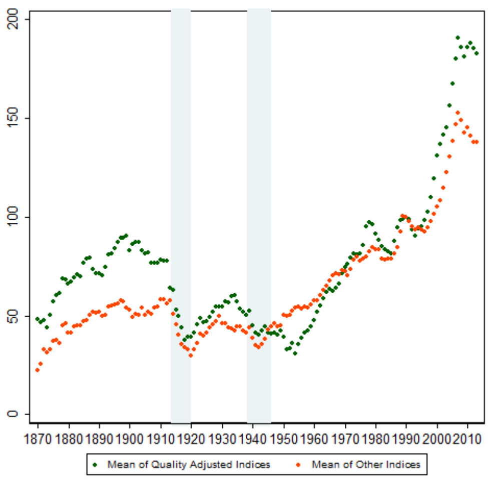
[5]The speed of the quality improvement varies over time and across countries. Davis and Heathcote (2007) estimate for the U.S. that quality gains amounted to less than 1 percent per year between 1930 and 2000. For Australia, Abelson and Chung (2005) calculate that spending on alterations and additions added about 1 percent per year to the market value of detached housing between 1979/80 and 2002/03. Stapledon (2007) arrives at similar conclusions. For the U.K., Feinstein and Pollard (1988) argue that housing standards rose about 0.22 percent per year between 1875 and 1913.

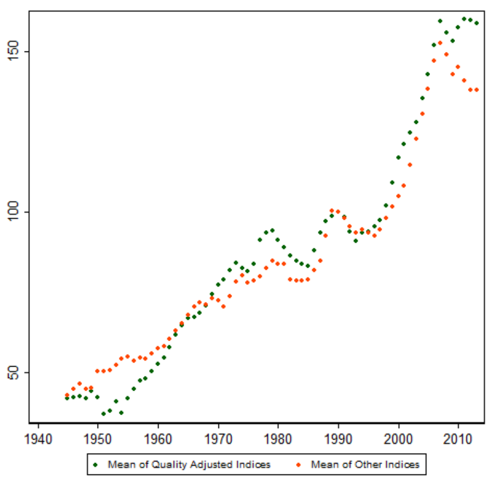
[6]By 1940, for example, about 70 percent of U.S. homes already had running water, 79 percent electric lighting and 42 percent central heating (Brunsman and Lowery, 1943).

World War II. The strong increase of house prices *after* World War II would be largely unaffected as most data for this period are adjusted for quality improvements. In other words, the reliance on mean or median prices prior to World War II likely accentuates the aggregate trends discussed above.

Second, the composition of the housing stock may change in response to secular trends such as urbanization or the business cycle. While business cycle effects are unlikely to matter much for the long-run trends discussed above, the supply of (comparably cheap) low quality houses in cities could have increased with urbanization. If more low quality houses were transacted, mean or median price indices could understate the price increase that occurred before World War II. Narrative accounts and historical housing statistics offer some support for the idea that the rapid growth of cities initially went hand in hand with deteriorating average urban housing conditions (Porter, 1998; Bernhardt, 1997; Wischermann, 1983; Kelly, 1978).[7] Unfortunately, there is very little information on trends in the overall quality-mix of transacted houses limiting our ability to quantify the effects with greater precision.

Figure 4: Quality adjustments.





Notes: Index, 1990=100. The years of the two world wars are shown with shading. The mean of quality adjusted indices includes the following countries: FRA, NLD, NOR, SWE, JPN (left figure); FRA, NLD, NOR, SWE, JPN, DEU, CHE (right figure).

[7] This could potentially affect our data for Australia, Germany, Switzerland, and the U.K. as these indices are not adjusted for quality changes and exclusively based on data for urban areas.

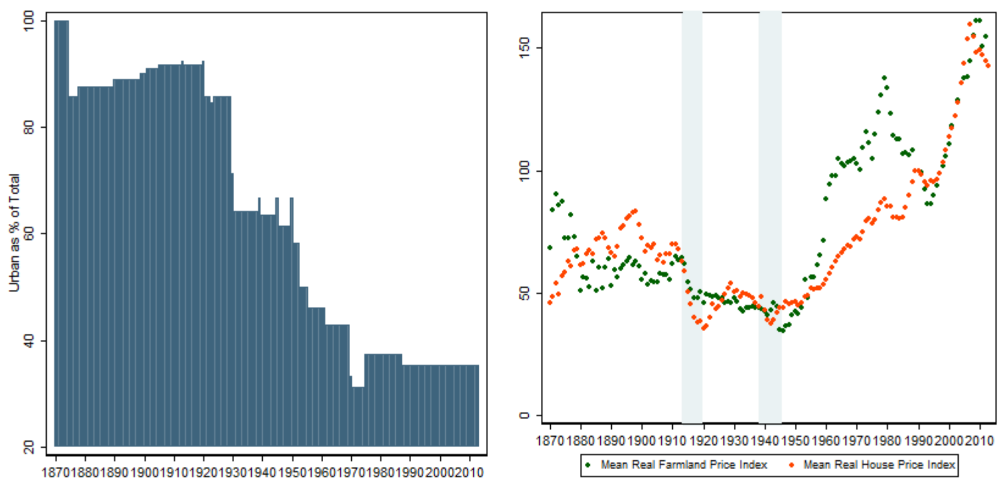
As an indicative test, we can compare house price trends for countries for which we have reliable quality adjusted price information with country indices for which the constant quality assumption is more doubtful. Figure 4 shows that the overall trajectories look similar.

All things considered, some uncertainty remains as to which these two opposing effects dominates in the pre-World War II period. On the one hand, there could be a potential overstatement of price increases because of rapid quality improvements, but on the other hand price increases could also be understated because of a deteriorating quality-mix. Researchers using our dataset in the future should take into account that accurate measurement of quality-adjustments remains a challenge.

3.2.3 Composition shifts

The world is considerably more urban today than it was in 1900. About 30 percent of Americans lived in cities in 1900. In 2010, the corresponding number was 80 percent. In Germany, 60 percent of the population lived in urban areas in 1910 and 74.5 percent in 2010 (United Nations, 2014; U.S. Bureau of the Census, 1975). The UK is the only exception as the country was already highly urbanized at the beginning of the 20th century.

Figure 5: Composition effects.



Notes: Left panel: Index, 1990=100. The years of the two world wars are shown with shading.

If the statistical coverage of house price data shifted from (cheap) rural to (expensive) urban prices over time, this could mechanically push up the average prices that we observe, even if rural and urban prices remain constant over time. The left panel of Figure 5 plots the share of purely urban house price observations for the entire sample. It turns out that the share of urban prices is declining over time, mainly because many of the early house price observations rely on city data only. The indices broaden out over time and cover more and more non-urban prices. Compositional shifts are not responsible for the patterns that we observe.

3.2.4 Urban and rural price dynamics

It remains, however, a possibility that the strong rise in house prices since the 1960s was predominantly an urban phenomenon, driven by a growing attractiveness of cities. Urban economists have long pointed to the economic advantage of living in cities, explaining high demand for urban land (Glaeser et al., 2012, 2001). It is essential, therefore, to separately examine the evidence we have on price trends in rural vis-a-vis urban areas.

As a first check, we went back to the historical sources and collected data for the price of farmland. Farmland prices can serve as a rough proxy for non-urban prices if the price of rural land used for farming and the price of land used for rural housing move together in the long run. To compare average farmland prices (as a proxy for rural housing) with average house prices we further need to assume that, in the long run, construction costs move together in cities and rural areas.[8] The right panel of Figure 5 plots mean farmland prices for 11 countries against the average house price index for the same 11-country sample.[9] Real farmland prices have more than doubled since 1900. This implies that the long-run growth in farmland prices was only slightly below the average growth rate of house prices (by about 0.3 percentage points per year). Clearly, farmland is cheaper than

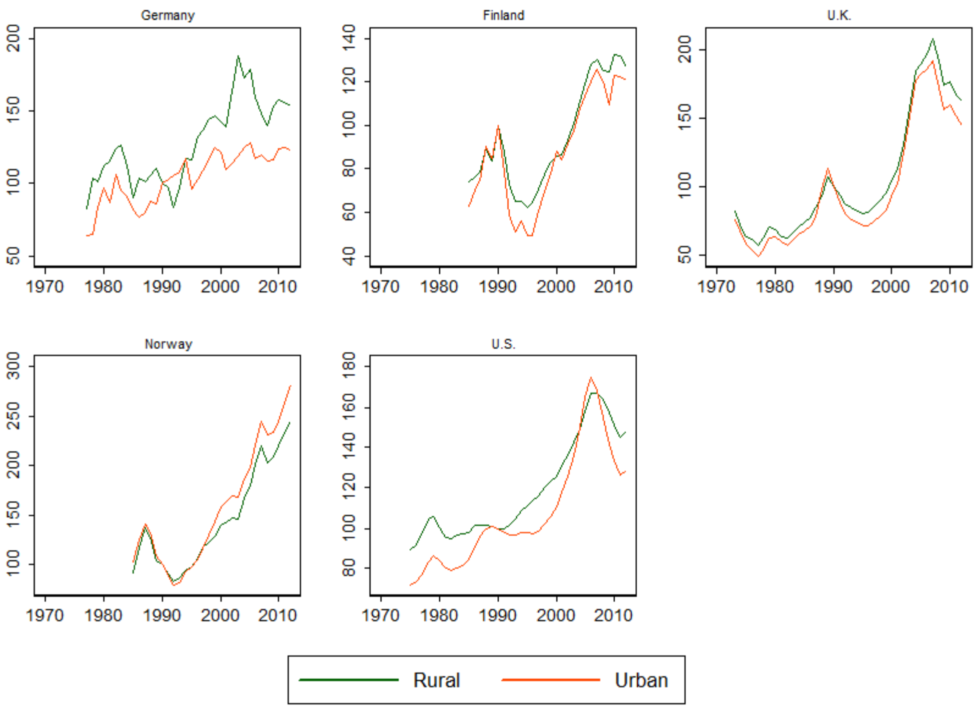
[8]This assumes that land use regulation does not drive a wedge between the price of land used for farming and for residential purposes.

[9]Data on farmland prices are available for Belgium, Canada, Switzerland, Germany, Denmark, Finland, United Kingdom, Japan, the Netherlands, Norway and the United States. See Appendix B for sources and description.

building land per area unit, but the long-run trajectories appear similar.

Figure 6 plots the development of urban and rural house prices for a sub-sample of five countries for the post-1970 period: Finland, Germany, Norway, the U.K. and the U.S.[10] Figure 6 shows that both rural and urban house prices trended strongly upwards in recent decades. While the increase in house prices has been most pronounced in cities, it is not exclusively an urban phenomenon.

Figure 6: Urban and rural house prices since the 1970s, 5 countries.



Notes: Index, 1990=100. Data for Germany 1977–2012, Finland 1985–2012, U.K. 1973–1999, Norway 1985–2010, U.S. 1975–2000.

4 Decomposing long-run house prices

What accounts for the surge of house prices in the second half of the 20th century? As a house is a bundle of the structure and the underlying land, a

[10]We divided regions in these five countries into urban and rural ones based on population shares. Regions with a share of urban population above the country-specific median are labeled predominantly urban.

decomposition of house prices into the replacement value and the value of the underlying land allows us to identify the driving forces of house price changes. If the price of a house rises faster than the cost of building a structure of similar size and quality, the underlying land gains in value. In this section, we introduce long-run data on construction costs (as a proxy for the trend in replacement costs) that we compiled from a wide range of historical sources, discussed in Appendix B. Using a stylized model of the housing market, we then study the role of construction costs and land prices as drivers of the increase in house prices over the past 140 years.

Consider a housing sector with a large number of identical firms (real estate developers) who produce houses under perfect competition. Production requires to combine land Z_t and residential structures X_t according to a Cobb-Douglas technology $F(Z, X) = (Z_t)^{\alpha}(X_t)^{1-\alpha}$, where $0 < \alpha < 1$ denotes a constant technology parameter (Hornstein, 2009a,b; Davis and Heathcote, 2005). Profit maximization implies that the house price p_t^H equals the equilibrium unit costs such that $p_t^H = B(p_t^Z)^{\alpha}(p_t^X)^{1-\alpha}$, where p_t^Z denotes the price of land at time t, p_t^X the price of (quality-adjusted) residential structures as captured by construction costs, and $B := (\alpha)^{-\alpha}(1-\alpha)^{-(1-\alpha)}$, respectively.[11] The preceding equation describes how the house price depends on the price of land and on construction costs. The implied growth rate of house prices reads

$$\frac{p_{t+1}^H}{p_t^H} = \left(\frac{p_{t+1}^Z}{p_t^Z}\right)^{\alpha} \left(\frac{p_{t+1}^X}{p_t^X}\right)^{1-\alpha} \quad (1)$$

and the imputed land price can be traced out by employing

$$\frac{p_{t+1}^Z}{p_t^Z} = \left(\frac{p_{t+1}^H}{p_t^H}\right)^{\frac{1}{\alpha}} \left(\frac{p_{t+1}^X}{p_t^X}\right)^{\frac{\alpha-1}{\alpha}}. \quad (2)$$

With information on house prices and construction costs, Equation 2 can be applied to impute the price of residential land. The decomposition

[11] Diewert (2013) uses a hedonic regression approach relying on micro data to decompose house prices into the price of land and the price of structures. Similar to Hornstein (2009a,b) and Davis and Heathcote (2005), Diewert (2013) applies a supply side analysis of house prices.

therefore allows us to identify the relative importance of construction costs and land prices as drivers of long-run house prices.[12]

4.1 Construction costs

The left panel of Figure 7 displays a cross-country construction cost index side by side with the global house price index.[13] It shows that construction costs, by and large, moved sideways until World War II. Before World War II, costs were likely held down by technological advances such as the invention of the steel frame. Construction costs rose somewhat in the interwar period, but increased substantially between the 1950s and the 1970s in many countries, including the U.S., Germany and Japan. Among other factors, this may reflect solid wage gains (relative to labor productivity) in the construction sector.[14]

Yet what is equally clear from the graph is that since the 1970s, construction cost growth has leveled off. During the past four decades, construction costs in advanced economies have remained broadly stable, while house prices surged. *Prima facie*, changes in replacement costs of the structure do not seem to offer an explanation for the strong increase in house prices in the second half of the 20th century.

4.2 Land prices

Historical prices for residential land are scarce. We were able to locate price information for residential land for six economies, predominantly for the

[12]Other factors, such as sales taxes or building permit fees, may also affect equilibrium house prices. The imputed land price series based on Equation 2 implicitly assume that the relative importance of these factors does not change over time. We illustrate this point in Appendix A.4.

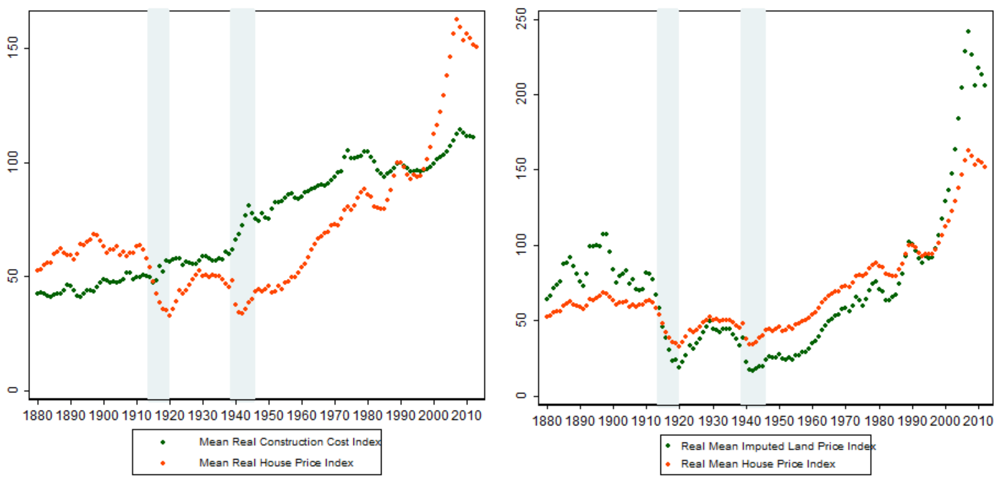
[13]Figure 7 starts in 1880 as we only have data for construction costs for two countries for the 1870s. Figure 15 in Appendix A.5 plots historical construction costs for each country. Appendix B.1 describes the data sources and discusses the methodological challenges involved in constructing long-run construction cost series.

[14]We calculated real unit labor cost indices for the construction sector based on national accounts data for Canada, France, Finland, Germany, Norway, Sweden, the U.K. and the U.S. (see Appendix B.1 for details). In the 8 countries for which data are available, average real unit labor costs rose by 13 percent between 1950 and 1970 compared to an increase in average real construction costs of 15.2 percent.

post-World War II era: Australia, Belgium, Japan, Great Britain, Switzerland, and the U.S. – for the latter we dispose of a derived land price index from Davis and Heathcote (2007). The land price series are displayed in Figure 16 in Appendix A.5 and show a substantial increase of residential land prices in the last decades of the 20th century. But a sample of six countries appears too small to make general inferences.

To obtain a more comprehensive picture and corroborate the trends evident in the primary residential land price series, we use Equation 2 to impute long-run land prices combining information on construction cost and the price of houses. For this decomposition, we need to specify α, the share of land in the total value of housing. Table 2 suggests that a reasonable assumption for α is a value of about 0.5, but there is some variation both across time and countries. Figure 12 in Appendix A.4 demonstrates that our results are robust to changing α within reasonable limits.[15]

Figure 7: Decomposition - land prices and construction costs.



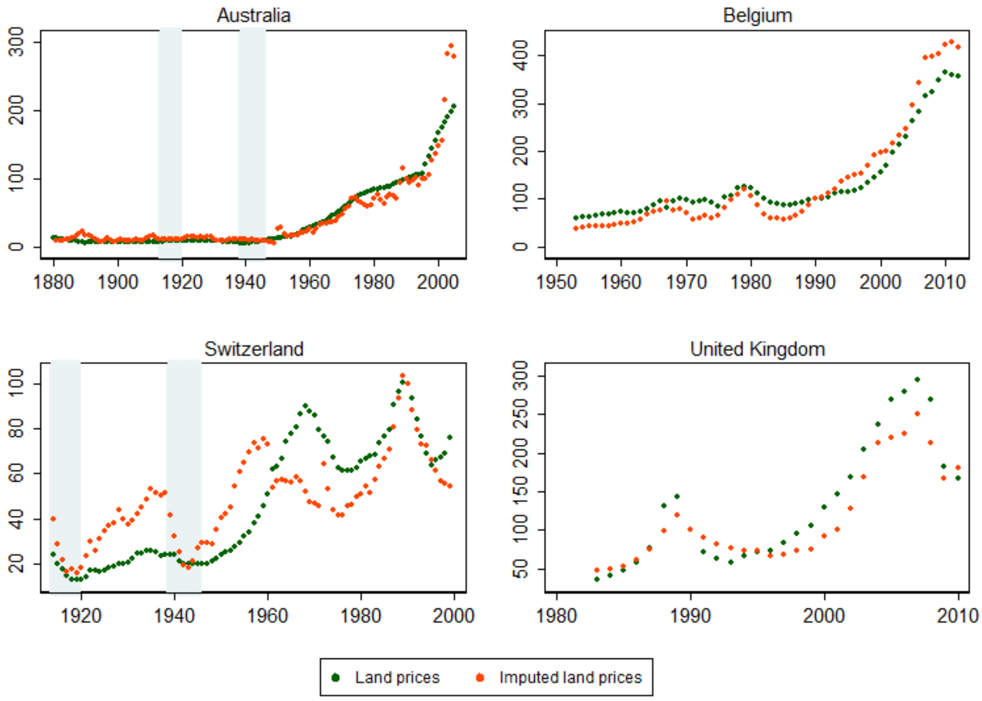
Notes: Index, 1990=100. The years of the two world wars are shown with shading.

The average land price that we back out from this decomposition is shown in the right panel of Figure 7 together with global house prices. Real residential land prices appear to have remained constant before World

[15]For the decomposition, we exclude Finland, Germany, and Japan since the house price indices for these countries in part rely on residential land prices.

War I and fell substantially in the interwar period. It took until the 1970s before real residential land prices in advanced economies had, on average, recovered their pre-1913 level. Since 1980, residential land prices have approximately doubled.[16]

Figure 8: Imputed land prices - individual countries.



Notes: Index, 1990=100 for Australia, Belgium, and the United Kingdom. Index, 1914=100 for Switzerland. The years of the two world wars are shown with shading.

As a plausibility check, we compare imputed land prices with observed land prices for a sub-sample of four countries for which we have independently collected residential land prices.[17] Country by country comparisons

[16]Figure 13 in Appendix A.4 presents the robustness of Figure 7 with respect to the underlying production technology. The Cobb-Douglas price index rests on the assumption of an elasticity of substitution between land and construction services in housing production equal to unity. We also consider the case of an elasticity of substitution equal to zero (Leontief technology) in the appendix.

[17]Since our aim is to compare empirical and imputed data, we are forced to exclude the residential land price series for the U.S. (Figure 16), which itself was imputed in a similar exercise by Davis and Heathcote (2007). We also exclude Japan as the Japanese house price index captures the price change of urban residential land plots (see Appendix B). For Switzerland, we rely on an alternative house price series covering house prices

of imputed and observed land price data are shown in Figure 8. The imputed land price index tracks the empirically observed price data closely and displays virtually identical trends – most importantly a sharp run-up of land prices in the past three decades.

4.3 Accounting for the global house price boom

How important is the land price increase relative to construction costs when it comes to explaining the surge in mean house prices during the second half of the 20th century? With data for construction costs and land prices at hand, it is straightforward to determine the contributions of land prices and constructions costs to the late 20th and early 21st century global house price boom. Noting Equation 1, the growth in global house prices between 1950 and 2012 may be expressed as follows

$$\frac{p^H_{2012}}{p^H_{1950}} = \left(\frac{p^Z_{2012}}{p^Z_{1950}}\right)^{\alpha} \left(\frac{p^X_{2012}}{p^X_{1950}}\right)^{1-\alpha}, \tag{3}$$

where p^Z_t denotes the imputed mean land price in period t. During 1950 to 2012 house prices grew by a factor of $\frac{p^H_{2012}}{p^H_{1950}} = 3.3$, land prices increased by $\frac{p^Z_{2012}}{p^Z_{1950}} = 7.5$, while construction costs exhibited $\frac{p^X_{2012}}{p^X_{1950}} = 1.5$. The share of house price growth that can be attributed to land price growth may therefore be expressed as $0.5\frac{\ln(7.5)}{\ln(3.3)}$.[18] The overall result is striking: 84 percent of the rise in house prices during 1950 to 2012 can be attributed to rising land prices. The remaining 16 percent can be attributed to the rise in real construction costs, reflecting lower productivity growth in the construction sector as compared to the rest of the economy. Clearly, these results are sensitive to the choice of α, the share of land in housing value. Using a lower bound estimate for α of 0.25 and an upper bound estimate of 0.75 gives us a range of 76 to 92 percent of the house price increase between

in Zurich so as to be able to compare imputed and empirical land prices in Zurich (for details see Appendix B.13.)

[18]Taking logs on both sides of Equation 3 and normalizing house price growth by dividing by $\ln\left(\frac{p^H_{2012}}{p^H_{1950}}\right)$ one gets $\alpha\frac{\ln\left(\frac{p^Z_{2012}}{p^Z_{1950}}\right)}{\ln\left(\frac{p^H_{2012}}{p^H_{1950}}\right)} + (1-\alpha)\frac{\ln\left(\frac{p^X_{2012}}{p^X_{1950}}\right)}{\ln\left(\frac{p^H_{2012}}{p^H_{1950}}\right)} = 1$.

1950 and 2012 that is accounted for by increasing land prices.

At a country-by-country level we find that the contribution of land prices in explaining house price growth ranges from 73 percent (U.K.) to 96 percent (Finland), while the median is 86 percent. The contribution of land prices to national house price growth is 77 percent for Denmark, 81 percent for Belgium, the Netherlands and Sweden, 83 percent for Switzerland, 89 percent for the U.S., 90 percent for Australia, 92 percent for Norway, 93 percent for France, and 95 percent for Canada.

5 Implications

Our historical journey into long-run house price trends has yielded two important new insights. First, house prices in advanced economies stayed largely constant until the mid-20th century and have risen strongly in the last decades of the 20th century. Second, the late 20th century surge in house prices was due to sharply rising land prices. About 80 percent of the increase in real house prices in advanced economies in the second half of the 20th century can be explained by higher land values. In this section, we discuss a number of important implications of these findings.

The existing literature offers two opposing views on the long-term evolution of land prices. The classical position emphasizes that land becomes increasingly scarce as the economy grows and land prices rise as a consequence (Walras, 1880; Ricardo, 1817). The opposing view is that land is still in ample supply so that house price increases trigger a supply response which brings prices down again (Shiller, 2009, 2007; Grebler et al., 1956). Davis et al. (2007) as well as Davis and Heathcote (2007) have already taken issue with the data underlying this view and show that U.S. land prices have been on a steady upward trajectory since World War II. Our data add an international dimension to this debate by showing that the cross-country evidence is hard to reconcile with the assumption of constant land prices. The findings indicate the significance of the classical view on the evolution of land prices, at least for the time period after World War II. If both land prices and the cost share of land in housing production are rising over time, the supply response to rising home values may not bring prices down again. Hence, the view that the long-run price elasticity of housing supply is high as new land for additional construction is available at constant prices must be scrutinized.[19]

A second important implication has to do with much-debated long-run trends in wealth-to-income ratios. Piketty (2014) argued that wealth-to-income ratios in advanced economies have followed a U-shaped curve over the past century and a half. At the end of the 20th century, wealth-to-income ratios – and with them measures of wealth inequality – have returned to pre-World War I levels. Piketty (2014) further hypothesizes that capital-to-income ratios may continue to rise.[20] Bonnet et al. (2014) have stressed that most of the late 20th century increase in wealth-to-income ratios in Western economies can be ascribed to rising housing wealth. They argue that wealth-to-income ratios, excluding housing wealth, have flatlined or fallen in many countries. Rognlie (2015) established that the (net) capital income share remained largely constant in the economy and only increased in the housing sector.

Our findings suggest that higher land prices likely played a critical role for the increase of housing wealth in the late 20th century. To check if this proposition is borne out by the data, we went back to the historical national wealth data to trace the share of land in the total value of housing over the 20th century. Collecting data for the land share in housing wealth, we mostly relied on the national wealth estimates by Goldsmith (Goldsmith, 1985, 1962; Garland and Goldsmith, 1959) for the pre-World War II period. For the postwar decades, we turned to published and unpublished data from national statistical offices such as the U.K. Office of National Statistics, Statistics Netherlands (1959), and Statistics Japan (2013). The resulting

[19]Since building additional houses takes time, the price elasticity of housing supply tends to be low in the short-run. By contrast, assuming that prices of production inputs (i.e., the price of land and construction costs) remain largely constant, the price elasticity should be significantly higher in the long-run. This may no longer be the case if land prices are rising.

[20]Assuming a saving rate s of 10 percent and real GDP growth g of 1.5 percent, Piketty (2014) argues, the capital-to-income ratio $\frac{K}{Y} = \frac{s}{g}$ would rise to 600–700 percent. Provided that r does not adjust, this would result in a rising capital income share ($\frac{rs}{g}$) and, given that capital is unequally distributed, in rising income inequality. These propositions have been debated recently (Krusell and Smith, 2015).

Table 2: Share of land in total housing value.

	AUS	CAN	DEU	FRA	GBR	JPN	NLD	USA
1880			0.13	0.25				
1890						0.40		
1900	0.54		0.18			0.40		0.21
1913/1914	0.43		0.20	0.30		0.43		0.20
1920								0.20
1930	0.40		0.17	0.30	0.23	0.52		0.20
1940			0.17		0.19	0.46		0.20
1950	0.49		0.17	0.32	0.17	0.65	0.15	0.13
1960	0.40		0.17	0.30	0.12	0.85		0.13
1970		0.48	0.25	0.30	0.15	0.86		0.19
1980	0.40	0.52		0.41	0.11	0.81		0.27
1990	0.62	0.47	0.36	0.42		0.90		0.40
2000	0.63	0.49	0.32	0.39		0.81	0.57	0.36
2010	0.71	0.53	0.37	0.59	0.54	0.77	0.53	0.38

Note: Dates are approximate. Sources: See Appendix B.

trends are displayed in Table 2. The data show a substantial increase of the land component in total housing wealth. In the U.S., the land share in the total value of housing roughly doubled over the course of the 20th century, rising from 20 percent on the eve of World War I to close to 40 percent today. In line with the land and house price trends we described in this paper, most of the increase occurred over the past 40 years. Even stronger effects can be observed in European countries such as the Netherlands and France.

The implications for the debate about the drivers of rising wealth-to-income ratios are profound. National wealth consists of components that can be accumulated, such as capital goods (K), and a land component (Z) whose quantity is fixed. Total wealth (W) may hence be expressed as $W = K + p^Z Z$.[21] If the land price rises faster than the economy grows, i.e. if $\hat{p}^Z > g$ with $\hat{p}^Z$ denoting the growth rate of p^Z, the wealth-to-income ratio increases even if $\frac{K}{Y}$ remains constant. This price channel of rising land valuations therefore differs from the quantity channel of capital accumulation stressed by Piketty (2014). The data presented in Table 2 imply that the land price channel played a critical role for wealth dynamics

[21] The price of K is normalized to one. Standard theory implies that this price is either equal to unity (Solow model) or constant in the steady state (capital-adjustment-cost model).

over the past century.[22] Scholars interested in the driving forces of long-run trends in wealth and its distribution must direct their attention to the striking path of land prices in the modern era.

In addition to distributional effects, land prices may also impact economic growth directly. In a dynamic stochastic general equilibrium model of cities, Davis et al. (2014) specifically point to the role of agglomeration effects. Rising land prices induce firms to economize on land which leads to rising density of production. While agglomeration increases congestion and lowers growth, rising density also fosters total factor productivity growth through technological spill-overs. The empirical analysis in Davis et al. (2014) suggests that in the U.S. case, the annual increase in the land price by 1.0 percent between 1978 and 2009 has increased the growth rate of per capita consumption by about 10 percent. Recent research by Liu et al. (2013) further demonstrates real effects of land price changes at the business cycle frequency.

6 Conclusion

In *The Wizard of Oz*, Dorothy's house is transported by a tornado to a strange new plot of land. The story neatly depicts the fact that a home consists of both the physical structure of the house and the underlying plot of land. A core insight of our study is that the price of land has played the central role for long-run trends in house prices. After a long period of stagnation from 1870 to the mid-20th century, real house prices rose strongly during the second half of the 20th century. The decomposition of house prices into the replacement cost of the structure and land prices revealed that rising land prices have been the driving force for the observed trends. Explanations for the long-run trajectory of house prices must be

[22]The importance of land prices for wealth brings Ricardo's famous principle of scarcity to mind. Ricardo (1817) reasoned that economic growth disproportionately benefits the owners of the fixed factor land. Writing in the 19th century, Ricardo was mainly concerned that population growth would push up the price of corn so that the land rent and the land price would continuously increase. In the 21st century, we may be more concerned with the price of residential land, but the underlying mechanism remains the same.

mapped onto the underlying land price dynamics and the comparatively minor role of changes in the replacement value of the structure.

Research interest in housing markets has surged in the wake of the global financial crisis. Despite its importance for macroeconomics, the study of housing market dynamics has been hampered by the lack of comparable long-run and cross-country data from economic history. We expect that the data presented in this study will open new avenues for empirical and theoretical research on housing market dynamics and their interactions with the macroeconomy.

References

Abelson, P. and D. Chung (2005): "The Real Story of Housing Prices in Australia from 1970 to 2003," *The Australian Economic Review*, 3, 265–281.

Adam, K. and M. Woodford (2013): "Housing Prices and Robustly Optimal Monetary Policy," *mimeo.*

Bai, J. and P. Perron (2003): "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics*, 18, 1–22.

Bailey, M. J., R. F. Muth, and H. O. Nourse (1963): "A Regression Method for Real Estate Price Index Construction," *Journal of the American Statistical Association*, 58, 933–942.

Bank of Japan (1966): *Hundred Year Statistics of the Japanese Economy*, Tokyo: Bank of Japan.

Bernhardt, C. (1997): *Bauplatz Gross-Berlin: Wohnungsmärkte, Terraingewerbe und Kommunalpolitik im Städtewachstum der Hochindustrialisierung (1871–1918)*, Berlin: Gruyter.

Bonnet, O., P.-H. Bono, G. Chapelle, and E. Wasmer (2014): "Does Housing Capital Contribute to Inequality? A Comment on Thomas Piketty's Capital in the 21st Century," *Science Po Department of Economics Discussion Paper*, 7.

Brunsman, H. G. and D. Lowery (1943): "Facts from the 1940 Census of Housing," *Journal of Land & Public Utility Economics*, 19, 89–93.

Canadian Real Estate Association (1981): *Annual Report 1981*, Ottawa: Canadian Real Estate Association.

Case, B. and S. Wachter (2005): "Residential Real Estate Price Indices as Financial Soundness Indicators: Methodological Issues," in *Real Estate Indicators and Financial Stability*, Basel: Bank for International Settlements, no. 21 in BIS Papers, 197–211.

Case, K. E. (2007): “The Value of Land in the United States,” in *Land Policies and their Outcomes*, ed. by G. K. Ingram and Y.-H. Hong, Cambridge, MA: Lincoln Institute of Land Policy, 127–147.

Case, K. E. and R. J. Shiller (1987): “Prices of Single-Family Homes Since 1970: New Indexes for Four Cities,” *New England Economic Review*, Sept./Oct., 45–56.

Davis, M., F. Ortalo-Magne, and P. Rupert (2007): “What’s Really Happening in Housing Markets?” *Federal Reserve Bank of Cleveland Economic Commentary*.

Davis, M. A., J. D. M. Fisher, and T. M. Whited (2014): “Macroeconomic Implications of Agglomeration,” *Econometrica*, 82, 731–764.

Davis, M. A. and J. Heathcote (2005): “Housing and the Business Cycle,” *International Economic Review*, 46, 751–784.

——— (2007): “The Price and Quantity of Residential Land in the United States,” *Journal of Monetary Economics*, 54, 2595–2620; data located at Land and Property Values in the U.S., Lincoln Institute of Land Policy `http://www.lincolninst.edu/resources/`.

Del Negro, M. and C. Otrok (2007): “99 Luftballons: Monetary Policy and the House Price Boom across U.S. States,” *Journal of Monetary Economics*, 54, 1962–1985.

Diewert, W. E. (2013): “Decomposing an RPPI into Land and Structures Components,” in *Handbook on Residential Property Price Indices (RPPIs)*, ed. by OECD, Eurostat, ILO, The World Bank, UNECE, Luxemburg: Eurostat, 82–99.

Eichholtz, P. M. (1994): “A Long-Run House Price Index: The Herengracht Index, 1628–1973,” *Real Estate Economics*, 25, 175–192.

Eitrheim, O. and S. K. Erlandsen (2004): “House Price Indices for Norway, 1819–2003,” in *Historical Monetary Statistics for Norway 1819–2003*, ed. by O. Eitrheim, J. T. Klovland, and J. F. Ovigstad, Oslo: Norges Bank, no. 35 in Norges Bank Skriftserie / Occasional Papers.

Feinstein, C. H. and S. Pollard (1988): *Studies in Capital Formation in the United Kingdom, 1750–1920*, Oxford: Clarendon Press.

Garland, J. M. and R. W. Goldsmith (1959): "The National Wealth of Australia," in *The Measurement of National Wealth*, ed. by R. W. Goldsmith and C. Saunders, Chicago: Quadrangle Books, Income and Wealth Series VIII, 323–364.

Glaeser, E. L., J. D. Gottlieb, and K. Tobio (2012): "Housing Booms and City Centers," *American Economic Review*, 102, 127–133.

Glaeser, E. L., J. Kolko, and A. Saiz (2001): "Consumer City," *Journal of Economic Geography*, 1, 27–50.

Glaeser, E. L. and B. A. Ward (2009): "The Causes and Consequences of Land Use Regulation: Evidence from Greater Boston," *Journal of Urban Economics*, 65, 265–278.

Goldsmith, R. W. (1962): *The National Wealth of the United States in the Postwar Period*, Princeton: Princeton University Press.

——— (1985): *Comparative National Balance Sheets: A Study of Twenty Countries, 1688–1978*, Chicago: University of Chicago Press.

Goodhart, C. and B. Hofmann (2008): "House Prices, Money, Credit, And the Macroeconomy," *Oxford Review of Economic Policy*, 24, 180–205.

Grebler, L., D. M. Blank, and L. Winnick (1956): *Capital Formation in Residential Real Estate: Trends and Prospects*, Princeton: Princeton University Press.

Gyourko, J., C. Mayer, , and T. Sinai (2006): "Superstar Cities," *American Economic Journal*, 5, 167–199.

Hornstein, A. (2009a): "Notes on Collateral Constraints in a Simple Model of Housing," *FRB Richmond Working Paper*, 09-3.

——— (2009b): "Problems for a Fundamental Theory of House Prices," *FRB Richmond Economic Quarterly*, 95, 1–24.

Jordà, O., M. Schularick, and A. M. Taylor (2015): "Leveraged Bubbles," *Journal of Monetary Economics*, 76, S1–S20.

——— (2016): "The Great Mortgaging: Housing Finance, Crises, and Business Cycles," *Economic Policy*, 31, 107–152.

Kelly, M. (1978): "Picturesque and Pestilential: The Sydney Slum Observed 1860–1900," in *Essays in Urban History*, ed. by M. Kelly, Sydney: Sydney University Press, 66–80.

Krusell, P. and A. A. Smith (2015): "Is Piketty's "Second Law of Capitalism" Fundamental?" *Journal of Political Economy*, 123, 725–748.

Leamer, E. E. (2007): "Housing IS the Business Cycle," in *Proceedings - Economic Policy Symposium - Jackson Hole*, ed. by F. K. City, 149–233.

Liu, Z., P. Wang, and T. Zha (2013): "Land-Price Dynamics and Macroeconomic Fluctuations," *Econometrica*, 81, 1147–1184.

Mian, A. and A. Sufi (2014): "House Price Gains and U.S. Household Spending from 2002 to 2006," *NBER Working Paper*, 20152.

Piketty, T. (2014): *Capital in the Twenty-First Century*, Cambridge: Harvard University Press.

Piketty, T. and G. Zucman (2014): "Capital Is Back: Wealth-to-Income Ratios in Rich Countries, 1700–2010," *Quarterly Journal of Economics*, 129, 1255–1310.

Porter, R. (1998): *London: A Social History*, Cambridge, MA: Harvard University Press.

Ricardo, D. (1817): *Principles of Political Economy and Taxation*, London: John Murray.

Rognlie, M. (2015): "Deciphering the Fall and Rise in the Net Capital Share," *Brookings Papers on Economic Activity*, 50, 1–69.

Shiller, R. J. (2007): "Understanding Recent Trends in House Prices and Home Ownership," in *Proceedings - Economic Policy Symposium - Jackson Hole*, ed. by F. K. City, 89–123.

——— (2009): *Irrational Excuberance*, New York: Broadway Books, 2nd revised and updated ed.

Silver, M. (2012): "Why House Price Indexes Differ: Measurement and Analysis," *IMF Working Paper*, 12/125.

Stapledon, N. (2007): "Long Term Housing Prices in Australia and Some Economic Perspectives," Ph.D. thesis, University of New South Wales, Sydney.

Statistics Japan (2013): "Historical Statistics of Japan: National Accounts," `http://www.stat.go.jp/english/data/chouki/03.htm`.

Statistics Netherlands (1959): "The Preparation of a National Balance Sheet: Experience in the Netherlands," in *The Measurement of National Wealth*, ed. by R. W. Goldsmith and C. Saunders, Chicago: Quadrangle Books, Income and Wealth Series VIII, 119–146.

United Nations (2014): *World Urbanization Prospects: The 2014 Revision*, New York: United Nations.

U.S. Bureau of the Census (1975): *Historical Statistics of the United States: Colonial Times to 1970*, Washington : U.S. Dept. of Commerce, Bureau of the Census.

Walras, L. (1880): "Théorie Mathématique du Prix des Terres et de leur Rachat par l'Etat," *Bulletin de la Société Vaudoise des Sciences Naturelles*, 17, 189–285.

Wickens, D. L. (1937): *Financial Survey of Urban Housing: Statistics on Financial Aspects of Urban Housing*, Washington: U.S. Department of Commerce.

Wischermann, C. (1983): "Wohnen und soziale Lage in der Urbanisierung: Die Wohnverhältnisse hamburgischer Unter- und Mittelschichten um die Jahrhundertwende," in *Urbanisierung im 19. und 20. Jahrhundert: Historische und Geographische Aspekte*, ed. by H.-J. Teuteberg, Köln: Böhlau, 309–337.

For Online Publication

Appendix

A Supplementary material

A.1 House price indices: methodology

Different approaches exist to construct house price indices that adjust for quality and composition changes over time. Stratification splits the sample into several strata with specific price determining characteristics. A mean or median price index is calculated for each sub-sample and the aggregate index is computed as a weighted average of these sub-indices. A stratified index with M different sub-samples can be written as

$$\Delta P_T^h = \sum_{m=1}^{M} (w_t^m \Delta P_T^m), \tag{4}$$

where ΔP_T^h denotes the aggregate house price change in period T, ΔP_T^m the price change in sub-sample m in period T, and w_t^m the weight of sub-sample m at time t. The weights used to aggregate the sub-sample indices are either based on stocks or on transactions and on quantities or values (European Commission, 2013; Silver, 2012). Since stratification neither controls for changes in the mix of houses that are not related to the sub-samples nor for changes within each sub-sample, the choice of the stratification variables determines the index' properties. If the stratification controls for quality change, the method is known as mix-adjustment (Mack and Martínez-García, 2012).

A complementary approach to stratification is the hedonic regression method. Here, the intercept of a regression of the house price on a set of characteristics – such as the number of rooms, the lot size or whether the house has a garage or not – is converted into a house price index (Case and Shiller, 1987). If the set of variables is comprehensive, the hedonic regression method adjusts for changes in the composition and changes in quality. The most commonly employed hedonic specification is a linear model in the form of

$$P_t = \beta_t^0 + \sum_{k=1}^{K} (\beta_t^k z^{n,k}) + \epsilon_t^n, \tag{5}$$

where β_t^0 is the intercept term and β_t^k the parameter for characteristic variable k and $z^{n,k}$ the characteristic variable k measured in quantities n.

The repeat sales method circumvents the problem of unobserved heterogeneity as it is based on repeated transactions of individual houses (Bailey et al., 1963). A method similar to the idea of repeat sales is the sales price appraisal (SPAR) method which, instead of using two transaction prices, matches an appraised value and a transaction price. Because of depreciation and new investments, the constant-quality assumption becomes more problematic the longer the time span between two transactions (Case and Wachter, 2005). The weighted repeat sales method (Case and Shiller, 1987) therefore assigns less weight to transaction pairs of long time intervals. Since the hedonic regression is complementary to the repeat sales approach, several studies propose hybrid methods (Shiller, 1993; Case et al., 1991; Case and Quigley, 1991), which may reduce the quality bias. Yet despite differences in the way house price indices are constructed, different methods tend to deliver similar overall results (Nagarja and Wachter, 2014; Pollakowski, 1995).

A.2 Structural break tests

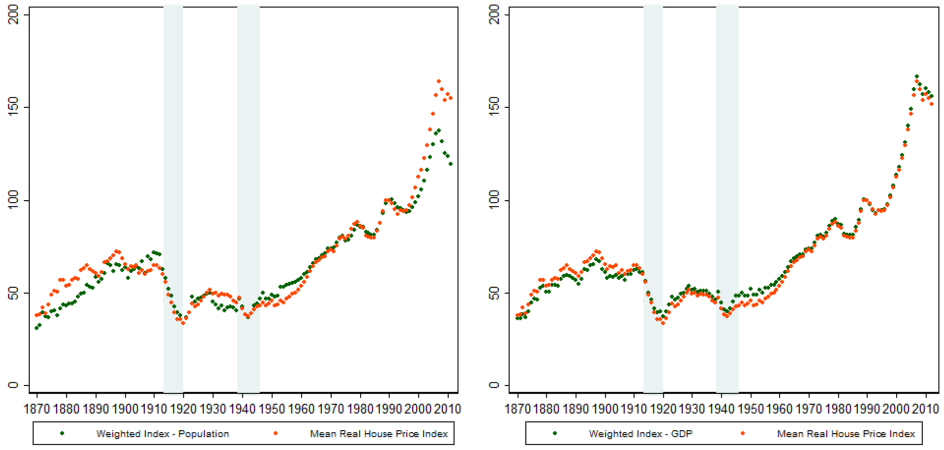
Table 3: Structural break tests by country

Country	k=1	k=2	k=3
Australia	1963	1950, 1988	1950, 1970, 1999
Belgium	1991	1966, 1998	1966, 1998
Canada	1973	1949, 1974	1947, 1973, 2004
Denmark	1961	1961, 2000	1961, 2000
Finland	1962	1962	1962
France	1964	1964	1964
Germany	1964	1964	1887, *1916*, 1963
Great Britain	1972	1963, 1987	1946, 1977, 2001
Japan	1960	1960	*1945*, 1955, 1965
Netherlands	1995	1970, 1998	1970, 1998
Norway	1999	1999	1999
Sweden	2000	2000	2000
Switzerland	1952	1952	1952
USA	1953	1953	1953

Note: k is the maximum number of structural breaks in the log-level of the real house price index determined using the Bai and Perron (2003) methodology with a trimming parameter of 10 percent and a significance level of 0.05, using White heteroskedasticity-consistent standard errors and heterogeneous error distributions across breaks. Break dates shown correspond to first date of new regime. Sample 1870–2012. Italics denote years of downward breaks in the real house price.

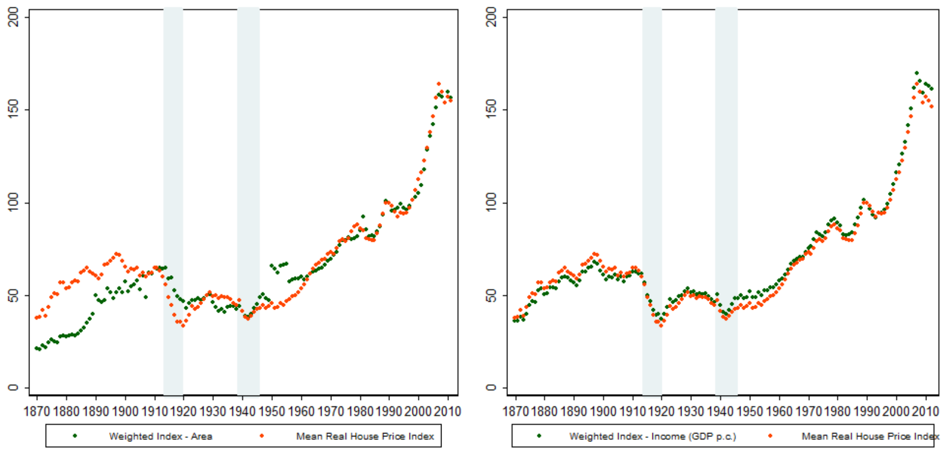
A.3 Robustness

Figure 9: Population and GDP weighted mean real house price indices, 14 countries.



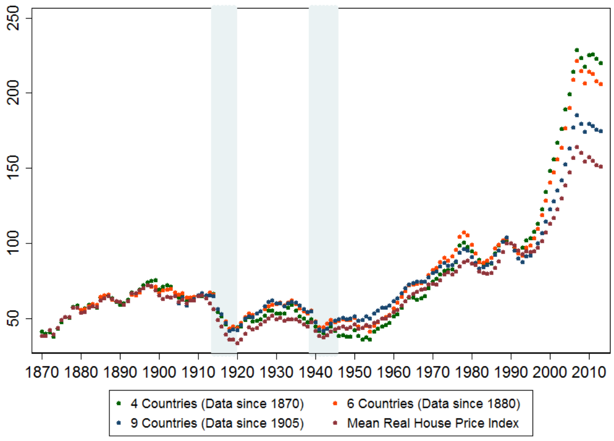
Notes: Index, 1990=100. The years of the two world wars are shown with shading.

Figure 10: Area and GDP p.c. weighted mean real house prices, 14 countries.



Notes: Index, 1990=100. The years of the two world wars are shown with shading. Note that most border changes were relative minor. Exceptions include the changes for Germany in the interwar period, after World War II and after reunification in 1990, and the change for the U.K. after the Irish Free State seceded in 1922.

Figure 11: Mean of all available data, fixed samples.



Notes: Index, 1990=100. The years of the two world wars are shown with shading. 4-, 6-, and 9-country indices include only continuous series. The 4-country sample includes Australia, France, the Netherlands, and Norway. The 6-country sample includes Australia, Denmark, France, the Netherlands, Norway, and Sweden. The 9-country sample includes Australia, Denmark, France, the Netherlands, Norway, Sweden, Switzerland, and the U.S.

A.4 Alternative decompositions

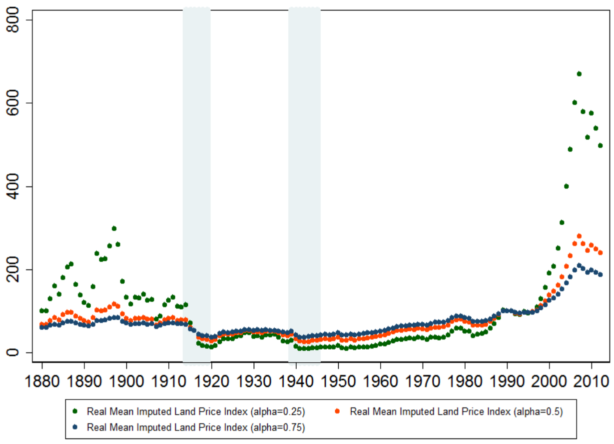
The decomposition in Section 4 rests on the assumption of an elasticity of substitution between land and construction services in housing production equal to unity (Cobb-Douglas technology). However, it is quite plausible to argue that this elasticity of substitution is much smaller than unity. Let us consider the extreme case of an elasticity of substitution equal to zero. The production technology then reads $F(Z,H) = \min\{\frac{Z}{a}, \frac{X}{b}\}$, where $a, b > 0$. In this case, the equilibrium house price is given by $p^H = a \cdot p^Z + b \cdot p^X$ such that its (gross) growth rate, noting $\frac{Z}{F(.)} = a$ and $\frac{X}{F(.)} = b$, may be expressed as

$$\frac{p^H_{t+1}}{p^H_t} = w_t \frac{p^Z_{t+1}}{p^Z_t} + (1 - w_t) \frac{p^X_{t+1}}{p^X_t}, \tag{6}$$

where $w_t := \frac{p^Z_t Z_t}{p^H_t F(.)}$. The index for imputed land prices can hence be traced out by applying

$$\frac{p^Z_{t+1}}{p^Z_t} = \frac{1}{w_t} \frac{p^H_{t+1}}{p^H_t} - \frac{(1 - w_t)}{w_t} \frac{p^X_{t+1}}{p^X_t}. \tag{7}$$

Figure 12: Imputed land prices - sensitivity analysis w.r.t. α, 14 countries.



Notes: Index, 1990=100. The years of the two world wars are shown with shading.

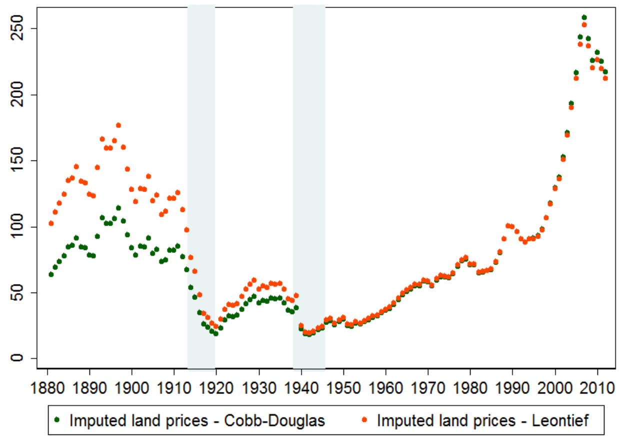
It should also be noticed that Davis and Heathcote (2007) start from the definition $p_t^Z Z_t = p_t^H H_t - p_t^X X_t$ which implies $\frac{p_{t+1}^H H_{t+1}}{p_t^H H_t} = \frac{p_{t+1}^Z Z_{t+1}}{p_t^H H_t} + \frac{p_{t+1}^X X_{t+1}}{p_t^H H_t}$. Employing $H_{t+1} = H_t$, $Z_{t+1} = Z_t$ and $X_{t+1} = X_t$, they receive

$$\frac{p_{t+1}^H}{p_t^H} = w_t \frac{p_{t+1}^Z}{p_t^Z} + (1 - w_t) \frac{p_{t+1}^X}{p_t^X}. \tag{8}$$

This expression is, not surprisingly, the same accounting equation as resulting from the Leontief case.

In the main text we discussed imputed land price series assuming an elasticity of substitution between Z and X of unity (Cobb Douglas) and $\alpha = 0.5$. How does the imputed land price series change if one deviates from either of these assumptions? Figure 12 shows the imputed land price as resulting from Equation 2 (Cobb-Douglas) assuming alternative values for α. Moreover, Figure 13 compares the imputed land price employing Equation 2 (Cobb-Douglas case, $\alpha = 0.5$) and Equation 7 (Leontief, $w_t = 0.5$).

Figure 13: Imputed land prices - sensitivity analysis w.r.t. technology, 14 countries.



Notes: Index, 1990=100. The years of the two world wars are shown with shading.

Finally, we consider how other factors (besides land prices and construction costs) may affect equilibrium house prices and hence imputed land prices. Let $0 \leq v_t \leq 1$ denote a cost term that is proportional to the value of newly built houses, such as an ad valorem sales tax or building permit fees. The profit function of the representative firm may then be written as $(1 - v_t)p_t^H F(Z_t, X_t) - p_t^Z Z_t - p_t^X X_t$, implying that the equilibrium house price reads

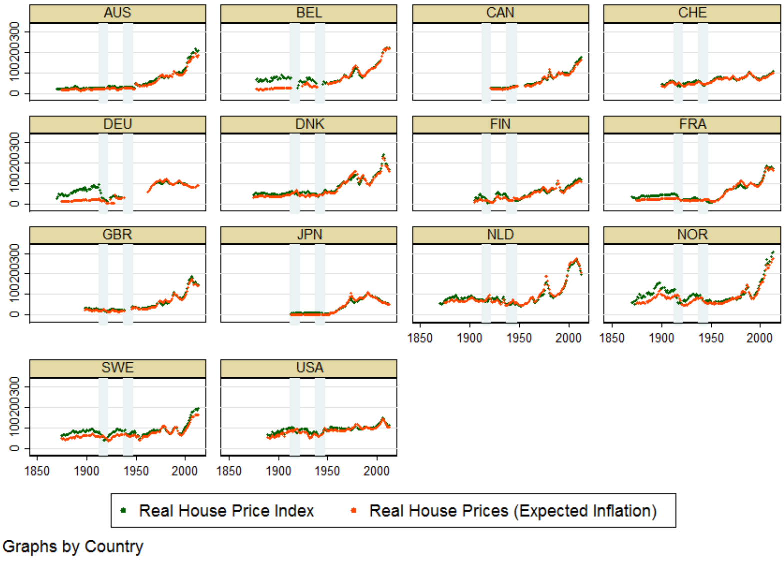
$$p_t^H = \frac{B}{1 - v_t}(p_t^Z)^\alpha (p_t^X)^{(1-\alpha)}, \tag{9}$$

where $B := \alpha^{-\alpha}(1 - \alpha)^{-(1-\alpha)}$.

Solving Equation 9 for p_t^Z shows that imputed real land prices now depend on real house prices p_t^H, real construction costs p_t^X and the cost term v_t. Yet Figure 8 indicates that such additional factors do not systematically bias the results.

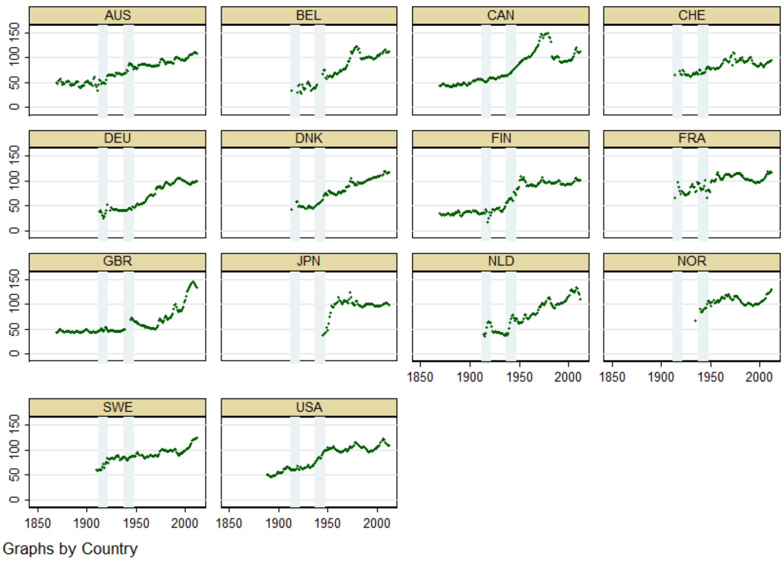
A.5 Additional tables and figures

Figure 14: Real house prices, 14 countries.



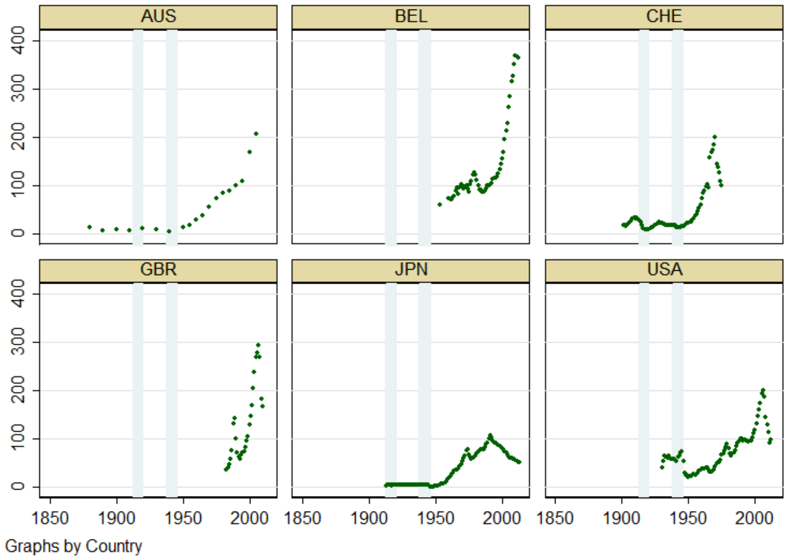
Notes: Index, 1990=100. The years of the two world wars are shown with shading. Nominal house prices deflated by average inflation over preceding 5 years

Figure 15: Real construction costs, 14 countries.



Notes: Index, 1990=100. The years of the two world wars are shown with shading.

Figure 16: Real residential land prices, 6 countries.



Notes: Index, 1990=100 for AUS, BEL, GBR, JPN, USA. Index, 1975=100 for CHE. The years of the two world wars are shown with shading.

Table 4: Annual summary statistics by country and by period.

	Δ log Nominal House Price Index			Δ log CPI			Δ log Real GDP p.c.		
	N	mean	s.d.	N	mean	s.d.	N	mean	s.d.
Australia									
Full Sample	127	0.047	0.106	127	0.027	0.047	127	0.016	0.040
Pre-World War II	62	0.009	0.083	62	0.001	0.037	62	0.011	0.054
Post-World War II	65	0.083	0.114	65	0.052	0.041	65	0.021	0.019
Belgium									
Full Sample	119	0.043	0.094	126	0.021	0.054	127	0.021	0.041
Pre-World War II	54	0.029	0.126	61	0.008	0.069	62	0.019	0.055
Post-World War II	65	0.056	0.054	65	0.034	0.031	65	0.023	0.020
Canada									
Full Sample	75	0.048	0.078	127	0.019	0.044	127	0.018	0.046
Pre-World War II	17	-0.014	0.048	62	-0.001	0.048	62	0.017	0.062
Post-World War II	58	0.066	0.076	65	0.038	0.032	65	0.019	0.023
Denmark									
Full Sample	122	0.032	0.074	127	0.021	0.053	127	0.019	0.024
Pre-World War II	57	-0.002	0.060	62	-0.004	0.058	62	0.017	0.025
Post-World War II	65	0.061	0.074	65	0.046	0.032	65	0.020	0.024
Finland									
Full Sample	92	0.088	0.156	127	0.031	0.059	127	0.026	0.034
Pre-World War II	27	0.094	0.244	62	0.006	0.055	62	0.023	0.036
Post-World War II	65	0.085	0.105	65	0.054	0.053	65	0.028	0.031
France									
Full Sample	127	0.062	0.075	127	0.036	0.071	127	0.020	0.038
Pre-World War II	62	0.023	0.055	62	0.017	0.73	62	0.013	0.049
Post-World War II	65	0.099	0.072	65	0.054	0.065	65	0.027	0.022
Germany									
Full Sample	110	0.040	0.108	123	0.025	0.097	127	0.027	0.043
Pre-World War II	60	0.043	0.140	58	0.022	0.139	62	0.019	0.049
Post-World War II	50	0.037	0.046	65	0.027	0.026	65	0.034	0.035
Japan									
Full Sample	84	0.078	0.155	127	0.027	0.120	127	0.029	0.046
Pre-World War II	19	-0.006	0.093	62	0.011	0.150	62	0.015	0.049
Post-World War II	65	0.103	0.162	65	0.043	0.081	65	0.042	0.038
The Netherlands									
Full Sample	127	0.026	0.091	127	0.015	0.044	127	0.019	0.031
Pre-World War II	62	-0.009	0.086	62	-0.007	0.049	62	0.014	0.036
Post-World War II	65	0.059	0.084	65	0.036	0.026	65	0.024	0.023
Norway									
Full Sample	127	0.041	0.087	127	0.020	0.058	127	0.023	0.027
Pre-World War II	62	0.013	0.085	62	-0.007	0.066	62	0.018	0.033
Post-World War II	65	0.068	0.080	65	0.045	0.035	65	0.027	0.018
Sweden									
Full Sample	122	0.036	0.077	127	0.021	0.047	127	0.022	0.029
Pre-World War II	57	0.010	0.052	62	-0.004	0.045	62	0.022	0.036
Post-World War II	65	0.059	0.089	65	0.045	0.035	65	0.022	0.021
Switzerland									
Full Sample	96	0.030	0.051	127	0.008	0.048	127	0.019	0.035
Pre-World War II	31	0.019	0.062	62	-0.008	0.061	62	0.016	0.044
Post-World War II	65	0.036	0.044	65	0.024	0.022	65	0.016	0.024
United Kingdom									
Full Sample	98	0.044	0.089	127	0.024	0.047	127	0.015	0.025
Pre-World War II	33	-0.008	0.088	62	-0.004	0.035	62	0.011	0.030
Post-World War II	65	0.070	0.080	65	0.050	0.042	65	0.019	0.019
United States									
Full Sample	107	0.026	0.078	127	0.015	0.040	127	0.017	0.041
Pre-World War II	42	0.006	0.115	62	-0.007	0.040	62	0.015	0.053
Post-World War II	65	0.038	0.039	65	0.036	0.027	65	0.020	0.023
All Countries									
Full Sample	1557	0.044	0.097	1900	0.024	0.069	1905	0.021	0.037
Pre-World War II	645	0.016	0.102	925	0.004	0.082	930	0.016	0.048
Post-World War II	912	0.066	0.087	975	0.043	0.046	975	0.025	0.027

Note: World wars (1914–1919 and 1939–1947) omitted.

B Data appendix

This data appendix supplements the paper, "No Price Like Home: Global House Prices" by Knoll, Schularick and Steger that introduces residential house price indices for 14 advanced economies for the period 1870 to 2012. It details and discusses the sources for constructing long-run house price indices.

We wish to thank Paul de Wael, Christopher Warisse, Willy Biesemann, Guy Lambrechts, Els Demuynck, and Erik Vloeberghs (Belgium); Debra Conner, Gregory Klump, Marvin McInnis (Canada); Kim Abildgren, Finn Østrup, and Tina Saaby Hvolbøl (Denmark); Riitta Hjerppe, Kari Leväinen, Juhani Väänänen, and Petri Kettunen (Finland); Jacques Friggit (France); Carl-Ludwig Holtfrerich, Petra Hauck, Alexander Nützenadel, Ulrich Weber, and Nikolaus Wolf (Germany); Alfredo Gigliobianco (Italy); Makoto Kasuya, and Ryoji Koike (Japan); Alfred Moest and Marjan Peppelmann (The Netherlands); Roger Bjornstad, and Trond Amund Steinset (Norway); Daniel Waldenström (Sweden); Annika Steiner, Robert Weinert, Joel Floris, Franz Murbach, Iso Schmid, and Christoph Enzler (Switzerland); Peter Mayer, Neil Monnery, Joshua Miller, Amanda Bell, Colin Beattie, and Niels Krieghoff (United Kingdom); Jonathan D. Rose, Kenneth Snowden and Alan M. Taylor (United States). Magdalena Korb and Katharina Mühlhoff helped with translation.

B.1 Description of the methodological approach

House price data

Data sources Most countries' statistical offices or central banks began only recently to collect data on house prices. For the 14 countries covered in our sample, data from the early 1970s to the present can be accessed through three principal repositories: the databases maintained by the Bank for International Settlements (2013), the OECD, and the Federal Reserve Bank of Dallas (2013). To extend these back to the 19th century, we used three principal types of country specific data.

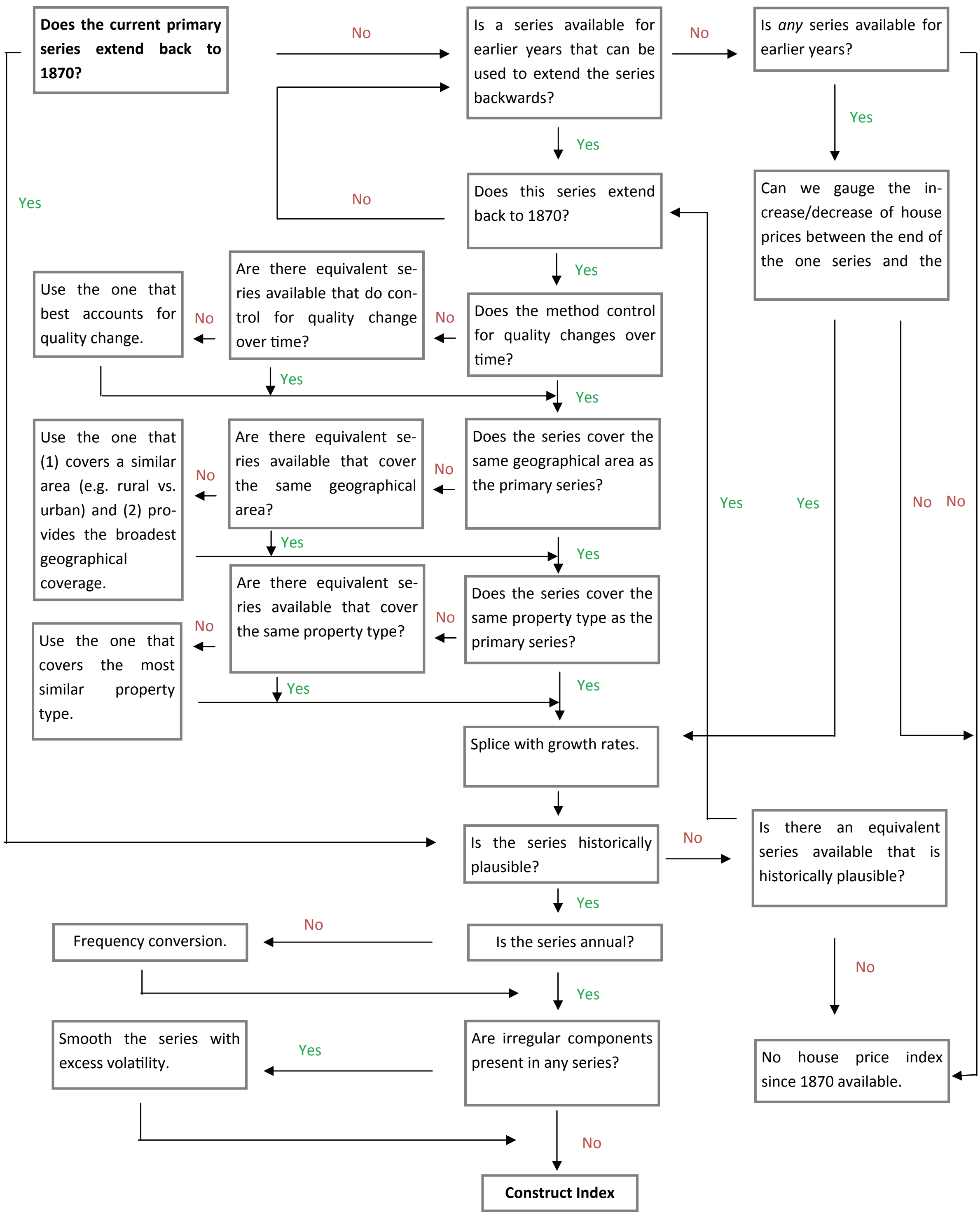


Figure 17: Methodological decision tree.

First, we turned to national official statistical publications, such as the Helsinki Statistical Yearbook or the annual publications of the Swiss Federal Statistical office, and collections of data based on official statistical abstracts. Typically, such official statistics publications contained raw data on the number and value of real estate transactions and in some cases price indices. A second key source were published and unpublished data gathered by legal or tax authorities (e.g., the U.K. Land Registry) or national real estate associations (e.g., the Canadian Real Estate Association). Third, we could also draw on the previous work of financial historians and commercial data providers.

Selection of house price series Constructing long-run data series usually involved a good many compromises between the ideal and the available data. We often found series spanning short time periods and had to splice them to arrive at a long-run index. The historical data we have at our disposal vary across countries and time with respect to key characteristics (area covered, property type, frequency, etc.) and in the method used for index construction. In choosing the best available country-year-series we followed three guiding principles: constant quality, longitudinal consistency, and historical plausibility.

We selected a primary series that is available up to 2012, refers to existing dwellings, and is constructed using a method that reflects the pure price change, i.e. controls for changes in composition and quality. When extending the series, we concentrated on within-country consistency to avoid principal structural breaks that may arise from changes in the market segment a country index covers. We aimed to ensure the broadest geographical coverage for each of the 14 country indices. Likewise we tried to keep the type of house covered constant over time, be it single-family houses, terraced houses, or apartments. We examined the historical plausibility of our long-run indices. We heavily draw on country specific economic and social history literature as well as primary sources such as newspaper accounts or contemporary studies on the housing market to scrutinize the general trends and short-term fluctuations in the indices. Based on extensive historical research, we are confident that the indices offer an accurate picture of house price developments in each of our 14 countries.

Construction of the country indices The methodological decision tree in Figure 17 describes the steps we follow to construct consistent series by combining the available sources for each country in the panel. By following this procedure we aimed to maintain consistency within countries while limiting data distortions. In all cases, the primary series does not extend back to 1870 but has to be complemented with other series.

Construction cost data

Data sources To decompose house prices into replacement costs and the value of the underlying land, a replacement cost index would ideally capture the change in the cost of replacing the structure covered by the house price index with a structure of similar size and quality. Data on replacement costs that perfectly matches our long-run house prices series, however, are not available. For the U.S., estimates of changes in replacement values exist for 1930–2012 (Davis and Heathcote, 2007). In all other cases, we use long-run price indices for construction costs to proxy for replacement costs of residential buildings. This choice rests on the assumption that the cost of constructing new (residential) buildings and the cost of replacing the structures covered by our house price indices move together in the long-run since both are primarily a function of the price of materials and wages.

For data on construction costs we mostly draw on publications by national statistical offices. In some cases, we also rely on the work of other scholars such as Stapledon (2012a), Maiwald (1954), and Fleming (1966), national associations of builders or surveyors (Belgian Association of Surveyors, 2013) or journals specializing in the building industry (Engineering News Record, 2013).

Construction cost indices: methodology Two main types of construction cost indices exist: input cost indices and output price indices. Input cost indices (or: factor price indices) cover the change in the price of a bundle of factors used to construct a certain type of building (or components thereof). They measure the evolution of wages in the construction sector, the prices paid by contractors to their suppliers of construction materials, equipment hire, and transport and energy costs. By contrast, output price indices decompose construction activity into a bundle of standardized operations covering both structural works (e.g. excavating a building pit) and finishing works (e.g. carpentry works such as doors and windows).[23] They hence reflect the change in the prices contractors charge their customers. Figure 18 summarizes the coverage of input costs and output price indices. The main difference is that output price indices also reflect changes in contractors' profit margins, productivity, and overhead costs (Eurostat, 1996; OECD and European Community, 1996) whereas input cost indices do not.[24] Conceptually, architect fees, legal fees, VAT, and the cost of land are included neither in input cost nor in output price indices (see also Figure 18). Whenever possible, we therefore rely on output price indices as estimates of replacement costs.

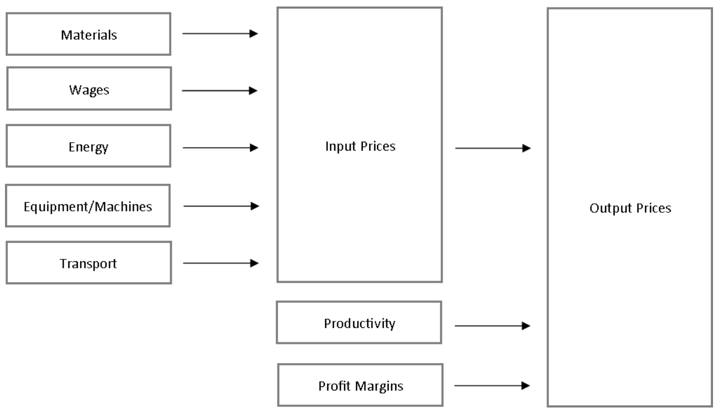


Figure 18: Construction costs: Input prices and output prices

Data on the price of materials used to construct input cost indices typically come from price lists, wholesale price indices as calculated by statistical offices or specific price survey. For wages, input cost indices mainly

[23]The decomposition can be made a priori (component cost method) or a posteriori (schedule of prices method) (Eurostat, 1996). Sometimes also hedonic methods are used to calculate output price indices.

[24]This may particularly matter for short-term fluctuations. Dechent (2006b), for examples, notes that during the first half of the 2000s German output prices did were weighed down by declining profit margins. In times of depressed building activity, construction firms' may not be able to fully pass on material price increases to customers resulting in a wedge between input costs and output prices.

rely on wages indices for the construction sector. For output price indices, price data comes from price surveys or invoice records. Typically, weights of factors or operations are determined according to a representative construction project. An input cost index is thus calculated as

$$ICI = \sum_{i=1}^{n} \left(\sum_{k=1}^{n} \left(I_{c,k}^{m} w_{c,k}^{m} \right) + I^{w} w_{c}^{w} \right) w_{c} \tag{10}$$

,

where ICI is the input cost index, $I_{c,k}^{m}$ is the price index for the material k used to construct component c, $w_{c,k}^{m}$ is the weight of that particular material k in constructing component c, I^{w} is the wage index for the construction cost sector and w_{k}^{w} is the weight of wages in constructing the component c and w_c is the weight of the component c in constructing the representative building.

An output price index is calculated as

$$OPI = \sum_{i=1}^{n} \left(I^{c} w^{c} \right) \tag{11}$$

where OPI is the output price index, I^{c} is the price index for component c and w^{c} is the weight of component c in constructing the representative building.

Construction of the country indices As in the case of house prices indices, we often found series spanning short time periods and had to splice them to arrive at a long-run index. Due to variation in building norms and standards, the historical data we have at our disposal differ across countries and time with respect to the factors or operations included, the sources of price data, and the weighting scheme used to arrive at an aggregate index. Typically, construction cost indices do not adjust for quality changes. By contrast, they aim to reflect the cost of erecting a structure according to current norms and standards. As a result, construction cost indices are regularly rebased which typically also involves an update of the coverage and the weighting scheme. Whenever possible, we rely on construction cost series covering the same or a similar type of house and area as covered by our long-run house price indices. It remains a possibility that the difference between the house price indices and the construction cost indices with respect to coverage and quality adjustment may bias the results of our decomposition exercise in Section 4. While we cannot gauge the exact size and direction of the bias, it is unlikely to systematically distort the long-run trends we uncover. Robustness checks such as in Figure 8 support the assumption that the cost of building a new residential structure and replacement costs of the structures covered by our long-run house price indices move together in the long-run.

We also construct real unit labor cost indices for the construction sector between 1950 and 1970 using national accounts data for Canada, France, Finland, Germany, Norway, Sweden, the U.K., and the U.S. Sources are detailed in the respective country sections below. Unit labor costs ULC_t are calculated as labor compensation per worker C_t divided by output per worker O_t,

$$ULC_t = \frac{C_t}{O_t}. \tag{12}$$

We measure compensation based on salaries and wages (per worker) in the construction sector. Salaries and wages are deflated by the CPI. Output (per worker) in the construction sector is deflated by the construction cost index (Bosworth and Perry, 1994).

Other housing statistics

We complement the house price data with additional housing related data series: prices of farmland and estimates for the total value of the housing stock. For prices of farmland we again rely on official statistical publications and series constructed by other researchers. For benchmark data on the total market value of housing and its components (i.e. structures and land) we turn to the OECD database of national account statistics for the most recent period (with different starting points depending on the country). We consult the work of Goldsmith (1981, 1985) and also build on more recent contributions, such as Piketty and Zucman (2014) (for Australia, Canada, France, Germany, Italy, Japan, the U.S., and UK) and Davis and Heathcote (2007) (for the U.S.) to cover earlier years. For macroeconomic and financial variables, we rely on the long-run macroeconomic dataset from Jordà et al. (2016). Note also that historical CPI series are often confined to urban areas. Due to limited data availability, changes in the quality of commodities and the timing of the introduction of new commodities are not always adequately captured by the historical CPI data. See Grytten (2004) and Officer (2007) for a discussion of the challenges involved in constructing long-run CPI series.

B.2 Australia

House price data

Historical data on house prices in Australia are available for 1870–2012.

The most comprehensive source for house prices for the Sydney and Melbourne area is Stapledon (2012b). His indices cover the years 1880–2011. For the sub-period 1880–1943, they are computed from the median asking price for all residential buildings, indiscriminate of their characteristics and specifics; for 1943–1949, Stapledon (2012b) estimates a fixed prices;[25] for 1950–1970, he uses the median sales price.[26] For the sub-period 1970–1985, Stapledon (2012b) relies on estimates of median house prices by Abelson and Chung (2005) (see below); for 1986–2011, he uses the Australian Bureau of Statistics (2013) (see below) index for established houses.

The median house price series compiled by Abelson and Chung (2005)[27] for Sydney and Melbourne are constructed from various data sources: for

[25]Price controls on houses and land were imposed in 1942 and were only removed in 1948 (Stapledon, 2007, 23 f.).

[26]The ask price series for residential houses (1880–1943) and the sales price series (1948–1970) are compiled from weekly property market reports in the *Sydney Morning Herald* and the *Melbourne Age*. The reports are for auction sales and private treaty sales.

[27]Abelson and Chung (2005) also present series for Brisbane (1973–2003), Adelaide (1971–2003), Perth (1970–2003), Hobart (1971–2003), Darwin (1986–2003), and Canberra (1971–2003). For details on the data sources used for these cities, see Abelson and Chung (2005, 10).

the Sydney series they rely on i) a 1991 study by Applied Economics and Travers Morgan which draws on sales price data from the Land Title Offices (for 1970–1989); and ii) on sales price data from the Department of Housing, i.e. the North South Wales Valuer-General Office (for 1990–2003). For the Melbourne series the authors rely on previously unpublished sales price data from the Productivity Commission drawing, in turn, on Valuer-General Office (for 1970–1979) and Victorian Valuer-General Office sales price data (for 1980–2003).

Besides the Sydney and Melbourne house price indices (see above), Stapledon (2007, 64 ff.) provides aggregate median price series for detached houses for the six Australian state capitals (Adelaide, Brisbane, Hobart, Melbourne, Perth, Sydney) for the years 1880–2006. As house price data are – with the exception of Melbourne and Sydney – not available for the time prior to 1973, the author uses census data on weekly average rents to estimate rent-to-rent ratios.[28] The rent-to-rent-ratios are then used to estimate mean and median price data for detached houses in the four state capitals (Adelaide, Brisbane, Hobart, Perth), based on the weighted mean price series for Sydney–Melbourne for the time 1901–1973.[29] For the years after 1972, Stapledon (2007, 234 f.) uses the Abelson and Chung (2005) series for the period 1973–1985 and the Australian Bureau of Statistics (2013) series for 1986–2006 (see below).

In addition to Stapledon (2012b, 2007) and Abelson and Chung (2005), four early additional house price data series and indices for Sydney and Melbourne are available: i) Abelson (1985) provides an index for Sydney for 1925–1970[30]; ii) Neutze (1972) presents house price indices for four areas in Sydney (1949–1967)[31]; iii) Butlin (1964) presents data for Melbourne

[28]The ratios are computed from average weekly rents for detached houses in the four state capitals (numerators) and a weighted weekly rent calculated from data for Sydney and Melbourne (denominators). Data are available for the years 1911, 1921, 1933, 1947, and 1954.

[29]The same method is applied to extend the series backwards, i.e. to the period 1880–1900. Each city's share of houses is applied for weighting.

[30]Abelson (1985) collects sales and valuation prices from the N.S.W. Valuer-General's records for about 200 residential lots in each of the 23 local government areas. He calculates a mean, a median, and a repeat valuation index.

[31]These areas are Redfern (1949–1969), Randwick (1948–1967), Bankstown (1948–1967) and Liverpool (1952–1967). He also calculates an average of these four for 1952–

(1861–1890)[32]; and iv) Fisher and Kent (1999) compute series of the aggregate capital value of ratable properties covering the 1880s and 1890s for Melbourne and Sydney.

For 1986–2012 the Australian Bureau of Statistics (2013) publishes quarterly indices for eight cities for i) established detached dwellings and ii) project homes. The indices are calculated using a mix-adjusted method.[33] Sales price data comes from the State Valuer-General offices and is supplemented by data on property loan applications from major mortgage lenders (Australian Bureau of Statistics, 2009).[34]

Figure 19 compares the nominal indices for 1860–1900, i.e. an index for Melbourne calculated from Butlin (1964), the Melbourne and Sydney

---

1967 (Neutze, 1972, 361). These areas are low to medium income areas. He relies on sales prices. In none of the years there are less than ten sales, in most years he includes data on more than 40 sales (Neutze, 1972, 363). Neutze does not further discuss the method he used. He argues, however, that his price series can be taken as being typical of all housing.

[32]According to Stapledon (2007), this series gives a general impression of house price movements after 1860. The series is based on advertisements of houses for sale in the newspapers *Melbourne Age* and *Argus*. Stapledon (2007, 16) reasons that by measuring the asking price in terms of rooms rather than houses, Butlin partially adjusted for quality changes and differences as the average amount of rooms per dwelling rose considerably between 1861 and 1890.

[33]The eight cities are Sydney, Melbourne, Brisbane, Adelaide, Perth, Hobart, Darwin, Canberra. 'Project homes' are dwellings that are not yet completed. In contrast, the concept of 'established dwellings' refers to both new and existing dwellings. Locational, structural and neighborhood characteristics are used to mix-adjust the index, i.e. to control for compositional change in the sample of houses. The series are constructed as Laspeyre-type indices. The ABS commenced a review of its house price indices in 2004 and 2007. Prior to the 2004 review, the index was designed as a price measure for mortgage interest charges to be included in the CPI. The weights used to calculate the index were thus housing finance commitments. As part of the 2004 review, the pricing point has been changed, the stratification method improved, and the relative value of each capital city's housing stock used as weights. In 2007 the stratification was again refined and the housing stock weights were updated. Due to the substantive methodological changes of 2004, the ABS publishes two separate sets of indices: 1986–2005 and 2002–2012 (Australian Bureau of Statistics, 2009). They move, however, closely together in the years they overlap.

[34]For 1960–2004, there also exists an unpublished index calculated by the Australian Treasury (Abelson and Chung, 2005). The index moves closely together with the one calculated by Abelson and Chung (2005) (correlation coefficient of 0.995 for the period 1986–2003 and 0.774 for 1970–1985). For the period 1970–2012, an index is available from the OECD based on the house price index covering eight capital cities published by the Australian Bureau of Statistics. For the period 1975–2012, the Federal Reserve Bank of Dallas splices together the index published by the Australian Bureau of Statistics (2013) and the Treasury house price index.

indices by Stapledon (2012b), and the six capital index (Stapledon, 2007). For the years they overlap (1880–1890) the four indices provide considerable indication of a boom-bust scenario, albeit with peaks and troughs staggered between two to three years. For the 1890s the indices generally show a positive trend, which culminates between 1888 (Butlin, 1964, Melbourne) and 1891 (Stapledon, 2012b, Sydney). The six-capitals-index follows a pattern that is somewhat disjoint and inconsistent with that picture: While from 1880 to 1887 prices are stagnant, the boom period is limited to mere three years (1888–1891) during which the index reports a nominal increase of house prices in the six capitals amounting to 25 percent. This trajectory, however, not only differs from the Melbourne and Sydney indices but is also at odds with various accounts (Daly, 1982; Stapledon, 2012b).[35] Against this background, the stagnation of the six-capital-index during most of the 1880s appears rather implausible.

Figure 20 compares the nominal indices for 1900–1970, i.e. the Melbourne and Sydney indices by Stapledon (2012b), the Sydney indices by Neutze (1972) and Abelson (1985), and the six capital index (Stapledon, 2007). Stapledon (2007) discusses the differences between his six-capital-index and the indices by Neutze (1972) and Abelson (1985) and concludes that they either almost fully correspond (in the case of Neutze (1972)) or at least show a very similar trend (in the case of Abelson (1985)) when compared to that of the six-capital-index. Reassuringly, these trends are also in line with narrative evidence on house price developments.[36]

[35]Daly (1982) provides a graphical analysis of land and housing prices in Sydney for the period 1860–1940 drawing on data from business records by Richardson and Wrench (at the time one of the largest real estate agents in Sydney), newspaper reports of sales, and advertisements. Daly (1982, 150) and Stapledon (2012b) describe a pronounced property price boom during the 1880s, followed by a bust in the 1890s. The surge in real estate prices was primarily spurred by a prolonged period of economic growth during the 1870s and 1880s following the gold rushes of the 1850s and 1860s. Also, the time from 1850–1880 was marked by substantial immigration and thus a significant increase in population particularly in the urban areas. For the case of Melbourne, where the house boom was most pronounced, the extensions of mortgage credit through thriving building societies during the 1870s and 1880s appears to have played a major role.

[36]The only very moderate rise in nominal house prices between the beginning of the 20th century and 1950 is striking. According to Stapledon (2012b, 305), this long period of weak house price growth may at least to some extent have been a result of the large volume of new urban land lots developed in the boom years of the 1880s). After a consolidation period following the depression of the 1890s that lasted to 1907,

Figure 21 shows the indices which are available for the period 1970–2012: the Sydney and Melbourne indices by Stapledon (2012b), indices calculated from the Sydney and Melbourne series by Abelson and Chung (2005), the six-capitals-index by Stapledon (2007), and the weighted index for eight cities for 1986–2012 by the Australian Bureau of Statistics (2013).[37] Despite their different geographical coverage, all indices for the years from 1970–2012 follow a joint, almost identical path. It is only after 2004 that the increase in Melbourne property prices shows to be more pronounced compared to Sydney or the Eight Capital Index.

As we aim to provide house price indices with the most comprehensive coverage possible, the series constructed by Stapledon (2007) for the six capitals constitutes the basis for the long-run index. Due to the above mentioned possible deficiencies of the index for the time of the 1880s boom and subsequent contraction, the Stapledon (2012b) index for Melbourne is used for 1880-1899. Therefore, the index may be biased upward to some extent since the boom of the 1880s was particularly pronounced in Mel-

nominal property prices slowly but constantly increased. While house prices reached a high plateau during the 1920s, the consolidation that can be ascribed to the adverse effects of the Great Depression of the 1930s appears to have been only minor in size, particularly in comparison to the substantive house price slumps experienced in other countries. Daly (1982, 169) reasons that this soft landing was mainly due to the fact that prices had been less elevated at the onset of the recession, particularly when compared to the boom and bust cycle of the 1880s and 1890s. The post-World War II surge in house prices has been primarily explained with the lifting of wartime price controls in 1949 that had been introduced for houses and land in 1942. The low construction activity during the war years had also led to a substantive housing shortage in the post-war years. A surge in construction activity was the result (Stapledon, 2012b, 294). While postwar Australia began to prosper, entering a phase of low levels of unemployment and rising real wages, the government aimed to raise the level of homeownership by various means, for example, through the provision of tax incentives (Daly, 1982, 133). By the end of the 1950s, however, the federal government became increasingly uncomfortable with the expansion of consumer credit and the strong increase in property values. As a response, measures to restrict credit expansion were introduced in 1960. The resulting credit squeeze had an immediate and sizable impact on both the real estate market and the economy as whole (Stapledon, 2007, 56). The recovery from this brief interruption was rapid and property prices continued to boom.

[37] The ABS series is spliced in 2003. As Stapledon (2012b) draws upon Abelson and Chung (2005) for 1970–1985, these series should therefore be identical for this period. As Stapledon (2012b) uses the Australian Bureau of Statistics (2013) series for Sydney and Melbourne for 1986–2012, these, again, should be identical for this period. In addition, since Stapledon (2007) uses the Australian Bureau of Statistics (2013) series for eight capital cities, these two indices are identical for post-1986. The Australian Bureau of Statistics (2013) index only starts in 1986.

bourne when compared to, for example, Sydney. The index is extended backwards to 1870 using the index calculated from the Melbourne series by Butlin (1964). Hence, prior to 1900, our index only refers to Melbourne. Although we can say little about the extent to which house prices in the Melbourne area prior to 1900 are representative of house prices in the other Australian state capitals, the graphical evidence provided by Daly (1981) at least suggests that during the time prior to 1880 Sydney house prices showed a comparable upward trend. Beginning in 2003, the index is spliced with the Australian Bureau of Statistics (2013) eight-cities-index.

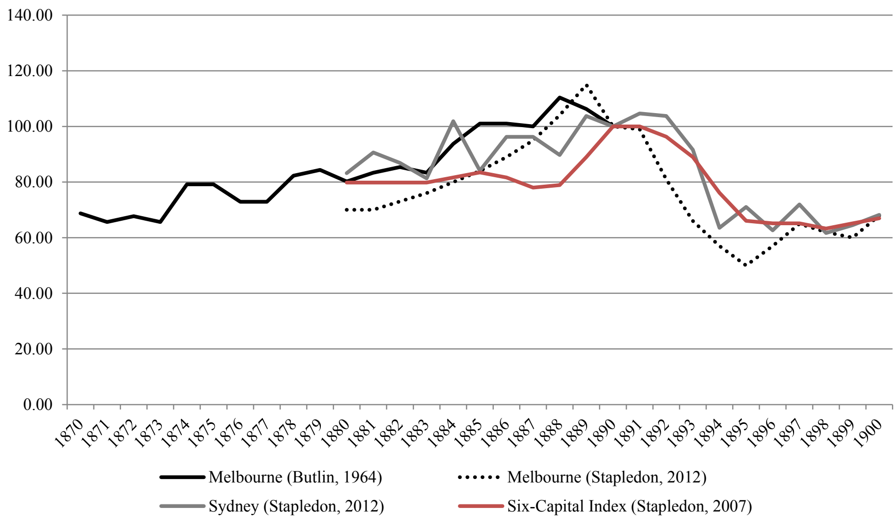


Figure 19: Australia: nominal house price indices 1870–1900 (1890=100).

The resulting index may suffer from three weaknesses: first, prior to 1943, the index is based on asking prices. These may differ from actual transaction prices and thus result in a bias of unknown size and direction. Second, the index does not explicitly control for quality changes, i.e. depreciation or improvement. Third, only after 1986 the index controls for quality changes. To gauge the extent of the quality bias we can rely on estimates provided by Stapledon (2007) according to which improvements, i.e. capital spending, adds an average of 0.95 percent per annum to the value of housing and changing composition of the stock subtracted 0.35 percent per annum from the median price. For the war years of 1914–1918 and 1940–1945 and the depression periods 1891–1895 and 1930–1935, Stapledon (2007) assumes 0.55 percent per annum. These estimates are in

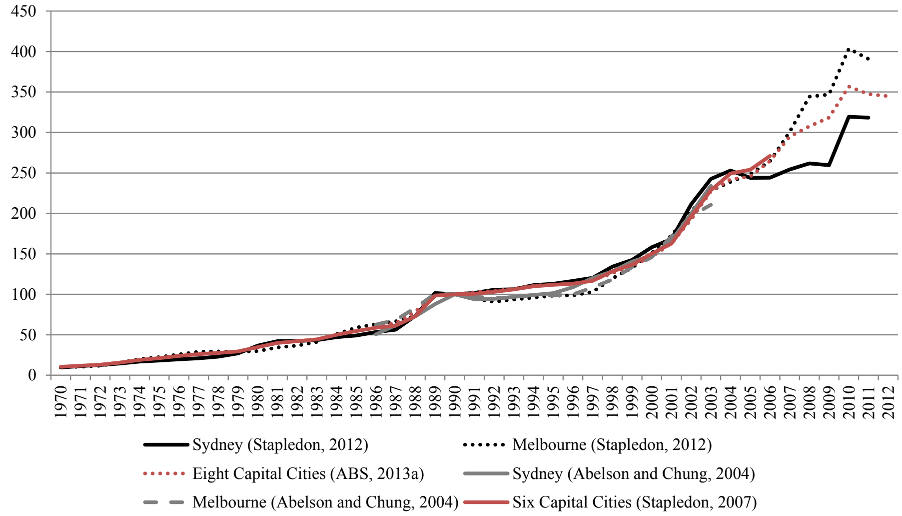


Figure 21: Australia: nominal house price indices 1970–2012 (1990=100).

line with Abelson and Chung (2005). If we adjust the growth rates of our long-run series downward accordingly, the average annual real growth rate over the period 1870–2012 of 1.68 percent becomes 1.11 percent in constant quality terms. As this is a rather crude adjustment, we use the unadjusted index (see Table 5) for our analysis.

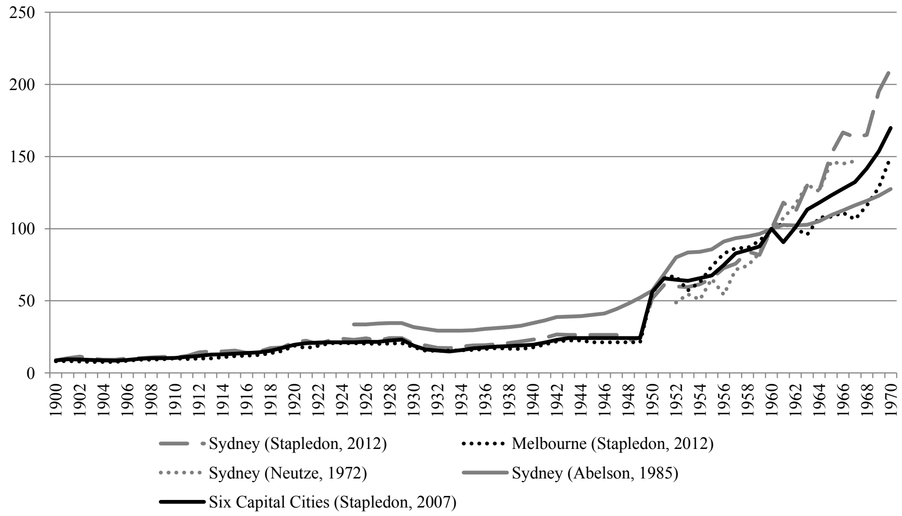


Figure 20: Australia: nominal house price indices 1900–1970 (1960=100).

Period	Series ID	Source	Details
1870–1880	AUS1	Butlin (1964)	*Geographic Coverage*: Melbourne; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Advertisements in newspapers; *Method*: Median asking prices.
1881–1899	AUS2	Stapledon (2012b)	*Geographic Coverage*: Melbourne; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Advertisements in newspapers; *Method*: Median asking prices.
1900–1942	AUS3	Stapledon (2007)	*Geographic Coverage*: Six capital cities; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Advertisements in newspapers and Census estimates of average rents; *Method*: Median asking prices.
1943–1949	AUS4	Stapledon (2007)	*Geographic Coverage*: Six capital cities; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Estimate of the fixed price; *Method*: Estimate of fixed price.
1950-1972	AUS5	Stapledon (2007)	*Geographic Coverage*: Six capital cities; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Weekly property reports in newspapers and Census estimates of average rents; *Method*: Median sales prices.
1973–1985	AUS6	Abelson and Chung (2005), as used in Stapledon (2007)	*Geographic Coverage*: Six capital cities; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Data from Land Title Offices (LTOs); Productivity Commission data; Valuer-General Offices; *Method*: Weighted average of median prices.
1986–2002	AUS7	Australian Bureau of Statistics (2013) as used in Stapledon (2007)	*Geographic Coverage*: Six capital cities; *Type(s) of Dwellings*: New and existing detached houses; *Data*: Data from State Valuer-General Offices, supplemented by data on property loan applications from major mortgage lenders; *Method*: Weighted average of mix-adjusted house price indices.
2003–2012	AUS8	Australian Bureau of Statistics (2013)	*Geographic Coverage*: Eight capital cities; *Type(s) of Dwellings*: New and existing detached houses; *Data*: Data from State Valuer-General Offices, supplemented by data on property loan applications from major mortgage lenders; *Method*: Mix adjustment.

Table 5: Australia: sources of house price index, 1870–2012.

Construction cost data

Historical data on construction costs in Australia are available for 1870–2012. The most comprehensive source is Stapledon (2012a, Table 2). Stapledon (2012a) reports an index for construction costs of new dwellings for 1881–2012. To arrive at a long-run series, the author combines data drawn from Butlin (1962) for 1870–1938, Butlin (1977) for 1939–1949, and the Australian Bureau of Statistics (2015) for the years thereafter. The series computed by Butlin (1962) refers to construction costs per room in Victoria and is based on loan applications for 1870–1890 and 1900–1939 and tender prices for the 1890s. Loan applications come from the records of the Modern Permanent Building Society and the County of Bourke Building Society. Tender prices are drawn from the *Australasian Builder and Contractors' News*. As price data in both sources include profit margins etc., the series can be interpreted as an output price index. To extend the series to cover the 1870s, Butlin (1962) relies on indices for the cost of building materials and of carpenters' and bricklayers' wages. For 1870–1879, the series are thus constructed as input cost indices. The series are smoothed with a three-year moving average. In addition to the aggregate series for all types of dwellings, several series for different types of dwellings and locations for shorter time periods are available. Reassuringly, they generally follow the same trends (see Figure 22).

For the years 1939–1949, Butlin (1977) constructs an input cost index but provides no further details on the characteristics of the series.

As part of the Australian National Accounts, the Australian Bureau of Statistics (2015) for the years since 1949 calculates an implicit price deflator for private residential construction, alterations and additions. The series is obtained by dividing the current value of residential structures by a volume estimate. The index therefore reflects the replacement value of all types of residential dwellings.

Our long-run construction cost index for Australia 1881–2012 splices the available series as shown in Table 6.

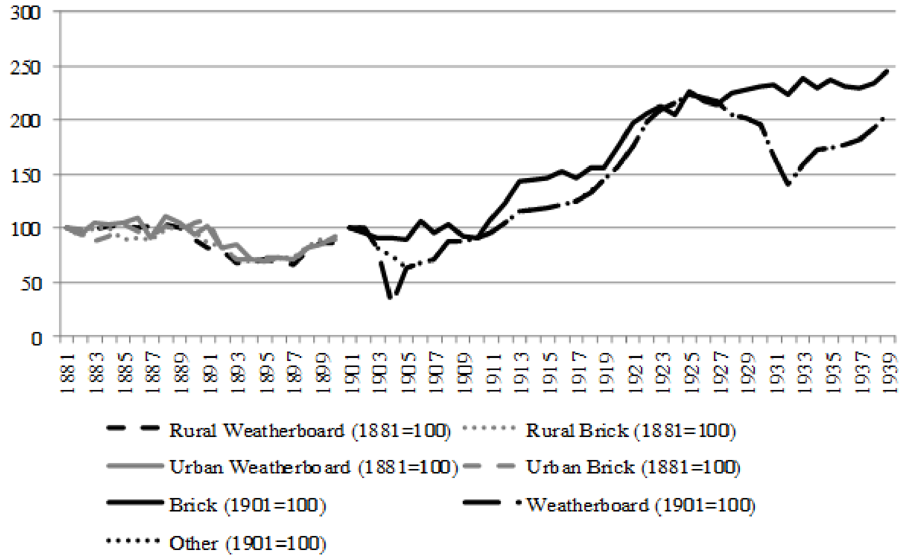


Figure 22: Australia: nominal construction cost indices 1881–1939.

Period	Source	Details
1870–1880	Butlin (1962)	*Geographic Coverage*: Victoria; *Type(s) of Dwellings*: All types of buildings; *Type of Index*: Input cost index.
1881–1900	Butlin (1962) as published in Stapledon (2012a)	*Geographic Coverage*: Victoria; *Type(s) of Dwellings*: All types of dwellings; *Type of Index*: Output price index.
1901–1939	Butlin (1962) as published in Stapledon (2012a)	*Geographic Coverage*: Victoria; *Type(s) of Dwellings*: All types of dwellings; *Type of Index*: Output price index.
1940–1948	Butlin (1977) as published in Stapledon (2012a)	*Geographic Coverage*: no information available; *Type(s) of Dwellings*: no information available; *Type of Index*: Input index.
1949–2012	Australian Bureau of Statistics (2015) as published in Stapledon (2012a)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of dwellings; *Type of Index*: Replacement values.

Table 6: Australia: sources of construction cost index, 1870–2012.

Land price data

Data on residential land prices for the period 1880–2005 comes from Stapledon (2007). Stapledon (2007) reports decennial data on median land prices in Sydney and Melbourne for 1880–1940 and quinquennial data for 1950–2005. Observations are calculated as period averages of median prices for 1880–1990 and as period averages of average prices thereafter. Note that the series is not adjusted for the size of the lot. For 1880–1970, the series is based on data on the price of land for sale and sold from newspaper advertisements (see above). The lots included are located in all segments of the urban areas but are predominantly new allotments in outer suburbs. Therefore, Stapledon (2007) argues that the sample reflects the value of land lots at the urban fringe rather than the value of urban land in general. For 1970–1989, he relies on a series of median residential land prices in Melbourne and Sydney constructed by BIS-Schrapnel using data from two newspapers, the *Sydney Morning Herald* and *Age*. For the years since 1990, he relies on data on the value of residential land by state collected by the Australian Bureau of Statistics and calculates an index of average land value per dwelling (see Stapledon (2007, 196f.) for further details). We use an unweighted average of the resulting long-run series for Melbourne and Sydney.

Other housing related and macroeconomic data

Value of housing stock: Goldsmith (1985) and Garland and Goldsmith (1959) provide estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1903, 1915, 1929, 1947, 1956, 1978. Data for 1988–2011 is drawn from OECD (2013). Piketty and Zucman (2014) present data on the value of household wealth in land and dwellings for 1959–2011.

CPI: 1870–2007: Taylor (2002); 2008–2012: International Monetary Fund (2012).

B.3 Belgium

House price data

Historical data on house prices in Belgium are available for 1878–2012.

The earliest available data on house prices in Belgium is provided by De Bruyne (1956). It covers the greater Brussels area for the period 1878–1952 and is reported as the annual median price per square meter of the interquartile range for four real estate categories: i) residential property[38] in the center of Brussels, ii) maisons de rentier,[39] iii) building sites (since 1885), and iv) commercial properties[40] (since 1879).[41]

A second extensive source comprising two house price indices - one for 1919–1960 and the other for 1960–2003 - is Janssens and de Wael (2005). The first index, i.e. for 1919–1960, is based on two data sources: for 1919–1950 the index relies on a property price index for Brussels published by the Antwerpsche Hypotheekkas (1961) using sales price data for maisons de rentier. The AHK-index is computed as the annual median price of the interquartile range. For 1950–1960, the index is based on nationwide data for all public housing sales subject to registration rights gathered by Statistics Belgium. For these years the index reflects the development of the weighted mean sales price; weights are constructed from the share of total national sales in each of the 43 Belgian arrondissements (districts). The compu-

[38]'Maisons d'habitation' are defined as houses of rather inferior quality. Some of them may be 'maisons de rentier' (see below) that have been downgraded because of the neighborhood or the age of the building. They are usually inhabited by workers or employees, small, and do not have electricity, central heating, gas or water (De Bruyne, 1956, 62).

[39]'Maisons de rentier' are defined as properties that are located in a good neighborhood, have usually more than one story, are well maintained, and serve as a single-family dwelling (De Bruyne, 1956, 61 f.).

[40]Commercial properties are defined as all buildings for commercial use, i.e. hotels, restaurants, retail stores, warehouses, etc. (De Bruyne, 1956, 63).

[41]Data are drawn from accounts of public real estate sales published in the *Guide de l'Expert en Immeubles* (Real Estate Agents' Catalogue), a periodical of the Union des Géomètres-Experts de Bruxelles (Union of Surveyors of Brussels). The records include the more urban parts of the Brussels district, such as Brussels itself, Etterbeek, Ixelles, Molenbeek, Saint-Gilles, Saint-Josse, Schaerbeek, Koekelberg, and Laeken. De Bruyne (1956) also publishes separate house price series for the more rural areas, such as Anderlecht, Auderghem, Forest, Ganshoren, Jette, Uccle, Watermael-Boitsfort, Berchem-Ste-Agathe, Woluwe-St-Lambert, Woluwe-St-Pierre, Evere, Haeren, Neder over-Heembeck.

tational method for the second index from Janssens and de Wael (2005), covering the years 1960–2003, is identical to that applied to the sub-period 1950–1960. The sole difference lies in the coverage of the data provided by Statistics Belgium. While for the period 1950–1960 sales information is limited to public sales, the index for the time 1960–2003 is computed using price information for both public and private housing sales that were subject to registration rights.

In addition to these two principal sources, for the years since 1986, Statistics Belgium (2013) on a quarterly basis publishes price indices for the following four types of real estate: i) building lots; ii) apartments; iii) villas; and iv) single-family dwellings. The indices are constructed using stratification and are available for the national, regional, district (arrondissements), and communal level.[42]

Figure 23 shows the nominal indices for the different property types (maisons d'habitation, maisons des rentier, commercial buildings, and building sites) based on the data from De Bruyne (1956). Three indices (maison d' habitation, maison de rentier, and maison de commerce) move closely together throughout the 1878–1913 period; only the building sites index shows a comparably higher degree of volatility particularly during the 1880s and 1890s. Nevertheless, all four indices depict a similar trend: nominal house prices trend downwards until the late 1880s and slowly recover afterwards. De Bruyne (1956) suggests that these trends are generally in line with the fundamental macroeconomic trends and narrative evidence on house price developments in Belgium.[43]

[42] Dwellings are stratified according to type and location. The stratification was refined in 2005 so that single-family dwellings are categorized according to their size (small, average, large) causing a break in the series between 2004 and 2005. The index is computed as a chain Laspeyre-type price index. It does not control for quality changes. Districts are aggregated according to the number of dwellings in the base period (2005). For the period 1970–2012, an index is available from the OECD based on the index compiled by the Bank of Belgium, which in turn is based on the data from Statistics Belgium (European Central Bank, 2013). For the period 1975–2012, the Federal Reserve Bank of Dallas also uses the data from Statistics Belgium (2013) and Stadim (2013).

[43] Since the 1880s, the Belgian economy had been in a recession. Recovery only began to take hold in the mid-1890s (Van der Wee, 1997). The housing act of 1899 through promoting reduced-rate loans and extending tax exemptions and tax reduction for homeowners may have further contributed to the slow upward trend in house prices (Van den Eeckhout, 1992). Following the economic resurgence in 1906, Belgium until the eve of

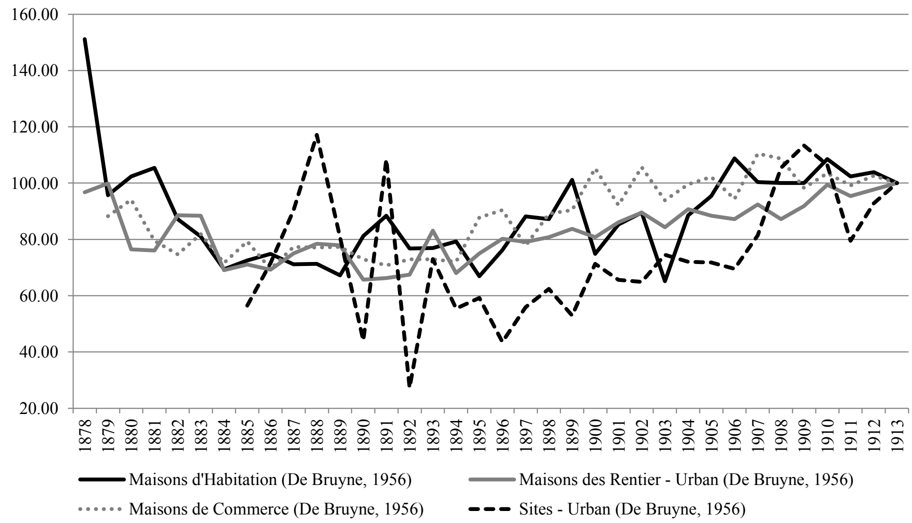


Figure 23: Belgium: nominal house price indices 1878–1913 (1913=100).

Figure 24 displays the nominal indices available for 1919–1960; i.e. the index calculated from the data by De Bruyne (1956) for the Brussels area, the indices from Janssens and de Wael (2005) for the Brussels area, and an index for Antwerp by Antwerpsche Hypotheekkas (1961). As Figure 24 shows, these nominal indices move closely together during the years they overlap, i.e. 1919–1952.[44] The indices accord with accounts of house price developments during this period.[45] Although all three indices only

World War I experienced years of prospering economic activity. De Bruyne (1956) notes that during this period the gap between prices for property in urban and more peripheral parts of the Brussels area began to close. He ascribes this convergence largely to improvements in transportation and communication systems during that time (Janssens and de Wael, 2005; Antwerpsche Hypotheekkas, 1961).

[44]Correlation coefficient of 0.995 for the two Brussels indices; correlation coefficient of 0.993 for the Antwerpen-index (Antwerpsche Hypotheekkas, 1961) and the Brussels index (De Bruyne, 1956).

[45]De Bruyne (1956) reasons that the increase in property prices between 1919 and 1922 was to a large extent caused by a general shortage of housing in the postwar years. While De Bruyne (1956) in this context diagnoses the house price boom to be primarily driven by speculation, the Antwerpsche Hypotheekkas (1961) attributes the price rise to the rapid economic growth during these years. House prices substantially decreased throughout the economic crisis of the 1930s. De Bruyne (1956), however, argues that the decrease was less pronounced in less expensive property categories, i.e. maisons d'habitation as opposed to maisons de rentier since with declining incomes many people were forced to relocate to either areas in which housing is less expensive or to lower quality housing. Prices appear to slightly recover in the end of the 1930s. Yet, the advent of World War II puts the property market back into decline. After the end of World War II, the Belgian economy entered three decades of substantive though non-linear growth which is clearly reflected in house prices. Also, as a result of the wartime

gauge price developments for maisons de rentier, we know from Figure 23 that their value should not develop in a fundamentally different way than the value of other property types. We may also assume that price trends across Belgian cities did not differ significantly. Figure 24 includes an index for maisons de rentier for Antwerp.[46] When comparing the index for Antwerp and the indices for Brussels, the latter seems not to show a singular development in house prices. Summary statistics of the indices by decade clearly confirm the similarity of general statistical characteristics of the series. This finding can be reinforced from another direction. Leeman (1955, 67) examines house prices in Brussels, Antwerp, Mechelen, Leuven, Bruges, Dinant, and Lier using records of a mortgage bank for the years 1914–1943. He, too, concludes that the trends in Brussels' house prices generally mirror the trends in other regions of Belgium during the interwar period.

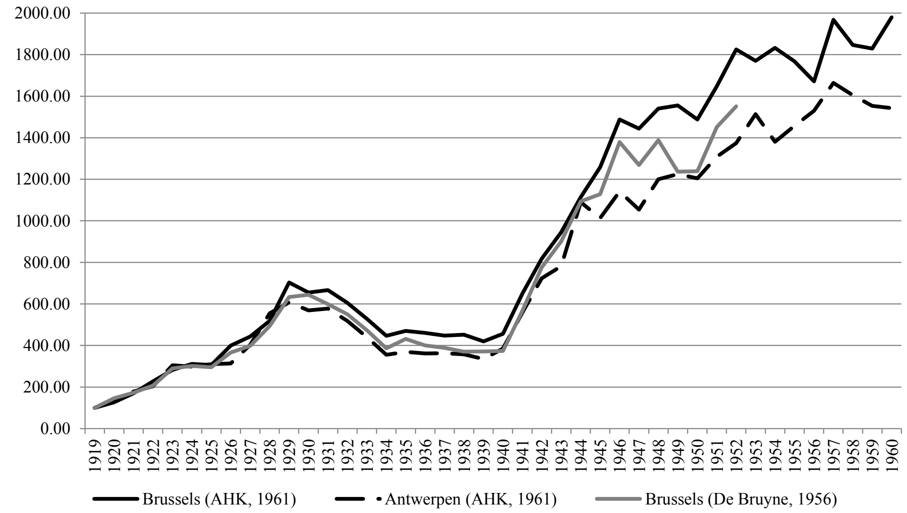


Figure 24: Belgium: nominal house price indices 1919–1960 (1919=100).

destruction, Belgium faced a substantial housing shortage which further drove up prices (Antwerpsche Hypotheekkas, 1961).

[46] To the best of our knowledge, no other index for this property type is available for other parts of Belgium.

Period	Series ID	Source	Details
1878–1913	BEL1	De Bruyne (1956)	*Geographic Coverage*: Brussels area; *Type(s) of Dwellings*: Existing maisons de rentier; *Data*: Guide de l'Export en Immeubles; *Method*: Median sales prices.
1919–1950	BEL2	Janssens and de Wael (2005); based on Antwerpsche Hypotheekkas (1961)	*Geographic Coverage*: Brussels area; *Type(s) of Dwellings*: Maisons de Rentier; *Data*: Antwerpsche Hypotheekkas (1961); *Method*: Median sales prices.
1951–1959	BEL3	Janssens and de Wael (2005)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Small & medium-sized existing houses; *Data*: Transaction prices (public sales; gathered by Statistics Belgium); *Method*: Weighted average of mean sales prices.
1960–1985	BEL4	Janssens and de Wael (2005)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: 1960–1970: Small & medium-sized existing houses; 1971 onwards: all kinds of existing dwellings (villas & mansions included); *Data*: Transaction prices (public and private sales) gathered by Statistics Belgium); *Method*: Weighted average of mean sales prices.
1986-2012	BEL5	Statistics Belgium (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Existing, single-family dwellings; *Data*: Transaction prices; *Method*: Weighted mix-adjusted index.

Table 7: Belgium: sources of house price index, 1878–2012.

Period	Source	Details
1914–2012	Belgian Association of Surveyors (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of buildings; *Type of Index*: Output price index.

Table 8: Belgium: sources of construction cost index, 1914–2012.

For the years 1986–2003 also the index by Janssens and de Wael (2005) for 1960–2003 and the one by Statistics Belgium (2013) show the same statistical characteristics.[47] Our long-run house price index for Belgium for 1878–2012 splices the available series as shown in Table 7.

The most important limitation of the long-run series is the lack of correction for changing qualitative characteristics of and quality differences between the dwellings in the sample. To some extent the latter aspect may be less of a problem for 1878–1950 since for that period the index is confined to a certain market segment, i.e. maisons de rentier. Prior to 1950, the series is also adjusted for the size of the dwelling as it is based on price data per square meter. Moreover, despite the fact that the movements in prices for maisons de rentier closely mirror fluctuations in prices of other property types prior to 1913 (cf. Figure 23), it is of course possible that this particular market segment is not perfectly representative of fluctuations in prices of other residential property types for the whole 1878–1950 period. In an effort to gauge the size of the upward bias stemming from quality improvements we calculate the value of expenditures on alterations and additions as percentage in total housing value for benchmark years. If we downward adjust the real annual growth rates of our long-run index accordingly, the average annual real growth rate over the period 1878–2012 of 1.96 percent becomes 1.77 percent in constant quality terms. Yet, as this is a rather crude adjustment, we use the unadjusted index (see Table 7) for our analysis.

Construction cost data

Historical data on construction costs in Belgium are available for 1914–2012.

Two main sources for construction costs in Belgium exist. First, the Belgian Association of Surveyors (2013) publishes an output price index (ABEX-index) for all types of new buildings (residential and commercial) covering the period 1914–2012. The index is constructed as an output price

[47]This, however, is unsurprising since Stadim cooperated with Statistics Belgium in the creation of its index. Both, Janssens and De Wael are founding members of Stadim.

index and is based on data collected by members of an ABEX commission. The index is published twice a year, in March and November. We calculate an unweighted average of March and November values to arrive at an annual series.

Second, Buyst (1992) graphically reports real building cost indices for 1890–1913, 1920–1939, and 1946–1961. The indices are constructed as input cost indices using data on prices of building materials reported in Buyst (1992) and data on wages in the construction sector from Scholliers (1982), the *Arbeidsblad*, and the *Statistisch Bulletin* published by Statistics Belgium. This graphical analysis of real building costs can be used as a comparative to the index published by the Belgian Association of Surveyors (2013). Reassuringly, the series follows a trend similar to the index calculated by Belgian Association of Surveyors (2013). Our long-run construction cost index for Belgium therefore relies on the ABEX-index for the whole 1914–2012 period (see Table 8).

Land price data

Data on residential land prices for the period 1953–2012 comes from Stadim (2013). The annual index refers to prices of building lots per square meter and is calculated based on transactions of land registered by the Dutch land registry (Kadaster). The national series is calculated as a weighted average of prices of building lots per square meter in the Flemish and the Walloon region.[48]

Other housing related and macroeconomic data

Farmland prices: 1980–2007: Vlaamse Overheid[49] - Price index for farmland; 2008–2009: Bergen (2011) - Sales prices for farmland in Vlaanderen per square meter.[50]

Value of housing stock: Goldsmith (1985) provides estimates of the value

[48] Number of transactions are used as weights.
[49] Series sent by email, contact person is Els Demuynck, Vlaamse Overheid
[50] No data are available for 2010–2012.

of total housing stock, dwellings, and land for 1950 and 1978. Data for 2005–2011 is drawn from Poullet (2013).

CPI: 1870–2007: National Bank of Belgium (2012)[51]; 2008–2012: International Monetary Fund (2012).

B.4 Canada

House price data

Historical data on house prices in Canada are scarce even though real estate boards were already established in the early 20th century. Data on house prices in Canada is available for 1921–2012.

The first available series is presented by Firestone (1951) and covers the years 1921–1949. The index is calculated using data on the average value of residential real estate (including land) and the number of existing dwellings and hence reflects the average replacement value of existing dwellings rather than prices realized in transactions.[52]

A dataset published by the Canadian Real Estate Association (1981, (CREA)) covers the time 1956–1981. It contains annual data on the average

[51] Table "Indice des prix à la Consommation en Belgique," series received from Daisy Dillen, National Bank of Belgium

[52] Firestone (1951, 431 ff.) calculates the value of residential capital, i.e. the value of all existent dwellings, in 1921 by computing the average construction cost per dwelling, adjusting it for the proportion of the life of the dwelling already consumed and multiplying it with the number of available dwellings. The adjustment was made by subtracting 22/75 of the average cost of a non-farm home (the average age of a non-farm home in 1921 was 22 years, Firestone (1951) assumes an average life expectancy of a dwelling of 75 years) and 18/60 for farm homes (the average age of a farm home in 1921 was 18 years, Firestone (1951) assumes an average life expectancy of a farm dwelling of 60 years). The resulting value for 1921 may thus underestimate the value of an average residential structure in 1921 as it is not adjusted for improvements or alterations of the existing housing stock. Using these estimates of the value of structures and data on the ratio of land cost to construction costs, Firestone (1951) calculates the value of residential land in 1921. For the years 1922–1949, the 1921 value is revalued using average construction costs, deducting depreciation, deducting the value of destroyed and damaged dwellings, and adding gross residential capital formation in the respective year. The value of land put in use for residential use in the respective year is added and the value of land removed from residential use is deducted. The series for the total value of residential real estate is calculated as the sum of the series for the value of structures and the series for the value of land.

value and the number of transactions recorded in the Canadian Multiple Listing System (MLS) for all properties, i.e. it includes both residential and non-residential real estate. In addition, Subocz (1977) presents a mean price index for new and existing single-family detached houses covering an earlier period, i.e. 1949–1976. The index is based on price data collected from the records of the Vancouver and New Westminster Registry offices serving the Greater Vancouver Regional District.

CREA also publishes a second house price data series that solely draws on price data from secondary market residential properties transactions through MLS covering the years 1980–2012.[53] The series is computed as average of all sales prices in the residential property market.

The University of British Columbia index constitutes another source for the development of house prices in Canada. It covers the period 1975–2012 and is computed from price information for existing bungalows and two story executive detached houses in ten main metropolitan areas of Canada (Centre for Urban Economics and Real Estate, University of British Columbia, 2013, UBC Sauder).[54] For each of the cities, UBC Sauder uses a population weighted average of the price change in each neighborhood for which data are available. Subsequently, the index is weighted on changes in the price level of different housing types, i.e. detached bungalows and executive detached houses, according to their share in total units sold. The aim is to capture the within-metro-variation in house prices in proportion to the size of the housing stock and variation across housing types. Data are drawn from the Royal LePage house price survey.[55]

In addition to that, Statistics Canada issues three house price indices for new developments. Data are disaggregated to the provincial level and currently cover the period 1981–2012. They measure price developments for i) buildings; ii) land; and iii) real estate (land and buildings) and are ag-

[53]Series sent by email, contact person is Gregory Klump, Canadian Real Estate Association (CREA).

[54]Bungalows are defined as detached, one-story, three-bedroom dwellings with living space of about 111 square meters.

[55]The way the house price survey is conducted ensures some degree of constant quality as Royal LePage standardizes each housing type according to several criteria, such as square footage, the number of rooms, etc. (European Commission, 2013, 119).

gregated to nationwide indices and a separate index for the Atlantic region (Statistics Canada, 2013c). The indices are computed from sales prices of new real estate constructed by contractors based on a survey that is conducted in 21 metropolitan areas with the number of builders in the sample representing at least 15 percent of the total building permit value of the respective city and year. The construction firms covered mainly develop single unit houses. The survey data includes information on various characteristics of the units constructed and sold. The index is a matched-model index, i.e. a constant-quality index in the sense that the characteristics of the structures and the lots are identical between successive periods.

The index produced by Firestone (1951) is hence the only available source for house prices in Canada prior to the 1950s. We therefore have to rely on accounts of housing market developments as plausibility check. The nominal index suggests that house prices are fairly stable throughout the 1920s, fall in the wake of the Great Depression, and increase after 1935. Anderson (1992), discussing Canadian housing policies in the interwar period, also suggests that house prices fall during the early 1930s. He furthermore points toward policy measures introduced during the second half of the 1930s that aimed at stimulating housing construction which may explain a demand-driven increase in house prices during these years.[56] Overall, the trajectory of the Firestone (1951) appears plausible.

Figure 25 compares the nominal house price indices available for 1956–2012, i.e. the UBC Sauder index, the price index for new houses (including land) by Statistics Canada, and an index computed from the two CREA datasets (i.e. 1956–1981, and 1980–2012). As the graph suggests, all indices show a marked positive trend in the post-1980 period. However, the magnitude of the price increase varies between the four measures. The European Commission (2013, 120) suggests that the more pronounced growth of the CREA index since the mid-1980s is due to the fact that the series is calculated from a simple average of real estate secondary market prices. Hence, it is biased with respect to the composition (e.g. size, standard, quality, etc.) of the overall volume of secondary market transactions. As

[56] Anderson (1992) lists the 1935 Dominion Housing Act, the 1937 Home Improvement Loan Guarantee Act, and the 1938 National Housing Act.

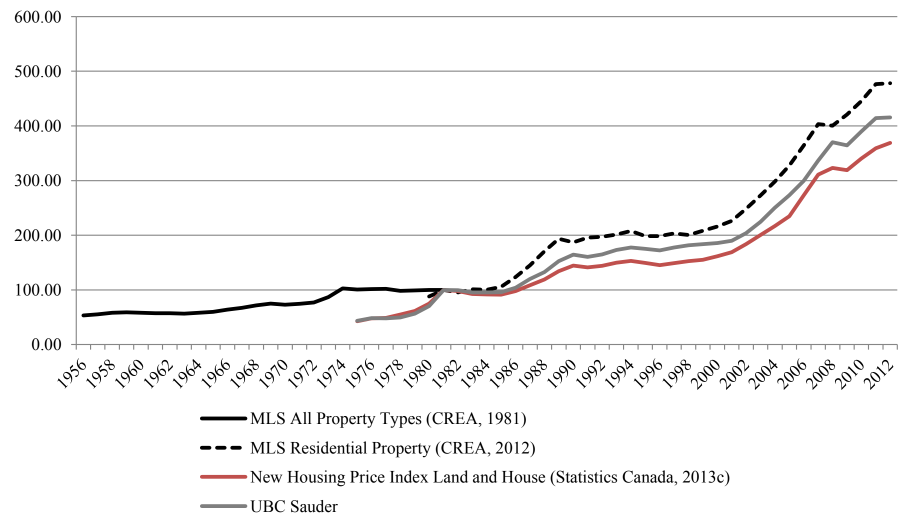


Figure 25: Canada: nominal house price indices 1956–2012 (1981=100).

this second CREA index, due to the substantive coverage of MLS, includes about 70 percent of all marketed residential properties (European Commission, 2013, 119), it can despite these conceptual limitations be considered a fairly reliable measure for the overall evolution of house prices in Canada for the time from 1980 to present. In comparison to the CREA index, the Statistics Canada index for new houses points toward a less pronounced increase in house prices. However, this Statistics Canada index - as it is solely calculated from price information on new developments - may also be subject to some degree of bias. New residential developments are primarily built in the suburban areas of larger agglomerations where prices and price fluctuations tend to be lower than in city centers (Statistics Canada, 2013a; European Commission, 2013). This may also be the reason for the different magnitude between the UBC Sauder index and the index by Statistics Canada. For the years since 1975 we use the UBC Sauder index as it is confined to a certain market segment (bungalows and existing two-story executive buildings) and thus should be less prone to composition bias than the CREA series.[57]

Figure 26 compares the CREA index for 1956–1981 with the one pre-

[57]Figure 25 suggests that the CREA index for the time 1975–1980 follows a trend different from that of the UBC and Statistics Canada indices. While the latter for the period under consideration show a considerable positive trend, the former appears to be fairly stagnant. We therefore also use the UBC Sauder index for the years 1975–1980.

sented by Subocz (1977). CREA argues that the MLS statistics covering residential and non-residential real estate for the time from 1956–1981 can be used to reliably proxy residential house price development. In addition to the CREA index and the Subocz index, two other sources discuss the development of Canadian house prices prior to the 1980s. The first is a report by Miron and Clayton (1987) which is commissioned by the Canada Mortgage and Housing Corporation and the housing agency of the Canadian government. The authors use scattered data from Statistics Canada to discuss developments in house prices in Canada between 1945 and 1986.[58] Their narrative suggests that house prices in the postwar period generally followed the development of the Canadian economy as a whole. According to the authors, postwar social policy schemes - even though not directly linked to housing policy - generated additional demand side effects as they enabled particularly low-income families to devote a larger disposable income to housing consumption. House prices strongly increased during postwar years, i.e. until the late 1950s, when economic growth declined creating a decline in house prices. In the economic resurgence starting in the mid-1960s, house prices also picked-up and *"increased at a frantic pace in the 1970s before tailing off again in the recession of the 1980s"* (Miron and Clayton, 1987, 10).[59] A second source is Poterba (1991) who also identifies a run-up in house prices during the 1970s that coincided with the recession of 1982. With the pattern of pronounced variation in the growth rates of real estate prices over time as diagnosed by Miron and Clayton (1987) and Poterba (1991), the first CREA index must be treated with caution. It shows that, different to the CREA-index, the Sobocz-index appears more consistent with narratives by Miron and Clayton (1987) and Poterba (1991) for the period 1949–1976. Yet, the Sobocz-index relies only on a rather small sample size and is confined to property sales in the Greater Vancouver area. Another sign of partial inconsistency is the fact that the Sobocz-index reports an increase in average real house prices of an astonishing 280 percent between 1956 and 1974. The CREA index for

[58] Years included: 1941, 1946, 1951, 1956, 1961, 1966, 1971, 1976, 1981, 1984.

[59] Miron and Clayton (1987) argue that the house price surge during the 1970s was also associated with the baby boomers starting to buy residential properties. They also suggest that tax policies made homeownership more attractive after the tax reforms of 1972 introducing tax exemption of capital gains from sales of principal residences.

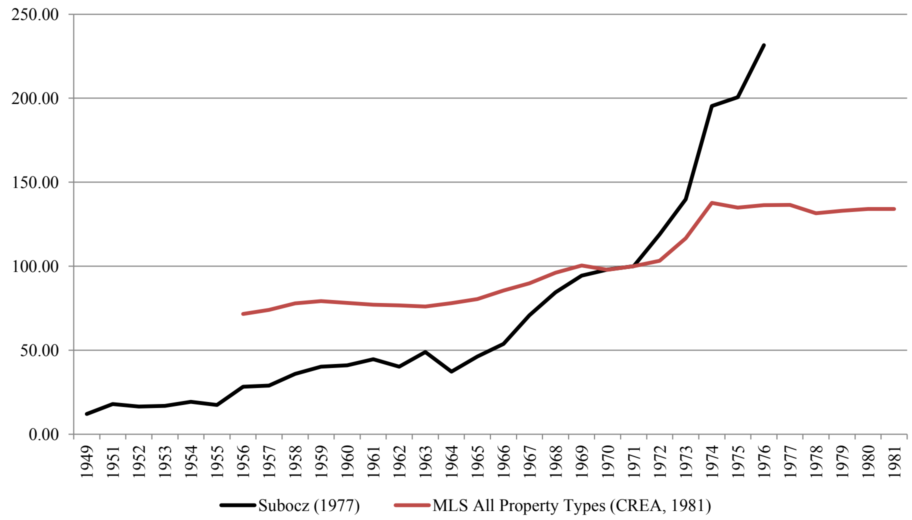


Figure 26: Canada: nominal house price indices 1949–1981 (1971=100).

the same time reports an increase of approximately 87 percent. Therefore, despite its potential weaknesses, we rely on the CREA index to construct the long-run house price index for Canada.

Data on residential house prices is available for 1921–1949 and for 1956 onwards. For 1921–1949, the series on average value of existing farm and existing non-farm dwellings including land are highly correlated (Firestone, 1951, Tables 69 & 80).[60] Since no data on residential house prices is available for 1949–1956, we use the percentage change in the value of farm real estate per acre to link the 1921–1949 and the 1956–1974 series (Urquhart and Buckley, 1965). Our long-run house price index for Canada 1921–2012 splices the available series as shown in Table 9.

The resulting long-run index has three drawbacks: first, data prior to 1949 is not based on actual list or transaction prices but calculated as the average replacement value of existing dwellings including land value (see data description above). This approach may result in a bias of unknown size and direction. Second, for 1956–1974, the index refers to both residential and non-residential real estate and is not adjusted for compositional changes. Third, the index is not adjusted for quality improvements for the years after 1956. The bias should be mitigated for the post-1975 years due

[60] Correlation coefficient of 0.856.

to the way the Royal LePage survey is set up (see above). As a way to gauge the potential effect of quality changes, we calculate the value of expenditures on alterations and additions as percentage in total housing value for benchmark years and adjust the annual growth rates of the series downward for the years 1956–1974 using these estimates. The average annual real growth rate over the period 1921–2012 of 2.21 percent becomes 1.67 percent in constant quality terms. As this is a rather crude adjustment, we use the unadjusted index (see Table 9) for our analysis.

Construction cost data

Historical data on construction costs in Canada are available for 1870–2012.

The earliest available data on construction costs has been collected by Urquhart (1993). Urquhart (1993) reports a construction cost index for 1870–1921. The index is calculated as an input cost index by combining the following series: i) a building material index calculated as unweighted average of the building materials index constructed by Rymes (1967) and the price index for wood and wood products published by Statistics Canada (1983, K38), and ii) a wage index calculated as weighted average of backward percentage changes of various series of construction sector wages (see Urquhart (1993, p.545) for details). Weights to construct the aggregate construction cost index for 1870–1921 are as follows: wages 0.387 and materials 0.613.

For 1921–1949, a construction cost index for new dwellings is available from Firestone (1951). The series is constructed as an input cost index by combining a wholesale price index for house-building materials prepared by the Dominion Bureau of Statistics and an index of wage rates in building trades published by the Canadian Department of Labor. Weights are chosen based on a 1946 survey of contractors and builders.

For 1926–1976, Statistics Canada (1983, Series S327, K136) publishes an input cost index for new residential construction. Prices of materials and equipment are manufacturers' new order selling prices of about 90 different commodities. For 1935–1970, wage rates are base rates in selected cities across Canada for eight construction trades. The composite wage index is computed as a weighted average of these sub-indices. Weights come from a survey of labor requirements in about 100 buildings conducted by the Department of Labor immediately after World War II. Since 1970, wage rates are basic union wage rates for building trades in major cities and weights are labor requirements based on studies published by the Central Mortgage and Housing Corporation.[61] For 1977–1985, we rely on the continuation of this input cost index for new residential construction as published in Statistics Canada (various years).

For 1986–2012, Statistics Canada (2013b) constructs an output price index for apartment buildings in metropolitan areas.[62] In addition to the main construction items, the index also covers the price of kitchen cupboards and carpets. Architects' fees, engineers' fees, goods and services taxes are excluded. Data are collected through telephone surveys and personal visits as well as from producer price index sources. Weights are based on a cost analysis of an index house. The index house is a concrete apartment building built in 1981 with 53 units on 7 stories, basement parking facility and a penthouse unit.

Our long-run construction cost index for Canada 1870–2012 splices the available series as shown in Table 10. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by Statistics Canada (2014). Between 1950 and 1970, real unit labor in Canada increased by 33 percent.

Other housing related and macroeconomic data

Farmland prices: 1901–1956: Urquhart and Buckley (1965) - Value of farm capital (land and buildings) per acre; 1965–2009: Manitoba Agriculture, Food and Rural Initiatives (2010) - Value of farm real estate (land and buildings) per acre; 2010–2011: Province of Manitoba (2012) - Value of farm real estate (land and buildings) per acre.

[61] Weights are: wages 0.359 and materials 0.641.

[62] Seven metropolitan areas are included: Halifax, Montréal, Toronto, Calgary, Edmonton, Vancouver and Ontario.

Period	Series ID	Source	Details
1921-1949	CAN1	Firestone (1951)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All kinds of existing dwellings (farm and non-farm) ; *Data*: Estimates of the value of residential structures and the value of residential land as well as data on all available residential dwellings; *Method*: Average replacement values.
1949-1956		Urquhart and Buckley (1965)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Farm real estate; *Method*: Value of farm real estate per acre.
1956-1974	CAN2	Canadian Real Estate Association (1981)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All kinds of real estate (residential and non-residential); *Data*: Transactions registered in the MLS system; *Method*: Average sales prices.
1975-2012	CAN3	Centre for Urban Economics and Real Estate, University of British Columbia (2013)	*Geographic Coverage*: Five cities; *Type(s) of Dwellings*: Existing bungalows and two story executive dwellings; *Data*: Royal LePage real estate experts; *Method*: Average prices.

Table 9: Canada: sources of house price index, 1921–2012.

Period	Source	Details
1870–1920	Urquhart (1993)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of buildings; *Type of Index*: Input cost index.
1921–1925	Firestone (1951)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Single-family houses; *Type of Index*: Input cost index.
1926–1985	Statistics Canada (1983, various years)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: Single-family houses; *Type of Index*: Input cost index.
1986–2012	Statistics Canada (2013b)	*Geographic Coverage*: Metropolitan areas; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Output price index.

Table 10: Canada: sources of construction cost index, 1870–2012.

Value of housing stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1950 and 1978. Data on the value of household wealth including the value of total housing stock, dwellings, and land for 1970-2011 is drawn from OECD (2013). Piketty and Zucman (2014) also present data on real estate wealth for benchmark years in the period 1895–1955.

CPI: 1870–2007: Taylor (2002); 2008–2012: International Monetary Fund (2012).

B.5 Denmark

House price data

Historical data on house prices in Denmark are available for 1875–2012.

The most comprehensive source for house prices in Denmark is Abildgren (2006). Abildgren (2006) provides a price index for single-family houses in Denmark for the period 1938–2005 and a price index for farms covering the time 1875–2005. The index for single-family houses reflects annual average sales prices and is computed using data from Økonomiministeret (1966, 1938–1965)[63], Danmarks Nationalbank (various years) and Statistics Denmark (various years,a, 1966–2005). The index for farms reflects the sales price per unit of land valuation based on estimated productivity[64] for 1875–1959, and average sales prices per farm for 1960–2005.[65]

A second important source for property price development in Denmark

[63]Økonomiministeret (1966) publishes an index on the average sales price of single-family houses for five different geographical areas: i) Copenhagen and Frederiksberg; ii) provincial towns; iii) Copenhagen area; iv) towns with more than 1500 inhabitants; and v) other rural communities. Until 1950 the indices refer to properties with a value of 20,000 Danish crowns or less. From 1951 onwards they are based on the average purchase price of properties containing one apartment. According to Økonomiministeret (1966), the break in the series may cause an upward bias for 1950–1951.

[64]Land was valued according to barrel of *hartkorn*, i.e. barley and rye, produced. Thus, the data refers to the price paid per barrel of *hartkorn*.

[65]The index is computed using sales price data for all farms for 1960–1967; for farms between 10 and 100 hectare for 1968–1975; and for farms between 15 and 60 hectare for 1976–2005. Data are drawn from Statistics Denmark (various years,a), Statistics Denmark (various years,b), Hansen and Svendsen (1968), and Statistics Denmark (1958).

is provided by the Danish Central Bank.[66] Drawing on data from the Ministry of Taxation (SKAT) and using the Sale-Price-Appraisal-Ratio (SPAR) as computational method, the bank publishes a quarterly house price series covering data for new and existing, single-family dwellings since 1971 (Danmarks Nationalbanken, 2003).

A third source is Statistics Denmark (2013). The agency publishes a nationwide house price index for single-family houses as well as for several types of multifamily structures for the time 1992–2012. As in the case of the index by the Danish Central Bank, the index by Statistics Denmark is computed using the SPAR method (Mack and Martínez-García, 2012).

As shown in Figure 27, the property price indices for farms and for single-family houses are strongly correlated for the years they overlap, i.e. for the years since 1938.[67] Kristensen (2007, 12) estimates that at the end of World War II, about 50 percent of the Danish population lived in rural areas. Thus, farm property accounted for a significant share of total Danish property and may be used as a proxy for Danish house prices prior to 1938. Nevertheless, the series for 1875–1937 must be treated with caution when analyzing house price fluctuations in Denmark in this period.[68] Reassuringly, the farm price index for the time prior to World War I appears to coherently mirror the general development of the Danish economy during that period (Nielsen, 1933) and generally accords with accounts of developments in the housing market (Hyldtoft, 1992). Finally, as shown in Figure 28, when comparing the single-family house price indices for 1938–1965, the development of house prices in urban areas does not seem to systematically differ from house prices in rural areas. It is only in the 1960s that

[66] Series sent by email, contact person is Tina Saaby Hvolbøl, Danish Central Bank.

[67] Correlation coefficient of 0.996 for 1938–2005. See also Abildgren (2006, 31).

[68] In 1895 the Danish economy entered a ten year long boom period. During the boom years, many newly established banks extended credit to finance a building boom in Copenhagen that developed into a price bubble in the market for residential property. The optimism started to wane in 1905 and prices substantially contracted during the financial crisis of 1907 (Østrup, 2008; Nielsen, 1933; Hyldtoft, 1992). The price index for farms does, however, not reflect such a boom-bust pattern. There are two possible explanations that may have joint or partial validity: First, since the construction boom was centered in the residential real estate sector, the index for farm prices may not provide an adequate picture of developments in house prices. Second, as the construction boom was concentrated in Copenhagen, the boom and bust may not be visible on the national level.

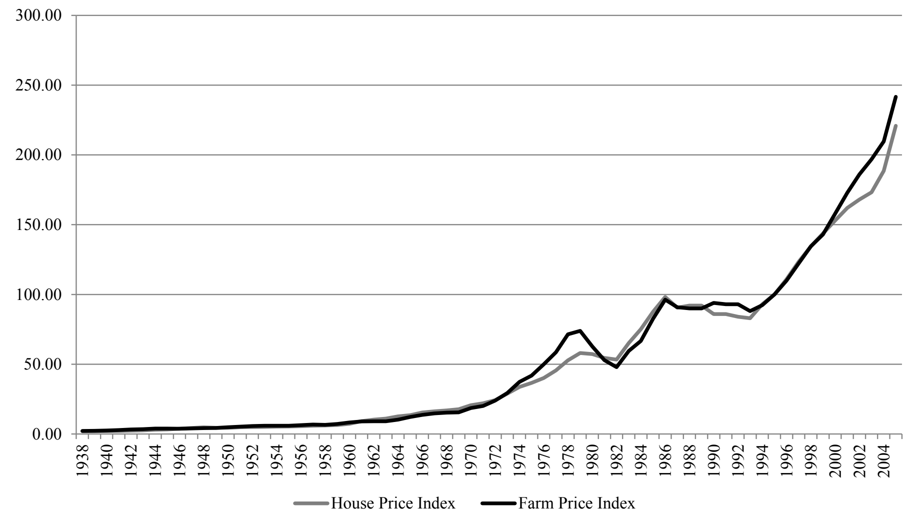


Figure 27: Denmark: nominal house and farm price indices 1938–2005 (1995=100).

urban areas show substantively stronger house price growth compared to rural areas.

The index for single-family houses by Abildgren (2006) and the index by Statistics Denmark (2013) show to be highly correlated for the years they overlap (1992–2010).[69] This is also the case for the index by Danmarks Nationalbanken, the index by Statistics Denmark (2013) and the one by Abildgren (2006).[70] To keep the number of data sources to construct an aggregate index to the minimum, the here composed long-run index relies on Danmarks Nationalbanken index for the period since 1971. Our long-run house price index for Denmark 1875–2012 splices the available series as shown in Table 11.

The resulting long-run index has two weaknesses: first, the series used for 1875–1938 only reflects the price development of farm property which may deviate to some extent from price developments of other residential properties. Second, the series used for 1875–1970 is adjusted neither for compositional changes nor for quality changes. To gauge the extent of the

[69] Correlation coefficient of 0.971 for 1992–2010.

[70] The series constructed by Statistics Denmark (2013) and Danmarks Nationalbanken have a correlation coefficient of 0.999 for 1992–2012. The series constructed by Abildgren (2006) and Danmarks Nationalbanken have a correlation coefficient of 0.999 for 1971–2005.

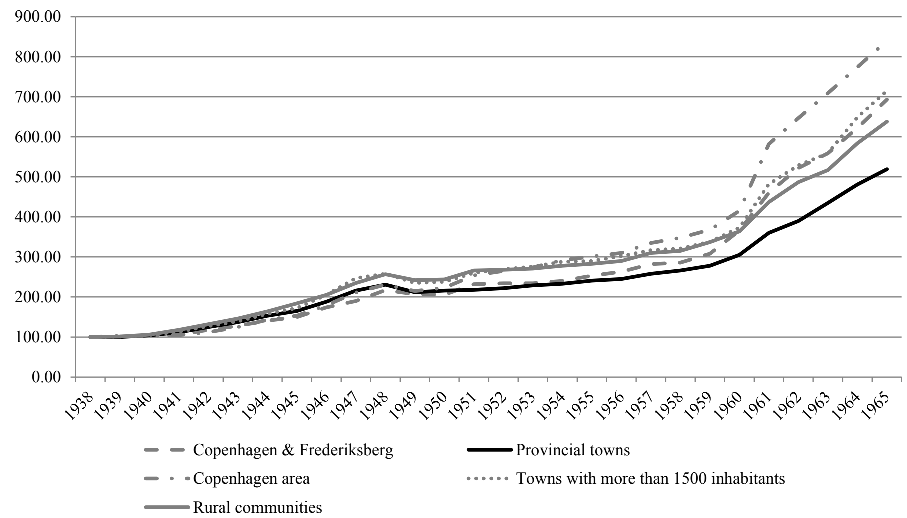


Figure 28: Denmark: nominal single-family house price indices 1938–1965 (1938=100).

quality bias we can rely on estimates of the quality effect by Lunde et al. (2013). If we adjust the real annual growth rates of our long-run index downward accordingly, the average annual real growth rate over the period 1875–2012 of 0.99 percent becomes 0.57 percent in constant quality terms. Yet, as this is a rather crude adjustment, we use the unadjusted index (see Table 11) for our analysis.

Construction cost data

Historical data on construction costs in Denmark are available for 1914–2012.

The first construction cost index for Denmark was published by Statistics Denmark in 1920 as an input cost index for small farms (Statistics Copenhagen, 1937; Statistics Denmark, various years,b).[71] It includes transport costs but excludes electrical installations. Combined, the series on construction costs of rural dwellings cover the period 1914–1970.

[71] A small farm is defined as consisting of 3 rooms, kitchen, laundry and stable. The definition of the index house was further refined in 1926 and 1959.

Period	Series ID	Source	Details
1875–1938	DNK1	Abildgren (2006)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Existing farms; *Data*: Data from various sources (see text); *Method*: Average prices.
1939–1971	DNK2	Abildgren (2006)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Existing single-family houses; *Data*: Data drawn from various sources (see text); *Method*: Average prices.
1972–2012	DNK3	Danmarks National-banken	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: New and existing single-family houses; *Data*: Ministry of Taxation (SKAT) *Method*: SPAR method.

Table 11: Denmark: sources of house price index, 1875–2012.

Period	Source	Details
1914–1939	Statistics Denmark (various years,b)	*Geographic Coverage*: Rural areas; *Type(s) of Dwellings*: Small farms; *Type of Index*: Input cost index.
1940–1968	Statistics Denmark (various years,b)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Apartment houses; *Type of Index*: Input cost index.
1969–2012	Statistics Denmark (various years,b)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Single-family houses; *Type of Index*: Input cost index.

Table 12: Denmark: sources of construction cost index, 1914–2012.

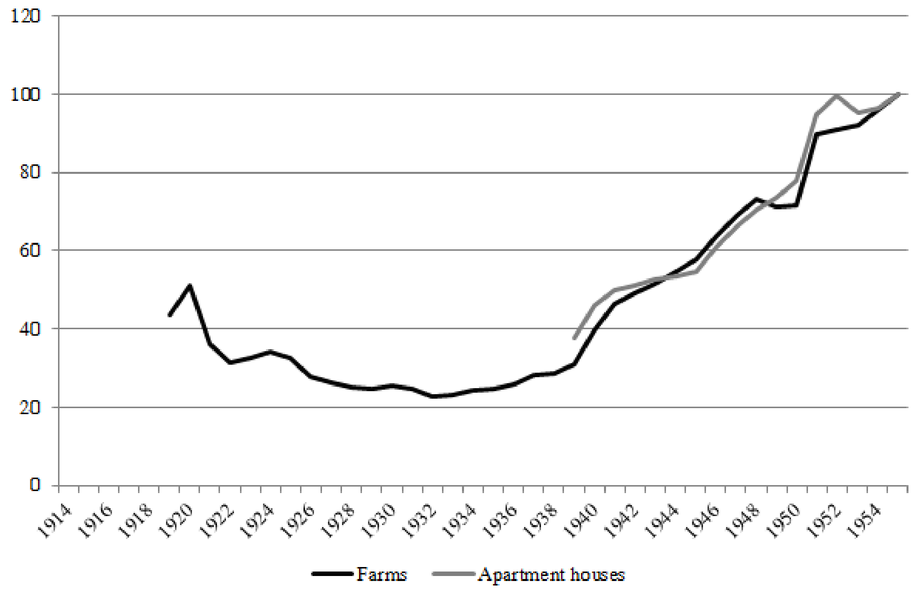


Figure 29: Denmark: nominal construction cost indices 1914–1955 (1955=100).

For 1940–1970, Statistics Denmark reports an input cost index for apartment houses in Denmark as a whole (Statistics Denmark, various years,b).[72] The series was succeeded in 1969 by input indices for three types of residential dwellings: one-family houses, apartment houses, and an aggregate index covering both types of dwellings (Statistics Denmark, 2015). The index for small farms and the index for apartment houses are strongly correlated for the years they overlap (see Figure 29).[73] Note that there is also no significant difference between the index for apartment houses and the index for one-family houses.[74]

Our long-run construction cost index for Denmark splices the available series as shown in Table 12. To trace construction costs of the type of houses covered by our long-run house price index, we rely on the index for small farms until 1939. Starting 1940 we use the index for apartment houses so as to cover also construction costs of non-rural dwellings. From 1969, we use the construction cost index for single-family houses.

[72] More specifically, the index house is a three story apartment house with 6 staircases and 36 apartments.

[73] Correlation coefficient of 0.98 for 1939–1955.

[74] Correlation coefficient of 0.99 for 1986–2012.

Other housing related and macroeconomic data

Farmland prices: 1875–2005: Abildgren (2006) - Index for farm property prices; 1870–1912: O'Rourke et al. (1996) - Index for agricultural land values.

Value of housing stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1880, 1900, 1913, 1929, 1938, 1948, 1960, 1965, 1973, 1978.

CPI: 1870–2007: Taylor (2002); 2008–2012: International Monetary Fund (2012).

B.6 Finland

House price data

Historical data on house prices in Finland are available for 1905–2012.

The earliest series at our disposal covers the period 1904–1962. It reports average annual prices of building sites for dwellings per square meter offered for sale by the city of Helsinki (Statistical Office of the City of Helsinki, various years). Drawing on this data source, we construct a three-year-average price index for residential building sites for 1905–1961 to smooth out some of the year-to-year fluctuations stemming from variation in the number of transactions.

A second important source for property price development is Leväinen (1991). Leväinen (1991, 39) using data from different sources computes a building site price index comprising the period 1909–1989.[75] The index is primarily calculated from price data for sites for detached and terraced houses in Southern Finland, particularly in the Helsinki area. Recently, Leväinen (2013) has been able to update his original index such that it now covers the years 1910–2011. Data for the more recent period, 1989–

[75] The index is a chain index constructed from several indices for shorter sub-periods. He then calculates the ratios of every two successive years. The resulting index is calculated based on all the ratios between the years. For years for which several data sources are available, Leväinen uses a simple average.

2011, is taken from the National Land Survey of Finland statistics.

A third source that covers the more recent development of residential property prices (1985–2012) is Statistics Finland. The agency constructs a nationwide house price index for existing single-family dwellings and single-family house plots using a combination of hedonic regression and a mix-adjusted method.[76] Statistics Finland uses data from the real estate register of the National Land Survey containing all real estate transactions (Saarnio, 2006; Statistics Finland, 2013). A second Statistics Finland index based on the same computational procedure (hedonic regression and mix-adjusted method) and covering the same time period (1985–2012) reports price development for existing dwellings in so-called housing companies, that is block of flats and terraced houses. The index is estimated from asset transfer tax statements of the Tax Administration (Saarnio, 2006; Statistics Finland, 2011).[77]

As one component of its index for dwellings in housing companies, Statistics Finland provides estimates for average prices per square meter of dwellings in old blocks of flats[78] in the center of Helsinki for the period 1947–2012 and for greater Helsinki[79] and Finland as a whole for the period 1970–2012.[80] For the years prior to 1987 Statistics Finland relies on data provided by real estate agencies. For the years since 1987 data are drawn from the asset transfer tax statements of the national Tax Administration.[81]

[76]Dwellings are stratified by type, number of rooms and location. A hedonic regression is then applied to estimate the price index for each stratum. The strata are combined using the value of the dwelling stock as weights. For details on the classification and the regression model see Saarnio (2006).

[77]Before February 2013 this price series was named 'Prices of Dwellings.' In Finland, dwellings are not classified as real estate but detached houses are. That is the reason there are two different series: one for dwellings and the other one for real estate.

[78]'Old' refers to blocks of flats that are not built in the year of the statistics and the year before (i.e. in the statistics for 2012, old dwellings are all dwellings built before 2011).

[79]Greater Helsinki includes the cities Helsinki, Espoo, Vantaa and Kauniainen. Series sent by email, contact person is Petri Kettunen, Statistics Finland.

[80]According to Statistics Finland, the data for the center of Helsinki quite well represents prices of dwellings in Finland before 1970 (email conversation with Petri Kettunen, Statistics Finland). Subsequently, however, the prices in Helsinki increased stronger than in the rest of the country.

[81]The structural break observable between 1986 and 1987 is not only due to the above described adjustment of the database but is also, at least in parts, caused by methodological changes, where the year 1987 marks the transition from the fixed weighted

Figure 30 depicts the nominal HSY site price index and the site price index from Leväinen (2013) for the period 1904–1945 (1920=100). Both indices consistently show two major boom periods: the first occurs during the second half of the 1900s, peaking around 1910; the second, more dynamic one, begins in the early 1920s. Between the first and the second boom period, i.e. during World War I, residential construction declined rapidly; particularly in urban areas (Heikkonen, 1971, 289), as did real house prices. For the second boom period, i.e. for the time during the 1920s, the two indices provide a disjoint and inconsistent picture with respect to duration and turning points. While the Leväinen index insinuates a more than tenfold increase in real terms from trough to peak (1920–1931), the one based on the data in the Helsinki Statistical Yearbook (HSY) reports a sevenfold rise between the trough in 1921 and the peak in 1929. An even more pronounced divergence between the two indices can be identified for the post-Depression period: While the Leväinen-index continues to rise throughout the years of the Great Depression and the first years of World War II, the HSY-index declines by about 20 percent between 1929 and 1933, and only recovers around 1936 before collapsing again throughout the years of World War II. Against the background of partly inconsistent information the question arises, which of the two indices reflects a more plausible development of real estate prices in Finland between the mid-1920s and the end of World War II. In this context it is important to note that neither indicator covers Finland as a whole; instead both indices solely focus on the Helsinki area. While one may argue that a boom in site prices is unlikely to occur in a period of depression such as during the early 1930s, there are examples of stagnant (UK) or even increasing (Switzerland) house prices during that period. In Switzerland the positive trend in house prices and construction activity was primarily driven by low building costs and easy credit (cp. Section B.13). For the example of Britain, a quick recovery in construction activity after an initial fall in the early years of the depression is observable while house prices remained very stable (see Section B.14). In the case of Finland, construction activity - as indicated above -

Laspeyres-type unit value to the above mentioned combined hedonic and mix-adjusted computation method. For the period 1975–2012 the Federal Reserve Bank of Dallas splices together the nationwide house price index for existing, single-family dwellings (1985–2012) and the price series for existing flats (1975–1985).

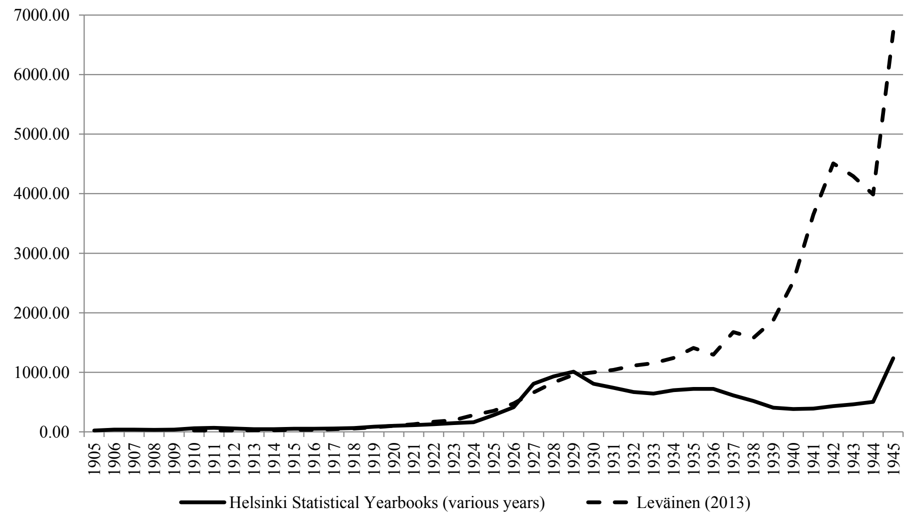


Figure 30: Finland: nominal house price indices 1905–1945 (1920=100).

strongly re-bounced after 1933 and thus may have also contributed towards a stabilization of site prices. Construction activity peaked in 1937/38 and contracted thereafter making a continued increase in site prices until 1942, also in the wake of World War II, appearing unreasonable. Therefore, the empirical analysis undertaken here relies on the HSY-index for the period prior to 1947.

Thus far, the present survey of Finnish property prices has focused on site prices in the Helsinki area, rather than house prices, since information on the latter is not available for the years prior to 1947. Yet, building site prices can be considered to be a good proxy for house prices as they tend to show similar developments. For example, the series for old blocks of flats in the center of Helsinki as published by Statistics Finland for 1947–2012 is highly correlated with Leväinen's site price index.[82] Nevertheless, there may be minor differences with regard to amplitudes and timing of house price cycles.

Figure 31 compares the nominal house price indices available for 1947–2012, i.e. the indices for dwellings in old blocks of flats (Helsinki, Greater Helsinki, Whole Country) and the indices for single-family dwellings (Helsinki, Greater Helsinki, Whole Country). All indices are available from Statistics

[82]Correlation coefficient of 0.96.

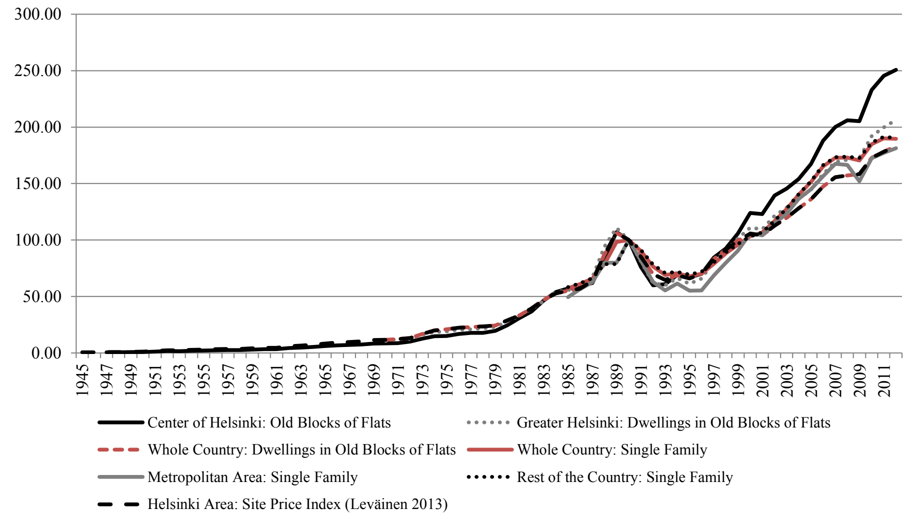


Figure 31: Finland: nominal house price indices 1945–2012 (1990=100).

Finland. Figure 31 indicates that all indices follow the same pattern for the period under consideration: a house prices boom that peaks in the early 1970s and is followed by a slump; a boom during the late 1980s with a subsequent recovery; a third contraction in the early 1990s followed by a strong rise from the mid-1990s until the onset of the Great Recession. The data only shows minor divergence in amplitudes and timing of house price cycles between old blocks of flats and single-family houses. For the sake of coherence with respect to property types, the long-run index uses the data for old blocks of apartments also for the post-1970 period. The index covering the center of Helsinki depicts the boom of the 1990s/2000s to be stronger than when considering Finland as a whole. Hence, for the years since 1970 we use the nationwide series for old blocks of flats. Our long-run house price index for Finland for 1905–2012 splices the available series as shown in Table 13.

In sum, the long-run index controls for quality changes only after 1970. For 1905–1947, the index refers to building sites and should not be diluted by unobserved changes in quality. In contrast, since for 1947–1969 the index is only based on simple average prices, it may be biased due to quality changes in the structures that are not controlled for. Since the series is restricted to one very specific market segment (i.e. existing apartments in the center of Helsinki), compositional bias should not play a major role.

Period	Series ID	Source	Details
1905–1946	FIN1	Statistical Office of the City of Helsinki (various years)	*Geographic Coverage*: Helsinki; *Type(s) of Dwellings:* Residential building sites; *Data*: Sales prices; *Method*: Three year moving average of average prices.
1947–1969	FIN2	Statistics Finland	*Geographic Coverage*: Center of Helsinki; *Type(s) of Dwellings*: Dwellings in existing blocks of flats; *Data*: Data from Statistics Finland; *Method*: Average prices.
1970–2012	FIN3	Statistics Finland (2011)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Dwellings in existing blocks of flats; *Data*: Data from Statistics Finland; *Method*: Hedonic mix-adjusted method.

Table 13: Finland: sources of house price index, 1905–2012.

Period	Source	Details
1870–1934	Heikkonen (1971) as published in Hjerppe (1989)	*Geographic Coverage*: Helsinki; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.
1935–1955	Bank of Finland (1946, 1952, 1955)	*Geographic Coverage*: Helsinki ; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.
1956–2012	Statistics Finland (various years)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.

Table 14: Finland: sources of construction cost index, 1870–2012.

Construction cost data

Historical data on construction costs in Finland are available for 1870–2012.

The most comprehensive series on building costs in Finland is provided by Hjerppe (1989, Appendix Table 13) and covers 1870–1984. Hjerppe (1989) uses three main sources to construct the series: First, she relies on Heikkonen (1971) for 1870–1934. The index published by Heikkonen (1971) is constructed as an input cost index using data on average wages in the construction sector and the price of three main building materials (timber, stone, and metal). While the data on prices and wages cover Finland as a whole, the weights are identical to the weights applied by Bank of Finland (1946) (see below) and hence are based on the construction of apartment houses in Helsinki.

Second, Hjerppe (1989) relies on the building cost index calculated by the Bank of Finland for 1935–1955. The series is based on construction cost data for apartment houses in Helsinki[83] and is constructed as an input cost index. It is adjusted to include architect fees and contractors' overhead costs and profits (Bank of Finland, 1946).[84]

Third, for 1955–1984, Hjerppe (1989) uses the construction cost index calculated by Statistics Finland (various years). The series is calculated as an input cost index and covers apartment buildings. Wage data comes from collective agreements, prices of materials are collected from manufacturers and wholesale dealers.[85] Weights and the range of materials included are updated at five or ten-year intervals (Statistics Finland, 2001). We extend the index reported by Hjerppe (1989) to cover the years until 2012 using the continuation of the series reported in Statistics Finland (various years).

Our long-run construction cost index for Finland 1870–2012 splices the

[83]For 1935–1951, the aggregate index is a weighted average of factor prices with the weighting scheme being constructed based on data for three representative houses built 1930-1933 (Bank of Finland, 1946). In 1951, the index was re-weighted based on construction cost of five representative houses built 1948–1950 (Bank of Finland, 1952).

[84]The Bank of Finland assumes that contractors' overhead costs (depreciation of machines, rents, wages of office staff and management) and firms profits amounts to 10 percent of booked costs.

[85]The construction cost index 2000=100 covers the change in prices of more than 50 building materials.

available series as shown in Table 14. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by Hjerppe (1989). Between 1950 and 1970, real construction costs and real unit labor costs decreased by a little more 7 percent.

Other housing related and macroeconomic data

Farmland prices: 1985–2012: National Land Survey of Finland[86] - Median transaction price of agricultural land per hectare.

CPI: 1870–1996: Taylor (2002); 1997–2012: International Monetary Fund (2012).

B.7 France

House price data

Historical data on house prices in France are available for 1870–2012

The most comprehensive single source for French house price data is the dataset provided by the Conseil General de l'Environnement et du Developpement Durable (2013b, CGEDD). It contains a national repeat sales index for all categories of existing residential dwellings, i.e. apartments and single-family houses, for the period 1936–2013.[87] Prior to 1999, the index is based on data drawn from two national notarial databases.[88]

Even though these databases were only established in the 1980s, they also include information on earlier real estate transactions (Friggit, 2002). For the post-1999 period, CGEDD splices this index with a mix-adjusted he-

[86]Series sent by email, contact person is Juhani Väänänen, National Land Survey of Finland

[87]For more information, see Conseil General de l'Environnement et du Developpement Durable (2013b).

[88]The two databases are: The *BIEN base*, managed by the Chambre Interdépartmentale des Notaires de Paris (CINP) that covers the Paris region and the *Perval France base*, which is managed by Perval, a Conseil Supérieur du Notariat (CSN) subsidiary, that covers the provinces. For a detailed discussion of the notarial databases the reader is referred to Beauvois et al. (2005, 25 ff.).

donic index by the National Institute of Statistics and Economic Studies (2012, INSEE) for existing detached houses and apartments in France (see below).

In addition to the national index, Conseil General de l'Environnement et du Developpement Durable (2013b) also publishes a price index for residential property in the greater Paris area. Combining several different data sources the index has been extended back to 1200. For the time period analyzed in this paper (1870–2012), the Paris index has been composed from three different data series. The first part of the index (1840–1944) is based on a repeat sales index by Duon (1946) using data gathered from property registers of the national Tax Department. It covers apartment buildings such that commercial properties, single-family houses, or apartments sold by the unit remain excluded.[89] The second part of the index (1944–1999) is based on price data for apartments sold by the unit compiled by CGEDD from the notaries' database and calculated using the repeat sales method. As raw data, however, is only available for the time 1950–1999, the gap between the index by Duon (1946) and the one calculated by CGEED, i.e. the years 1945–1949, has been filled applying simple linear interpolation (Friggit, 2002). For the post-1999 period, the index is again spliced with an index by National Institute of Statistics and Economic Studies (2012) for existing apartments in Paris (Beauvois et al., 2005).

A second important source for French house prices is the National Institute of Statistics and Economic Studies (2012, INSEE). For the years since 1996, INSEE publishes a mix-adjusted hedonic nationwide house price index for all types of existing dwellings as well as two sub-indices for existing detached houses and apartments (Beauvois et al., 2005). In addition, the agency provides regional sub-indices for Paris, Provence-Alpes-Cote d'Azur, Rhone-Alpes, Mord-Pas-de-Calais, and Provence.[90] As CGEDD, also INSEE draws on sales price data from the two national notarial databases.

[89] Prior to World War I, apartments could not be sold by the unit. There were few such transactions in the interwar period.

[90] For the period 1975–2012, the Federal Reserve Bank of Dallas splices together the CGEDD nationwide house price index for existing, single-family dwellings (1975–1995) and the INSEE price index for all types of existing dwelling (1996–2012).

Figure 32 compares the nominal indices available for 1936–2012, i.e. the indices for France and Paris published by Conseil General de l'Environnement et du Developpement Durable (2013b), and the nationwide house price index published by National Institute of Statistics and Economic Studies (2012). It shows that throughout the years 1936–1976 the Paris index is in cadence with the CGEDD France and the INSEE national indices. Considering also the broad macroeconomic trends prior to 1936 and narrative evidence on developments in the French housing market, the Paris index may serve as a fairly reliable measure for the trends in national house prices.[91] We have to keep in mind, however, that Parisian house prices may for some years not be a reliable proxy for house prices in France as a whole.[92] Friggit, for example, suggests that real house prices in Paris

[91]The second half of the 19th century, particularly the time during the second phase of the industrial revolution, featured rapid population growth and urbanization that lead to an increase in rents, property prices, and construction activity (Price, 1981; Caron, 1979). In the wake of the Franco-Prussian war of 1870, this trend came to a temporary halt. To service its reparation obligations France heavily relied on domestic borrowing with adverse effects on interest rates: While the yield for government security substantively increased, the return from real estate due to higher financing cost declined, making it a relatively less attractive investment (Price, 1981; Friggit, 2002). In the second half of the 1870s building activity resumed despite the continuing Long Depression. An important factor in this building boom, according to Caron (1979, 66 f.), was what he calls *"rural exodus"* and the associated ongoing urbanization. The increase in the demand for housing in urban areas resulted in a substantive increase in the price of building land and rents (Lescure, 1992). The national rent index increased by 14 percent between 1876 and 1900, clearly outperforming the trend in general cost of living during that time. The boom that peaked in the years 1876–1882 was further fueled by optimistic expectations of investors. Following the Paris Bourse market crash and the failure of the Union General Bank in 1882, France went into the deepest and longest recession and financial crisis in the 19th century. With France's national income declining from 1882 to 1892 and less people leaving the rural areas to move into cities, construction activity stagnated until about 1906 (Caron, 1979, 66 f.). The effects of World War I on real house prices were quite severe and long-lasting. Wartime rent controls remained in place throughout the interwar period dampening the profitability of property investments (Lescure, 1992; Duclaud-Williams, 1978). Only by the mid-1920s, real house prices started to recover and subsequently also fared comparably well after the stock market crash in 1929. According to Friggit (2002), investors were – distrusting any kind of financial instrument – eager to substitute their stock and bond holdings for real estate.

[92]The house price index for Paris only refers to apartment buildings. Apartment buildings were, however, the most important part of the Parisian property market at the time since prior to World War I only about 3.3 percent of houses in Paris were owner occupied. As noted before, apartments could not be sold by the unit before World War I and there were only few such transactions in the interwar period.

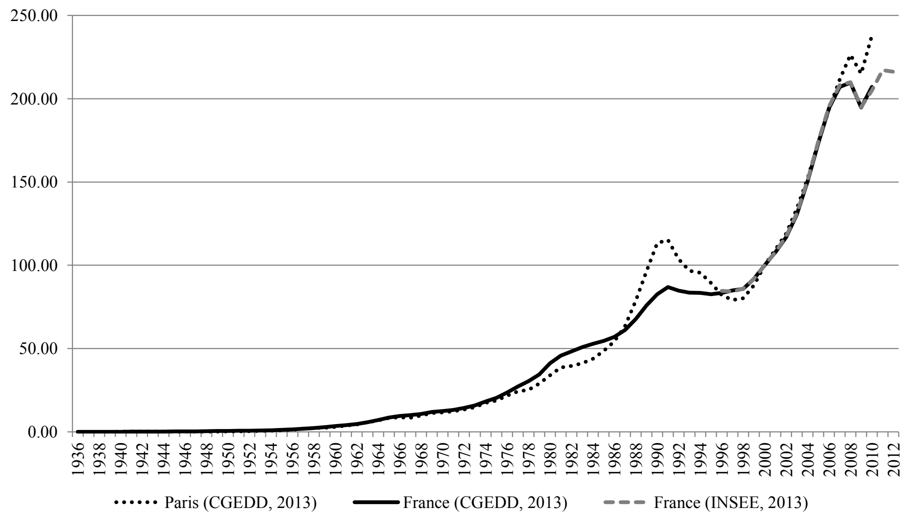


Figure 32: France: nominal house price indices 1936–2012 (1990=100).

were more devalued during World War I than in other parts of France.[93] According to Friggit (2002), also the national index for the time prior to 1950 can only serve as a rough estimate of the true development of house prices in France. Moreover, the index may be biased upwards in the 1950s as there may be a substantial price difference between rented and vacant properties with rented properties having a lower price than vacant houses. Friggit (2002) emphasizes that the share of vacant properties sold particularly increased in the 1950s, thus diluting the quality of the index by overestimating the price increase during this decade (Friggit, 2002).

When examining the three indices during the second half of the 20th century in Figure 32, it shows that the Paris index is lower than the national index for 1976–1986 but then surpasses the national index increasing strongly until 1991 before reverting to the national level. According to Friggit (2002), this boom and bust pattern was primarily a feature of the Paris region and a few other areas such that it is barely detectable in the national index. For the period 1996–2012, the INSEE and the CGEDD index show an almost identical development. Overall, French house prices

[93]Email conversation with Jacques Friggit. Rent controls introduced during the war years reduced real returns from investment in residential real estate and hence its value (Friggit, 2002). Rent controls were not abandoned in the interwar period but alternately relaxed and tightened which may have depressed the value of apartment buildings vis-à-vis other real estate.

rapidly increased since the late 1990s. The CGEDD Paris index moves in lock-step with the two national indices until 2008 and subsequently shows a comparably stronger increase.

Given the data availability, our long-run house price index for France 1870–2012 splices the indices as shown in Table 15. The long-run index has two major drawbacks: First, as no house price series for France as a whole is available for the years prior to 1936, we rely on the CGEDD Paris index instead. Second, despite the fact that by using the repeat sales method the effect of quality differences between houses is somewhat reduced, it does not control for all potential changes in the quality and standards of dwellings over time.

Construction cost data

Historical data on construction costs in France are available for 1914–2012.

The earliest available data on construction costs in France are published by the Conseil General de l'Environnement et du Developpement Durable (2013a). The input cost index is originally constructed by the Société Centrale des Architectes[94] and covers construction costs of apartment buildings the Paris region for the period 1914–1953 (Duon, 1946; Guet, 1969). For the years since 1942, an additional input cost index for apartment buildings in Paris is available from Federation Francaise du Batiment (2015). Since 1953, Statistics France (2015b) publishes an output price index for all kinds of residential dwellings (excluding public housing) in France (Statistics France, 2015a). The output price index and the input cost index constructed by Federation Francaise du Batiment (2015) are highly correlated for the years they overlap.[95].

Our long-run construction cost index for France 1870–2012 splices the available series as shown in Table 16. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national ac-

[94]The Société Centrale des Architectes was renamed in 1953 as Académie d'Architecture.

[95]Correlation coefficient of 0.99 for 1953–2012. Yet, the input cost index by Federation Francaise du Batiment (2015) shows a comparably stronger increase over the whole 1953–2012 period (see Figure 33)

counts data published by OECD (2016). Between 1950 and 1970, real unit labor costs increased by 19 percent.

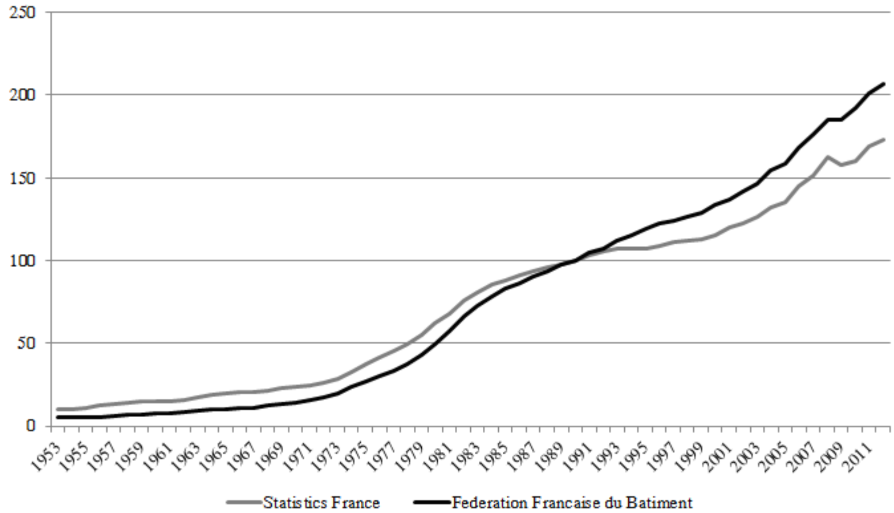


Figure 33: France: nominal construction cost indices 1953–2012 (1990=100).

Other housing related and macroeconomic data

Value of housing stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1880, 1913, 1929, 1950, 1960, 1972, 1977. Data on the value of household wealth including the value of total housing stock, dwellings, and land for 1978–2011 is drawn from OECD (2013). Piketty and Zucman (2014) also present data on real estate wealth for benchmark years in the period 1870–1954 and for 1970–2011.

CPI: 1870–1965: Mitchell (2013); 1966–2012: International Monetary Fund (2015).

Period	Series ID	Source	Details
1870–1935	FRA1	Conseil General de l'Environnement et du Developpement Durable (2013b)	*Geographic Coverage*: Paris; *Type(s) of Dwellings*: Apartment buildings; *Data*: Data from property registers of the Tax Department; *Method*: Repeat sales method.
1936–1996	FRA2	Conseil General de l'Environnement et du Developpement Durable (2013b)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of existing dwellings; *Data*: Notarial database; *Method*: Repeat sales method.
1997–2012	FRA3	National Institute of Statistics and Economic Studies (2012)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of existing dwellings; *Method*: Hedonic, mix-adjusted index.

Table 15: France: sources of house price index, 1870–2012.

Period	Source	Details
1914–1953	Conseil General de l'Environnement et du Developpement Durable (2013a)	*Geographic Coverage*: Paris region; *Type(s) of Dwellings*: Apartment houses; *Type of Index*: Input cost index.
1954–2012	Statistics France (2015b)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of residential dwellings; *Type of Index*: Output price index.

Table 16: France: sources of construction cost index, 1914–2012.

B.8 Germany

House price data

Historical data on house prices in Germany are available for 1870–1938 and 1962–2012.

Statistics Berlin (various years) in its yearbooks reports data on transactions of developed lots, i.e. lots including structures, in the city of Berlin for 1870–1918.[96] We compute an annual index from average transaction prices. As the source does not provide details on the lots sold, it is impossible to control for size, number of structures erected on the lot, and type or use of buildings (commercial or residential).

A second source for German house prices is Matti (1963). Matti (1963) presents data on the price of developed lots (number of transactions, average sales price per square meter in German Mark) for the city of Hamburg for 1903–1935.[97] While it is, as in the case of the data for Berlin, impossible to account for the number of structures on the lot and the type or use of buildings in computing the index, we can at least control for the size of the lot. In addition to this series, Matti (1963) for 1955–1962 computed a lot price index for Hamburg using data on average sakes prices per square meter.

As a third source, the Statistical Yearbooks of German Cities (Association of German Municipal Statisticians, various years)[98] reports transaction data for developed lots for 1924–1935 and for building sites for 1935–1939.[99] For each year, information is available on the number of lots sold, the total size of lots sold, and the total value of all transactions in the city or municipality. No information on the type or use of property (residential or commercial) is included.[100]

[96] The yearbooks include the number of lots sold and the total value of all transactions. No data are available for 1911 and 1914.

[97] Data for the years of the German hyperinflation, i.e. 1923 and 1924, are missing.

[98] The Statistical Yearbook of German Cities was published until 1935 and succeeded by the Statistical Yearbook of German Municipalities.

[99] The series includes data on public and private transactions.

[100] Wagemann (1935) publishes an index computed from this data for 'representative cities' for 1925–1935.

A fourth source for real estate prices is the Federal Statistical Office of Germany (various years,b). The agency publishes nationwide data on average building site sales prices per square meter for the years since 1962.[101] For the years since 2000 the Federal Statistics Office produces a hedonic national house price index for new owner-occupied dwellings as well as three sub-indices for i) turnkey homes; ii) built to order homes; and iii) prefabricated homes (Dechent, 2006a).[102] In addition, for the years since 2000, the Federal Statistics Office produces house price indices comprising both owner-occupied and rental properties for i) new and existing dwellings; ii) existing dwellings; and iii) new dwellings (Dechent and Ritzheim, 2012). The indices are computed using data compiled from the local Expert Committees for Property Valuation (Gutachterausschüsse für Grundstückswerte).

Finally, the German Central Bank produces two sets of house price indices: i) a set of indices covering 100 West- and 25 East-German agglomerations with a population above 100,000 since 1995; and ii) a set of indices covering only Western German agglomerations for 1975–2010. The first set includes house price indices for the following building types: i) all types of existing dwellings; ii) all types of new dwellings; iii) existing terraced single-family houses;[103] iv) new terraced single-family houses; v) existing flats; and vi) new flats (Deutsche Bundesbank, 2014).[104] The indices are computed using data collected by BulwienGesa AG.[105] Population is used as weights (Bank for International Settlements, 2013; Mack and Martínez-García, 2012). The indices do not control for quality differences between houses or quality changes over time but only cover properties that pro-

[101]For years prior to 1991, the data only covers West-Germany. Since 1992 it includes all German federal states (Federal Statistical Office of Germany, various years,b).

[102]The hedonic regression controls for a variety of characteristics such as the size of the lot, living space, detached house, basement, parking space, and location (Dechent, 2006a, 1292 f.). The aggregate index is weighted by the market share of the respective property type in a certain period (Dechent, 2006a, 1294).

[103]Terraced houses are single-family dwellings with a living space of about 100 square meters (Bank for International Settlements, 2013).

[104]Series available from the Bank for International Settlements (2013, BIS).

[105]Data sources include the Association of German Real Estate Agents (Immobilienverband Deutschland); Chambers of Industry and Commerce, Building & Loan Associations, research institutions, own surveys, newspaper advertisements, and mystery shoppings (Bank for International Settlements, 2013).

vide *"comfortable living conditions"* and are located in *"average to good locations."* By confining the indices to this market segment, the effect of quality differences may be somewhat reduced (Bank for International Settlements, 2013; Deutsche Bundesbank, 2014). The second set of indices, for West-German agglomerations 1975–2012, also draws on data provided by BulwienGesa.[106] They cover 100 Western German towns since 1990 and 50 Western German towns in the years 1975–1989. Indices are available for the following types of property: i) all kinds of new dwellings; ii) new terraced houses; iii) new flats; and iv) building sites for detached single-family dwellings.[107] The indices are also weighted by population (Bank for International Settlements, 2013; Mack and Martínez-García, 2012), do not control for quality differences but are again confined to dwellings providing *"comfortable living conditions"* located in *"average to good locations"* (Bank for International Settlements, 2013; Deutsche Bundesbank, 2014). The index for new terraced houses (ii) has been extended back to 1970 (cf. OECD Database).[108]

Figure 34 depicts the nominal indices calculated from the data for Berlin and for Hamburg for 1870–1935. While the Berlin index is the only one available for 1870–1903, its development accords with narrative and scattered quantitative evidence on other German housing markets for the years prior to World War I, such as Carthaus (1917), Führer (1995), Rothkegel (1920), and Ensgraber (1913).[109] In the most general terms, these accounts describe the years of the German Empire as a period of a considerable, yet non-linear, upward trend. All urban areas discussed experienced boom years as well as years of crises that emanated from the macro-economic volatilities of the time (Führer, 1995). While the exact timing of troughs and peaks differed across cities, the local house price cycles nevertheless

[106] Series available from Bank for International Settlements (2013).

[107] The indices for flats and building sites for detached single-family dwellings are adjusted for size, i.e. refer to prices per square meter. The indices for all kinds of new dwellings and terraced houses refer to prices per dwelling (Bank for International Settlements, 2013).

[108] Mack and Martínez-García (2012) stress, however, that this index may also include existing dwellings.

[109] Rothkegel (1920) focuses on Mariendorf, a suburbian part of Berlin; Ensgraber (1913) on Darmstadt. Carthaus (1917) presents a more comprehensive description and covers developments in Dresden, Munich, and Berlin. Führer (1995) focuses in housing policy.

correspond.

During the years of World War I and the German hyperinflation, nominal house prices increase across the board but significantly lag inflation. As we see in Figure 34, the indices for Berlin and Hamburg depict a similar trend for the years they overlap. The collapse in real house prices may appear surprising at first given the severe housing shortage in the immediate postwar years. Moreover, in light of rapidly rising building costs and scarce building capital, building activity remained depressed well into the 1920s (Deutsche Bauzeitung, 1923, 1921). Yet returns on existing residential real estate were low or even negative in the immediate post-World War I years. Real estate owners struggled with low rental income due to persistent rent controls,[110] often even too low to cover tax expenses, insurance, and rising utility and maintenance costs (Hausbesitzer-Zeitung für die Rheinprovinz, 1922b; Deutsche Bauzeitung, 1922). In 1921, the *Wall Street Journal* noted that *"[n]o matter what you pay for an apartment house you can not make money at present, and the future prospect is not much better"* (Wall Street Journal, February 4, 1921). Despite depressed real estate values, many homeowners therefore had to sell their properties. Particularly in large cities, foreign investors spent large sums buying up real estate knowing that the property may not cover costs for a few years to come but presuming that their investment will be profitable once Germany returns to normal economic conditions and the value of the mark stabilizes (Deutsche Bauzeitung, 1923; Hausbesitzer-Zeitung für die Rheinprovinz, 1922a). In the mid-1920s, real house prices start slowly to recover but are still substantially below their pre-World War I level. Contemporary newspapers confirm the significant fall in German real house prices during the interwar period. In 1921, the *Wall Street Journal* for example noted that *"an apartment house valued at $100,000 before the war can be bought for $5,000"* (Wall Street Journal, February 4, 1921). *The New York Times* reported in 1923, *"[o]ne building [in Berlin], now held at $6,500 in American money, cost $250,000 before the war"* but that *"the buyer would realize probably not more than $2.50 a year on this investment"* (The New York Times, April 10, 1923). In 1927, according to the *Wall Street Journal*, *"[p]rices of*

[110] State control of rents and legal protection of tenants became permanent law during the 1920s (Teuteberg, 1992).

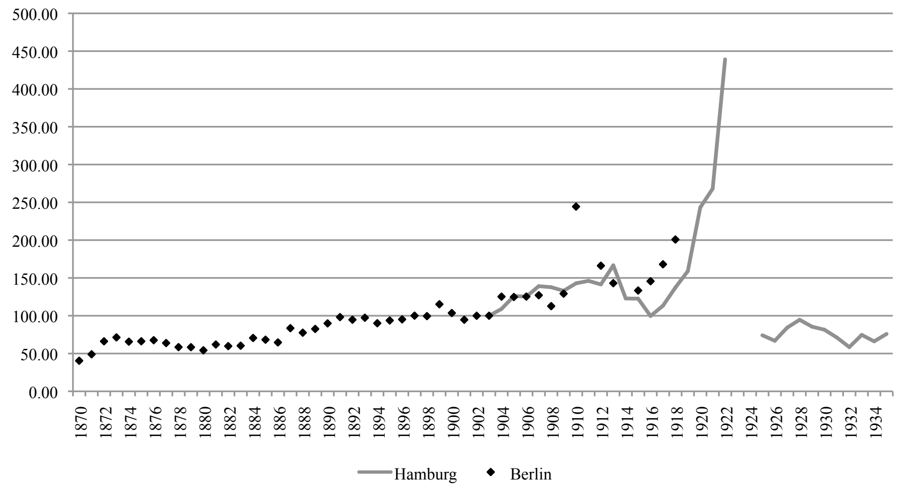


Figure 34: Germany: nominal house price indices 1870–1935 (1903=100).

apartment houses in general were but 25 percent to 40 percent of pre-war at the beginning of 1926" (Wall Street Journal, April 5, 1927).

Figure 35 compares the indices that are available for 1924–1938. For these years, the Statistical Yearbooks of German Cities and the Statistical Yearbooks of German Municipalities provide property price data with a wider geographic coverage (see above). With the information available, it is possible to calculate average transaction prices in German Mark per square meter of developed lots. Based on data for ten cities and municipalities for which data coverage is complete in the years from 1924–1938, we compute a weighted 10-cities index.[111] When comparing the index computed from data published by Matti (1963) and the index computed from average transaction prices for the ten German cities, it shows that - while far away from perfect lockstep - they generally follow the same trend.[112] This observation is somewhat reassuring as it supports the assumption that the index by Matti (1963) may also for the earlier years (i.e. 1903–1922) serve as a more or less reliable proxy for urban property prices in Germany in general. The two indices show that lot prices substantively increased after 1924 and peaked in 1928 (Matti, 1963) and 1929 (10 cities), respectively. During the first years of the Great Depression nominal property prices contracted and only started to recover in 1936.

[111] The number of transactions is used as weights.

[112] Correlation coefficient of 0.73.

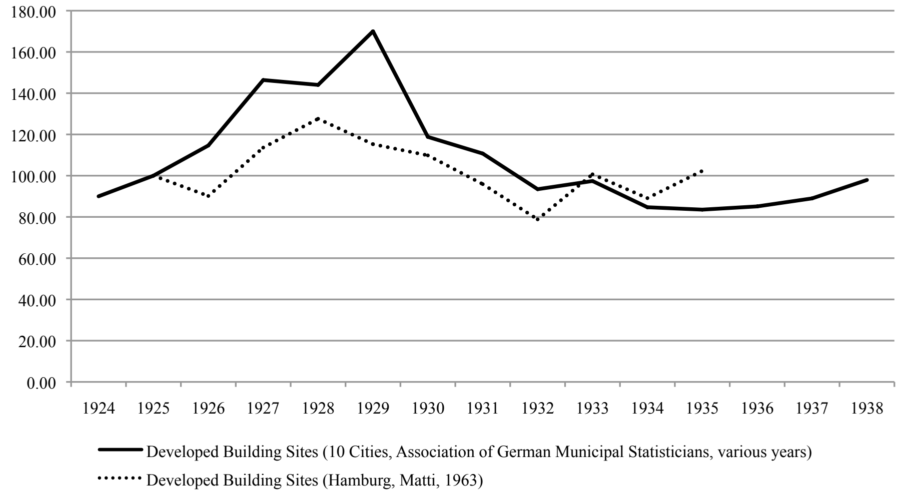


Figure 35: Germany: nominal house price indices 1924–1938 (1925=100).

For the years they overlap and only cover Western Germany, i.e. 1970–1991, the index computed from building site prices (Federal Statistical Office of Germany, various years,b) and the urban index for new terraced dwellings produced by the German Central Bank[113] are highly correlated.[114] Hence, we assume that prices for building land may serve a good approximation for house prices prior to 1970.

Our long-run index for Germany splices the available series as shown in Table 17. For 1870–1902 we use the index for Berlin but rely on the index for Hamburg for 1903–1923 mainly for two reasons: first, in contrast to the Berlin index, the Hamburg index controls for the size of the lots sold and may hence be considered a more reliable indicator of price developments. Second, the boom in Berlin between 1902 and 1906 was stronger and the recession preceding World War I started earlier than in most other German urban housing markets (Carthaus, 1917). For 1924–1938 we use the index for 10 cities due to its wider geographical coverage.

Unfortunately, price data for houses or building lots to the authors knowledge is not available for the period 1939–1954 such that a complete index for house prices can only be constructed for the period since 1955. For the years 1955–1962 the development of real estate prices could be

[113]Bank for International Settlements (2013); extended to 1970 as reported in the OECD database.
[114]Correlation coefficient of 0.992.

approximated using the building site index for Hamburg (Matti, 1963). This index, however, reports a quintupling of prices between 1955–1962 (Matti, 1963). Although the 1950s and 1960s are generally described as a time of rising house and land prices (see below) such a tremendous price spike has not been acknowledged in the literature and therefore must be considered to either have been specific to the city of Hamburg or to have resulted from measurement errors. Accordingly, the index by Matti (1963) is not used for the construction of the long-run real estate price index for Germany. Instead, the here constructed index only starts in 1962 and for the period from 1962 to 1970 relies on price data of building sites per square meter.[115] To obtain our long-run index, we link the two sub-indices, i.e. 1870–1938 and 1962–2012, assuming an average increase in prices of building sites of 300 percent based on the results of a survey conducted by Deutsches Volksheimstättenwerk (1959).

The index suggests that real estate prices more than doubled during the 1960s. Overall, a strong increasing trend in property values during the 1960s seems plausible for the following reasons: first, during the 1950s and 1960s, Germany experienced strong economic growth, also referred to as the 'Wirtschaftswunder' (economic miracle). Second and more importantly, price controls for building sites which had been introduced in 1936 were only fully abolished in the Bundesbaugesetz of 1960. Building site prices had, however, already increased tremendously during the years preceding the repeal of the price control. At the time this development was vividly discussed (DER SPIEGEL, 1961; Koch, 1961). According to Deutsches Volksheimstättenwerk (1959), building site prices in 1959, i.e. a year before the price controls had been officially repealed, stood at a level of 250 to 300 percent of the officially still binding price ceiling price established in 1936. After the repeal of the price controls, building site prices surged. Third, rent control and tenant protection laws were gradually relaxed in the 1950s and 1960s. By 1965, rent control had been with the exception of some larger cities been fully abolished. As a result, rents strongly increased during the 1960s making investment in new housing more profitable. For the time since 1971, we use the urban index for new terraced dwellings produced by the

[115] Actual coverage: 1962—2012; Federal Statistical Office of Germany (various years,b).

German Central Bank (as reported by Bank for International Settlements (2013)).

The index has, however, three flaws: First, while the Hamburg and Berlin indices appear to well reflect the developments in housing markets as discussed in the literature, it - due to the limited availability of property price data – remains uncertain to what extent they can be considered a fully reliable image of the national trend. A second limitation of the index prior to 1938 remains the lack of correction for changing structural characteristics of and quality differences between the developed lots as well as quality change in the structures built on these lots over time. Third, for 1970–2012, the extent to which the effect of quality differences are indeed reduced through confining the index to a certain market segment remains difficult to determine.

Construction cost data

Historical data on construction costs in Germany are available for 1913–2012.

The standard reference for German construction costs is the monthly construction cost report published by the Federal Statistical Office of Germany (2012). The series covers the period 1913–2012 and has been calculated as input cost index for 1913–1958 and as output price index thereafter (Horstmann, 1959). Data are collected through price surveys. Note that the area covered by the index varies over time.[116] Yet changes in territory are unlikely to bias the index given the high level of standardization in the German residential construction sector (Vorholt, 1995).

In addition, since 1968, the Federal Statistical Office of Germany (2012) publishes an output price index for prefabricated one-family dwellings. In the long run, the indices for all types of residential dwellings and for prefabricated dwellings move closely together (Vorholt, 1995). For the years since 2000, the Federal Statistical Office of Germany (2012) reports an input cost

[116] 1913–1944 territory of the German Reich; 1945–1959 former federal territory, excluding Berlin and Saarland; 1960–1965 former federal territory excluding Berlin; 1966–1990 former federal territory; since 1991 Germany.

index for residential dwellings (Dechent, 2006a).

The main characteristics of the long-run construction cost index for Germany 1913–2012 are summarized in Table 18. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by the Federal Statistical Office of Germany (1991). Between 1950 and 1970, real unit labor costs increased by 59 percent.

Other housing related and macroeconomic data

Farmland prices: 1961–2012: Federal Statistical Office of Germany (various years,a,v) - Selling price for agricultural land per hectare.

Value of housing stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1875, 1913, 1929, 1950, 1978. Data on the value of household wealth including the value of dwellings, and underlying land for 1991-2011 is drawn from OECD (2013). Piketty and Zucman (2014) also present data on real estate wealth for benchmark years in the period 1870–2011.

CPI: 1870–1996: Taylor (2002); 1997–2012: International Monetary Fund (2012).

Period	Series ID	Source	Details
1870–1902	DEU1	Statistics Berlin (various years)	*Geographic Coverage*: Berlin; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Sales prices collected by Statistics Berlin; *Method*: Average transaction prices.
1903–1923	DEU2	Matti (1963)	*Geographic Coverage*: Hamburg; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Sales prices collected by Statistics Hamburg; *Method*: Average transaction prices.
1924–1938	DEU3	Association of German Municipal Statisticians (various years)	*Geographic Coverage*: Ten cities; *Type(s) of Dwellings*: All kinds of existing dwellings; *Data*: Sales prices collected by the city's statistical offices; *Method*: Weighted average transaction price index.
1939–1961		Deutsches Volksheimstättenwerk (1959)	*Geographic Coverage*: Western Germany; *Type(s) of Dwellings*: Building sites; *Data*: Data collected through survey; *Method*: Estimated increase in sales prices.
1962–1970	DEU4	Federal Statistical Office of Germany (various years,b)	*Geographic Coverage*: Western Germany; *Type(s) of Dwellings*: Building sites; *Data*: Sales prices collected by the Federal Statistical Office of Germany; *Method*: Average sales prices.
1971–1995	DEU5	Bundesbank as reported by OECD	*Geographic Coverage*: Urban areas in Western Germany; *Type(s) of Dwellings*: New terraced homes; *Data*: Various data sources collected by BulwienGesa *Method*: Weighted average sales price index.
1995–2012	DEU6	Bundesbank as reported by OECD	*Geographic Coverage*: Urban areas in Western Germany; *Type(s) of Dwellings*:New and existing terraced homes; *Data*: Various data sources assembled by BulwienGesa *Method*: Weighted average sales price index.

Table 17: Germany: sources of house price index, 1870–2012.

Period	Source	Details
1914–1958	Federal Statistical Office of Germany (2012)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of residential dwellings; *Type of Index*: Input cost index. .
1959–2012	Federal Statistical Office of Germany (2012)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of residential dwellings; *Type of Index*: Output price index. .

Table 18: Germany: sources of construction cost index, 1913–2012.

B.9 Japan

House price data

Historical data on house prices in Japan are available for the time 1881–2012.

The earliest data are provided by the Bank of Japan (1970a). Bank of Japan (1970a) reports prices for rural residential land (measured in Yen/10 are) for selected years during the period 1880–1915 in the Tokyo prefecture (today referred to as greater Tokyo metropolitan area) and for Japan as a whole (national average). The data are based on public surveys conducted for the purpose of land taxation assessments. Average prices at the national level and for the greater Tokyo area were originally published in the Teikoku Statistics Annual. The data indicates a structural break in prices for residential sites in 1913. Presumably, this break has been caused by the 1910 Residential Land Price Revision Law that was associated with a sharp increase in the valuation price of residential lots (Bank of Japan, 1970a).

For 1913–1930 the Bank of Japan (1986a) using data from the division of statistics of the city of Tokyo reports a land price index for urban land covering six cities.[117] The database also contains a paddy field price index for 1897–1942.

For 1936–1965 the Bank of Japan (1986b) reports four indices; i.e. an urban average land price index, an urban commercial land price index, an urban residential land price index, and an urban industrial land price index calculated from the all-cities and the-six-largest-cities sample, respectively. Furthermore, the database (Bank of Japan, 1986b) contains farm land prices for paddy fields for the period 1913–1965. The land prices are measured in Yen/10 are and are available for eleven districts and as average of all districts. These prices are prices realized in transactions where the farm land remained owner-operated (i.e. transactions in which the land was sold, for example, for road construction are excluded) and were collected

[117]Tokyo, Kyoto, Osaka, Yokohama, Kobe, and Nagoya (Nanjo, 2002).

through land assessors' surveys .(Bank of Japan, 1970b).

For the periods 1955–2004 and 1969–2012 urban land price indices are available from the Japan Real Estate Institute (Statistics Japan, 2012, 2013b). Each of the two indices is disaggregated by the form of land utilization (commercial, residential, and industrial use; as well as an average of these) and by location (nationwide, i.e. referring to 233 cities, six largest cities, and nationwide excluding the six largest cities). Data for index calculation is drawn from appraisals.

For the period 1974–2009 the Land Appraisal Committee of the Japanese Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) publishes data on annual growth rates of appraised real estate prices for "standard" commercial and residential properties. The property is valued assuming a free market transaction (Ministry of Land, Infrastructure, Transport, and Tourism, 2009). In addition to the national price growth data MLIT provides sub-series for the following five geographic categories: i) three largest metropolitan regions, ii) the Tokyo region, iii) the Osaka region, iv) the Nagoya region, and v) other regions.

Figure 36 shows the nominal indices available for 1880–1942, i.e. the paddy field index, the rural residential land index, and the urban residential land index (Bank of Japan, 1970a, 1986a). The rural residential land index (Bank of Japan, 1970a) suggests that land prices continuously decreased between 1881 and 1913. The Meiji-era (1868–1912), however, was a time of considerable economic growth which makes the decrease in land values seem rather surprising. We can offer two explanations for this puzzle which may have joint or partial validity: first, data quality may be poor. The data are based on property valuation by public assessors and not on actual sales prices (Bank of Japan, 1970a). The taxable amount of land seems also not to be changed frequently or not adequately adjusted to the 'real' value.[118] There may hence be differences between trends in assessed values and actual sales prices. Second, the index is based on residential land values for rural areas. Since the last decades of the 19th century were a period of ongoing industrialization and urbanization, trends in rural land values may

[118]Email conversation with Makoto Kasuya, Tokyo University.

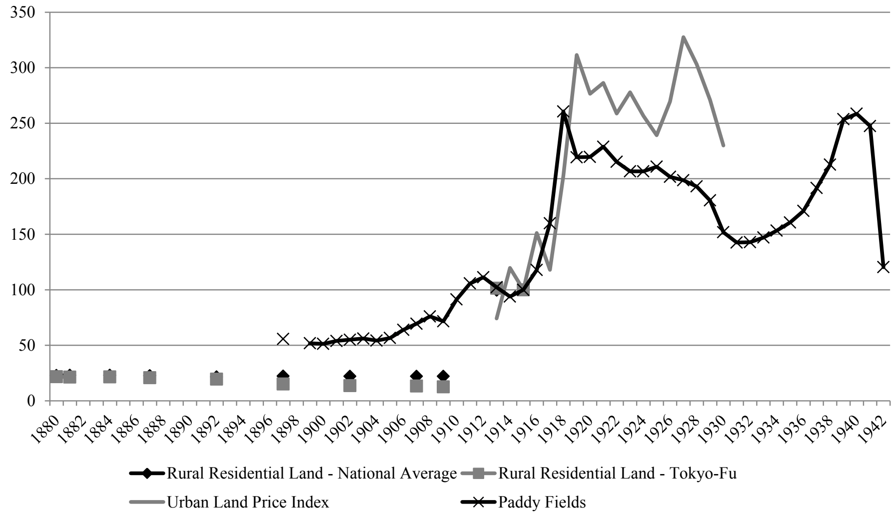


Figure 36: Japan: nominal house price indices 1880–1942 (1915=100).

differ from trends in urban land values and thus not adequately reflect the general national trend during these years.

For the immediate post-World War II decades there are two indices available for urban residential land indices: i) a nationwide index produced by the Bank of Japan (1986b) and ii) a nationwide index by Statistics Japan (2012, 2013b). For the years they overlap (1955–1965), they are perfect substitutes as they follow exactly the same trend.[119]

Figure 37 shows the indices produced by Ministry of Land, Infrastructure, Transport, and Tourism (2009) and Statistics Japan (2013b) for 1970–2012. The graphs indicate that both series closely follow the same trend during the period in which they overlap, i.e. 1975–2009.

Since the land price trend as suggested by Bank of Japan (1970a) seems partially implausible considering the economic environment, our long-run index for Japan only starts in 1913. No data for urban residential land prices, however, is available for 1931–1935.[120] The paddy field index and the urban residential land index, however, are strongly correlated for the years they overlap.[121] To obtain our long-run index we thus link the two

[119]Correlation coefficient of 0.998.

[120]Nanjo (2002) estimates that urban land prices decreased by more than 20 percent in 1931 but were stable 1932–1933.

[121]Correlation coefficient of 0.778 for 1913–1930 (Bank of Japan, 1986a) and correlation

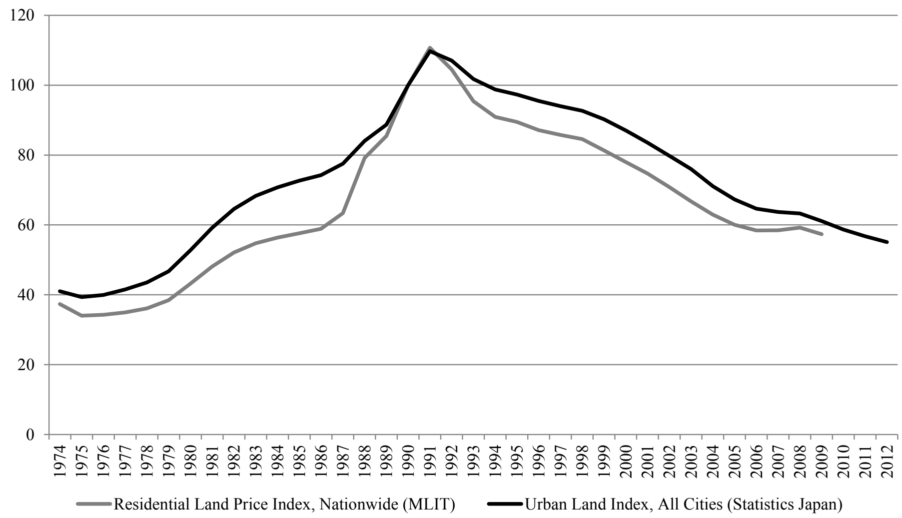


Figure 37: Japan: nominal house price indices 1974–2012 (1990=100).

sub-indices, i.e. 1913–1930 and 1936–2012 using the growth rate of the paddy field index 1930–1936. For 1936–1954 we rely on the urban land price index for all cities by Bank of Japan (1986b). The long-run index uses the Statistics Japan (2013b, 2012) index for the whole 1955–2012 period for two reasons: first, the index produced by Statistics Japan (2012) reflects appraised values rather than actual sales prices. Hence, the Statistics Japan (2013b, 2012) may better reflect real price trends. Second, to keep the number of data sources to construct an aggregate index to the minimum, we do not use the Ministry of Land, Infrastructure, Transport, and Tourism (2009) for the post-1970 period but rely on Statistics Japan (2013b, 2012) instead. Our long-run house price index for Japan 1880–2012 splices the available series as shown in Table 19.

Three aspects have to be considered when using the series on urban residential sites. First, the index only refers to sites for residential use, and thus does not include the value of the structures. However, as discussed above, particularly in urban areas the land price constitutes a large share of the overall real estate value. Fluctuations in property prices in such densely populated areas are often driven by changes in site prices (Möckel, 2007, 142). Second, Nakamura and Saita (2007) suggest that the land price series, i.e. the Urban Land Price Index published by the Japan Real Es-

coefficient of 0.934 for 1936–1965 (Bank of Japan, 1986b).

tate Institute and the series published by Ministry of Land, Infrastructure, Transport, and Tourism (2009) may actually underestimate the general development in site prices. Both indices are calculated as simple averages thus assigning the same weight to high priced plots and low priced lots. The authors, however, argue that the more pronounced fluctuations were particularly symptomatic for the high priced neighborhoods such as the Tokyo metropolitan area. Simple averages may hence underestimate the magnitude of these movements. Third, for 1936–1954, the index reflects appraised land values which may deviate from actual sales prices.

Construction cost data

Historical data on construction costs in Japan are available for 1938–2012.

Two main sources for construction costs in Japan exist. First, Statistics Japan (2012) reports data on the construction costs of wooden houses in 46 cities for 1938–2004.[122] The index is computed by the Japan Real Estate Institute based on surveys of the per square meter market value of medium quality wooden frame houses (building only). The index thus captures changes in replacement values.

Second, the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) reports a construction cost deflator for 1960–2006 and sub-indices for various types of buildings, including residential buildings (Ministry of Land, Infrastructure, Transport, and Tourism, 2015). The index is calculated as an input cost index and reflects the changes in the costs of materials and labor, installation costs for water, gas, electricity, bathroom, kitchen, and outside fittings. Prices of materials are list prices, data on wages come from surveys of employers. The index is based on data for Greater Tokyo for 1960–1990 and on data for 10 cities (including Greater Tokyo) thereafter. The series covers all types of wooden and non-wooden residential dwellings.

To obtain a long-run index, we rely on the construction cost index published by the Ministry of Land, Infrastructure, Transport, and Tourism

[122]These include all prefectural capitals except for Naha. The index for 1938–1954 is reported in Toyo Keizai Shinposha (1991).

(2015) for 1960–2012 and the index for constructed by Statistics Japan (2012) for 1955–1959. Note that the two series are highly correlated for the years they overlap.[123] Table 20 summarizes the main characteristics of our long-run construction cost index.

Other housing related and macroeconomic data

Farmland prices: 1880–1954: Bank of Japan (1966) - Land price index for paddy fields; 1955-2012: Statistics Japan (2012, 2013b) - Land price index for paddy fields.

Value of housing stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1885, 1900, 1913, 1930, 1940, 1955, 1965, 1970, 1977. Data for 1954–1998 is drawn from Statistics Japan (2013a). Data on the value of dwellings and land for 2001–2011 is drawn from OECD (2013).

CPI: 1870–2000: van Leeuwen (2004); 2001–2012: International Monetary Fund (2012).

[123] Correlation coefficient of 0.99.

Period	Series ID	Source	Details
1913–1930	JPN1	Bank of Japan (1986a)	*Geographic Coverage*: Tokyo; *Type(s) of Dwellings*: Urban residential land; *Method*: Average price index.
1931–1935		Bank of Japan (1986b)	*Geographic Coverage*: Kanto district; *Type(s) of Dwellings*: Paddy Fields; *Data*: Transaction data obtained through surveys; *Method*: Average price index.
1936–1954	JPN2	Statistics Japan (2012)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: Residential land; *Data*: Appraisal of land value as if vacant; *Method*: Average price index.
1955–2012	JPN3	Statistics Japan (2013b)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: Residential land; *Data*: Appraisal of land value as if vacant; *Method*: Average price index.

Table 19: Japan: sources of house price index, 1880–2012.

Period	Source	Details
1955–1959	Statistics Japan (2012)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: Wooden houses; *Type of Index*: Replacement costs.
1981–2012	Ministry of Land, Infrastructure, Transport, and Tourism (2015)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: All types of residential dwellings; *Type of Index*: Input cost index.

Table 20: Japan: sources of construction cost index, 1955–2012.

B.10 The Netherlands

House price data

Historical data on house prices in the Netherlands are available for the time 1870–2012.

The most comprehensive source is provided by Eichholtz (1994). Using transaction data for buildings at the Herengracht in Amsterdam, Eichholtz computes a biannual hedonic repeat sales index for the period 1628–1973.[124]

A second index covering the development of prices for all types of existing dwellings in the Netherlands during 1970–1994 is constructed by the Dutch land registry (Kadaster).[125] Though the index is not directly available, it is included in the international house price database maintained by the Federal Reserve Bank of Dallas (Mack and Martínez-García, 2012) and the OECD database. For the time 1970–1992 the index is computed from the median sales price of dwellings as reported by the Dutch Association of Real Estate Agents (Nederlandse Vereniging van Makelaars; NVM). For the years since 1992 the index is based on the Land Registry's records of sales prices of existing residential dwellings and computed using the repeat sales method (De Haan et al., 2008).

Besides the indices by Eichholtz (1994) and Kadaster (Mack and Martínez-García, 2012), a third source is available from Statistics Netherlands (2013d). The agency since 1995 on a monthly basis has published price indices for several types of property, such as all types of dwellings, single-family houses, and flats. The indices are computed using the Sales Price Appraisal Ratio

[124] Eichholtz (1994) notes that the buildings in his sample are of constant high quality as well as relatively homogeneous. For his hedonic regression he only includes one explanatory variable to control for changes in the buildings between transactions, that is use of the buildings. Most of the buildings had been built for residential use. Since the early 20th century, however, many of the properties along the Herengracht were converted into offices which, in turn, increased the value of the buildings. The data he uses to compute the index was published as part of a publication, *Vier eeuwen Herengracht*, at the occasion of Amsterdam's 750th anniversary in 1975. It contains the complete history of about 200 buildings along the Herengracht including all recorded transactions and transaction prices.

[125] The original index as published by the Dutch land registry is only available since 1976. However, a backcasted version of the index which covers the period 1970–2012 is available from the OECD.

(SPAR) method and rely on two separate sources of data: the Dutch land registry (Kadaster) records of sales prices and the municipalities' official value appraisals conducted for residential property taxation.

As indicated above, the only available source that covers the time prior to 1970 is the index by Eichholtz (1994). Even though the index only refers to real estate on one street in the city of Amsterdam (Herengracht), the series appears to be in line with the general trends in house prices as discussed in the literature (Elsinga, 2003; Van Zanden, 1997; Van Zanden and van Riel, 2000; Van der Heijden et al., 2006; Vandevyvere and Zenthöfer, 2012; Van der Schaar, 1987; De Vries, 1980).[126] To obtain an annual index we apply linear interpolation.

Figure 38 covers the development of real estate prices in the Netherlands for the more recent period and shows the Kadaster-index (available since

[126] Real house prices are reported to have increased by about 70 percent between 1870 and 1886. According to Glaesz (1935) and Van Zanden and van Riel (2000), urbanization at the time fueled construction activity in the cities. The ensuing construction boom between 1866–1886 induced a substantive increase in residential investment (Prak and Primus, 1992). The boom faltered in the second half of the 1880s and only resumed in the 1890s. This second boom in house prices and construction activity continued until the crisis of 1907 (Glaesz, 1935; Van Zanden and van Riel, 2000). The enactment of a new housing law in 1901 to set structural and design standard requirements in the field of health, sanitation and safety at the same time fostered the improvement of the dwellings stock and hence further contributed to the construction boom (Prak and Primus, 1992; Van der Heijden et al., 2006). During World War I the Netherlands remained neutral. While the war nevertheless adversely affected Dutch economic development, real house prices remain fairly stable between 1914 and 1918. After years of economic growth in the 1920s, in 1929, the Dutch economy entered what Van Zanden (1997) calls the *"long stagnation"* that lasted until 1949. In line with the dire state of the Dutch economy, real house prices fell by 30 percent between 1930 and 1936 and remained depressed throughout the years of World War II. The German occupation from 1940 to 1945 had devastating effects on the Dutch economy. As many other countries, the Netherlands due to a virtual halt in construction and large scale destruction faced a severe housing shortage after 1945. The housing shortage was further aggravated by rapid population growth and family formation during the 1950s. Rent controls that had already been introduced during the German occupation remained in place until the end of the 1950s, but proved counterproductive to investment in residential real estate (Vandevyvere and Zenthöfer, 2012; Van Zanden, 1997; Van der Schaar, 1987). Not surprisingly considering the strict housing regulation, house price growth remains weak during the late 1940s and 1950s. It was only in 1959 that the government under Prime Minister Jan de Quay (1959–1963) began to liberalize the housing market, i.e. removed the rent controls and cut back social housing subsidization (Van Zanden, 1997; Van der Schaar, 1987). By the 1960s a high rate of homeownership had become a widely supported objective of Dutch housing policy (Elsinga, 2003).

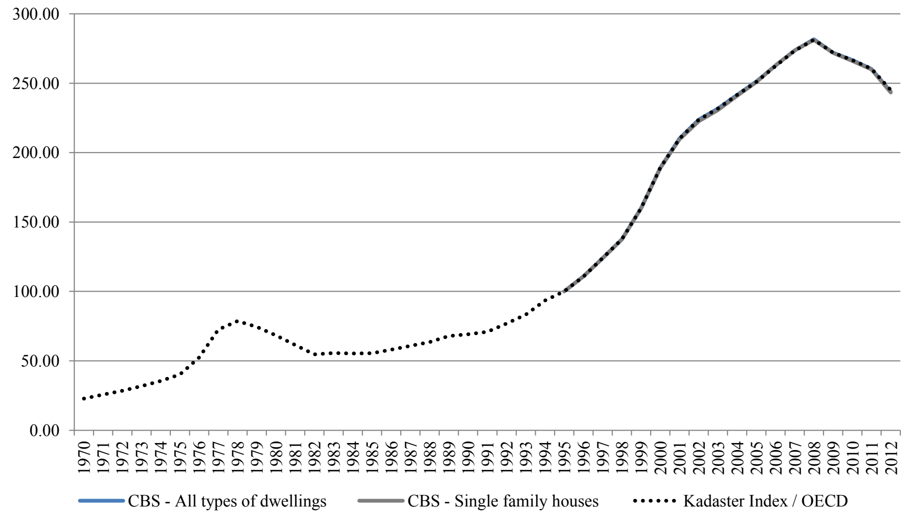


Figure 38: The Netherlands: nominal house price indices 1970–2012 (1995=100)

1970), the CBS-indices for all types of properties and for single-family houses (available since 1995). For the period in which the three indices overlap, i.e. the time from 1995–2012, the indices are perfect substitutes as they follow exactly the same trend and accord with the house price trends discussed in the literature (Vandevyvere and Zenthöfer, 2012).

Our long-run house price index for the Netherlands 1870–2012 splices the available series as shown in Table 21. The long-run index has two weaknesses: first, as no house price series for the Netherlands as a whole is available for the years prior to 1970, we rely on the Herengracht index instead. The extent to which house prices at the Herengracht are representative of house prices in other urban areas or the Netherlands as a whole remains, however, difficult to determine. Second, despite the fact that by using the repeat sales method the effect of quality differences between houses is somewhat reduced, it does not control for all potential changes in the quality and standards of dwellings over time.

Construction cost data

Historical data on construction costs in the Netherlands are available for 1914–2012.

Statistics Netherlands publishes an output price index for new dwellings since 1914 (Statistics Netherlands, 2013a). For 1914–1999, the index is based on construction costs for council houses[127] including VAT and is adjusted to control for quality changes of dwellings using a hedonic regression. Since the production of council houses declined significantly over time, Statistics Netherlands since 1995 calculates a new construction cost series based on data for all types of dwellings (Statistics Netherlands, 2009b, 2000). Two versions of the post-1995 series are available: including and excluding VAT.

A second source for construction costs for the period 1914–2012 is an input cost index constructed by the Bureau Documentatie Bouwwezen (BDB), an independent research institute for the construction sector. The index for single-family houses is based on list prices of building materials and surveys on wages in the construction sector.[128]

In addition, since 1995, Statistics Netherlands, also calculates an input cost index for residential dwellings (Statistics Netherlands, 2013c). For 1995–1998, the index is an average construction cost index for detached houses, apartments, and terraced houses. For 1998–2012, the index is based on eight representative construction projects.[129] The input cost index and the output price index are highly correlated for the years they overlap (1995–2012).[130]

Figure 39 depicts the nominal construction cost indices available for 1914–2012, i.e. the output price index published by Statistics Netherlands (2013a) (1914–2012), the input cost index constructed by BDB (1914–2012), and the input cost index calculated by (Statistics Netherlands, 2013c) (1995–2012). As it shows, the indices generally move together. Nevertheless, in the immediate post-World War II decades, the long-run index by Statistics Netherlands (2013a) follows an upward trend that is slightly more pronounced compared to the BDB-index. In the late 1970s, the se-

[127] Public rental housing built by local municipalities.

[128] Series sent by email. Contact person is Marjan Peppelmann, BDB.

[129] The projects are: apartments and detached houses (for rent) in northern and eastern provinces, apartments and detached houses (to buy) in middle and southern provinces, apartments and detached houses (for rent and to buy) in western provinces.

[130] Correlation coefficient of 0.91.

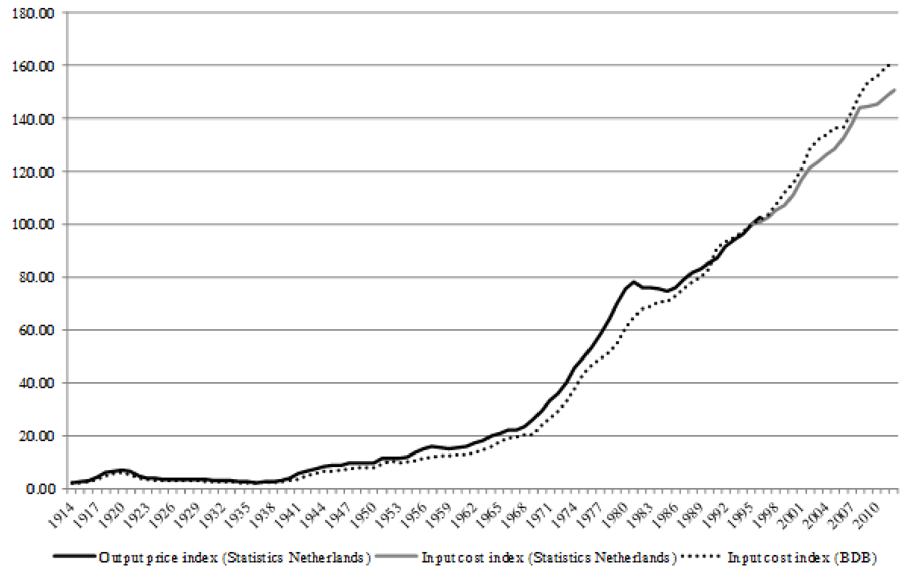


Figure 39: The Netherlands: nominal construction cost indices 1914–2012 (1995=100).

ries suggests a modest decline in construction costs whereas the BDB-index continues to increase.

To arrive at a long-run construction cost series for 1914–2012, we rely on the output price index (incl. VAT) as shown in Table 22.

Other housing related and macroeconomic data

Farmland prices: 1963–1989: Statistics Netherlands (2013b) - Sales price index for farmland (without lease); 1990–2001: Statistics Netherlands (2009a) - Sales price index for farmland (without lease).

Value of housing stock: The Statistics Netherlands (1959) provides estimates of the total value of land and the total value of dwellings for 1952. Data on the value of dwellings and land for 1996–2011 is drawn from OECD (2013).

CPI: 1870–2007: Taylor (2002); 2008–2012: International Monetary Fund (2012).

Period	Source	Details	
1870–1969	NLD1	Eichholtz (1994)	*Geographic Coverage*: Amsterdam; *Type(s) of Dwellings*: All types of existing dwellings; *Data*: Sales prices published in *Vier eeuwen Herengracht*; *Method*: Hedonic repeat sales method.
1970–1994	NLD2	Kadaster Index, as published by OECD	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of existing dwellings; *Data*: Nederlandse Vereniging van Makelaars, Kadaster; *Method*: 1970–1991: median sales price; 1992–1994: repeat sales method.
1997–2012	NLD3	Statistics Netherlands (2013d)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of existing dwellings; *Data*: Kadaster, officially appraised values determined by municipalities as basis for the residential property tax; *Method*: SPAR method.

Table 21: The Netherlands: sources of house price index, 1870–2012.

Period	Source	Details
1914–1994	Statistics Netherlands (2013a)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Council houses; *Type of Index*: Output price index.
1995–2012	Statistics Netherlands (2013a)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of dwellings; *Type of Index*: Output price index.

Table 22: Netherlands: sources of construction cost index, 1914–2012.

B.11 Norway

House price data

Historical data on house prices in Norway are available for the time 1870–2012.

The most comprehensive source for historical data on real estate price in Norway is presented by Eitrheim and Erlandsen (2004). Their data set contains five house price indices; four for urban areas, i.e. for the inner city of Oslo, Bergen, Trondheim and Kristiansand as well as an aggregate index. With the exception of Trondheim, for which data are only available since 1897, the indices cover the period 1819–2003. The indices are constructed from two different sources:

For the years 1819–1985 the indices are computed from nominal transaction prices of real estate property (mostly residential). The data has been compiled from real property registers of the four cities and refers to property in city centers. The four city indices are computed using the weighted repeat sales method, for the aggregate index the hedonic repeat sales method is applied. However, the hedonic regression only controls for location (Eitrheim and Erlandsen, 2004, 358 ff.).

For the years since 1986 Eitrheim and Erlandsen (2004) rely on a monthly index jointly published by the Norwegian Association of Real Estate Agents (Norges Eiendomsmeglerforbund, 2012, NEF) and the Norwegian Real Estate Association (EFF), Finn.no, and Pöyry, a consulting firm. For the years 1986–2001 the index is based on sales price data voluntarily reported by NEF members. Since 2002 the index is based on all transactions managed by NEF and EFF member real estate agents. Reported NEF/EFF raw data are in prices per square meter. There are several sub-series available for various types of properties: all residential dwellings, detached houses, semi-detached houses, and apartments. The data series are disaggregated to county level. NEF/EFF use a hedonic regression method controlling for location and square meters (Eiendomsverdi, Eiendomsmeglerforetakenes forening, and Finn.no, 2013). Since 1986 the share of total property transactions covered by the NEF/EFF database has been steadily increasing and currently stands at about 70 percent.

Besides the indices by Eitrheim and Erlandsen (2004) and NEF/EFF, a third source that covers the more recent development of residential property prices (1991–2012) is provided by Statistics Norway (2013b). Statistics Norway (2013b) publishes house price indices on a quarterly basis for i) all houses; ii) detached houses; iii) row houses; and iv) multi-family dwellings. The indices are based on house sales registered with FINN.no AS. Statistics Norway follows the approach of a mix-adjusted hedonic index.[131]

Figure 40 shows the real house price indices based on the deflated nominal indices for Bergen, Kristiansand, Oslo, and Trondheim and the aggregate four-cities-index by Eitrheim and Erlandsen (2004) for 1870–2002. The four city indices appear to follow the same trends throughout the observation period and are in line with developments in the Norwegian housing market as discussed in the literature.[132]

---

that continued until 1991. During these years the private banking system entered a severe crisis during which borrowing activities remained restricted. House prices sharply contracted before in 1993 again entering a period of strong expansion (Eitrheim and Erlandsen, 2004).

[131]While the hedonic regression specification as currently applied by Statistics Norway controls for dwelling size and location, it ignores other important characteristics such as age of the property or other distinct quality characteristics. Statistics Norway uses mix-adjustment techniques to account for this limitation (Mack and Martínez-García, 2012).

[132]Norwegian house prices strongly increased throughout the last decade of the 19th century. While the underlying macroeconomics were not particularly favorable, strong population growth, and ongoing urbanization substantively fostered the demand for urban housing and thus put upward pressure on house prices. During those years, construction activity increased considerably (Grytten, 2010; Eitrheim and Erlandsen, 2004). The boom period abruptly came to an end in 1899 when the Norwegian building industry crashed causing a financial collapse. The following consolidation period lasted until 1905 (Grytten, 2010; Eitrheim and Erlandsen, 2004). Although Norway remained neutral during World War I, the war had a strong and depressing effect on the Norwegian economy, particularly due to the disruption in trade. While house prices substantially increased in nominal terms, they considerably lacked behind inflation. Rent controls introduced in 1916 lowered the rates of return from rented residential property and put additional downward pressure on house prices (Eitrheim and Erlandsen, 2004). Only after the war house prices begun to recover. During the 1920s the continuous rise in real estate prices was only briefly interrupted during the international postwar recession which in Norway was associated with a banking crisis. Interestingly, the literature provides different and partly contradictory explanations for the massive rise in real estate prices during the 1920s and the first half of the 1930s. Grytten (2010) reasons that the house price hike was primarily driven by relative changes in the nominal house prices and the general price level: while Norway during that time experienced a phase of general price deflation, nominal house prices remained relatively stable. Husbanken (2011) in-

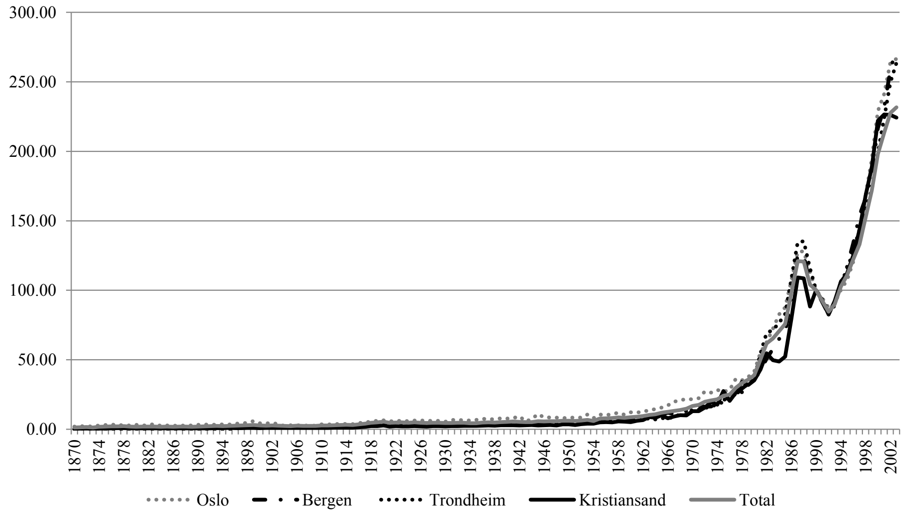


Figure 40: Norway: nominal house price indices 1870–2003 (1990=100).

Figure 41 compares the following four indices for the post-1985 period: the index by Eitrheim and Erlandsen (2004), the national NEF-index (all houses), a four-cities index calculated by averaging the NEF data for Bergen, Kristiansand, Oslo, and Trondheim (all houses), and the national index by Statistics Norway (all houses).[133] It shows that the four indices

stead diagnoses a supply shortage to have been a principal price driver. During the years of German occupation (1940–1945) house prices collapsed. Although destructions were limited in comparison to most other European countries there was a perceptible housing shortage after the war. In response, the government in 1946 established the Norwegian State Housing Bank (*Husbanken*) to provide the required liquidity for residential construction (Husbanken, 2011). Throughout the years 1940–1969, however, strict housing market regulations were in place, with house prices essentially fixed until 1954. This may explain why real house prices continued to decrease after the war until mid-1950. In subsequent years (1955–1960) regulations were gradually relaxed and house price started to rise (Eitrheim and Erlandsen, 2004). Liberalization of the tightly regulated banking sector which began in the late 1970s allowed for more flexibility in bank lending rates but also increased the cost of housing credit such that access to housing finance became more restricted. During these years the significance of the State Housing Bank decreased and private sector finance played an increasingly important role in Norwegian housing finance. In 1976 the State Housing Bank had financed about 87 percent of new dwellings. In 1984 its share had shrunk to about 53 percent (Pugh, 1987). The contractive monetary policy pursued by the Federal Reserve since 1979 and the subsequent global surge in interest rates also effected the Norwegian economy, particularly with respect to capital formation and thus also housing (Pugh, 1987). Starting in the mid-1980s a pronounced increase in house prices emerges fueled by credit liberalization and a considerable credit boom (Grytten, 2010). However, when oil prices declined at the end of the 1980s economic activity slowed considerably and Norway entered a recession

[133]Since the index by Eitrheim and Erlandsen (2004) refers to all kinds of existing dwellings, the respective series for all houses from Norges Eiendomsmeglerforbund (2012)

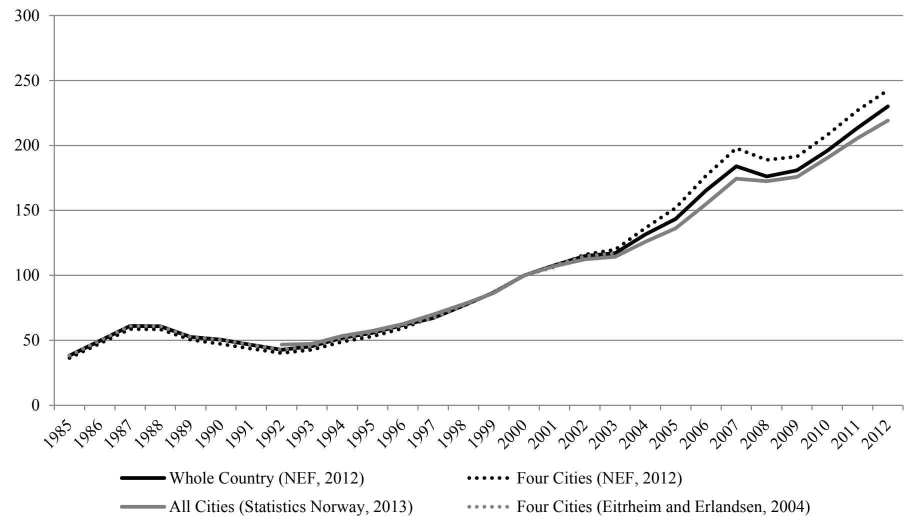


Figure 41: Norway: nominal house price indices 1985–2012 (1990=100).

move in almost perfect lock-step. An analysis by Statistics Norway (2013) suggests that the minor differences between the nationwide index by Statistics Norway and the one by NEF primarily originate from the application of different weights for aggregation. Nevertheless, both the national NEF and the four-cities-index after 2000 follow an upward trend that is slightly more pronounced relative to the Statistics Norway-index. A comparison of the index specific summary statistics suggests that the index by Eitrheim and Erlandsen (2004) perfectly mirrors the level, trend, and volatility of the national NEF index for the time in which they overlap (1990–1999). In an effort to construct a coherent index for the period 1870–2012, splicing the Eitrheim and Erlandsen (2004) and the NEF index appears recommendable. Nevertheless, this approach may result in slightly overestimating the increase in house prices in Norway as a whole in the years after 2000 as the NEF index for the whole of Norway indicates a more pronounced rise in house prices when compared to the other indices available (cf. Figure 41).

Our long-run house price index for Norway 1870-2012 splices the available series as shown in Table 23. A drawback of the long-run index is that prior to 1986 it accounts for quality changes only to some extent. By using the repeat sales method the effect of quality differences between houses is somewhat reduced, but not all potential changes in the quality

and Statistics Norway (2013b) are included.

and standards of dwellings over time are controlled for.

Construction cost data

Historical data on construction costs in Norway are available for the time 1935–2012. The most comprehensive source for construction costs is published by Statistics Norway (2013a). For the years 1935–1977 Statistics Norway (2013a) relies on data by Aspelin-Stormbull – a company producing steel, iron and building materials – for the Oslo area. The dataset contains two construction cost indices for 1935–1977: for brick-built houses and for wooden two-family houses. The two series move closely together (see Figure 42). For 1935–1967 an additional series for dwellings in rural districts is available. For the years since 1978, Statistics Norway (2013a) calculates two nationwide construction cost series: for multifamily houses and for detached houses of wood. The two series are highly correlated.[134] The long-run construction cost index is based on the data series for wooden houses and splices the available series as shown in Table 24. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by Statistics Norway (1981, 1979, 1965). Between 1950 and 1970, real unit labor costs rose by a little less than 3 percent.

Other housing related and macroeconomic data

Value of housing stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1880, 1899, 1913, 1930, 1939, 1953, 1965, 1972, 1978.

Farmland prices: 1985–2005: Statistics Norway[135] - Average purchase price of agricultural and forestry properties sold on the free market; 2006-2010: Statistics Norway (2011) - Average purchase price of agricultural and forestry properties sold on the free market.

CPI: 1870–2012: Bank of Norway (2015).

[134] Correlation coefficient of 0.99.
[135] Series sent by email, contact person is Trond Amund Steinset, Statistics Norway.

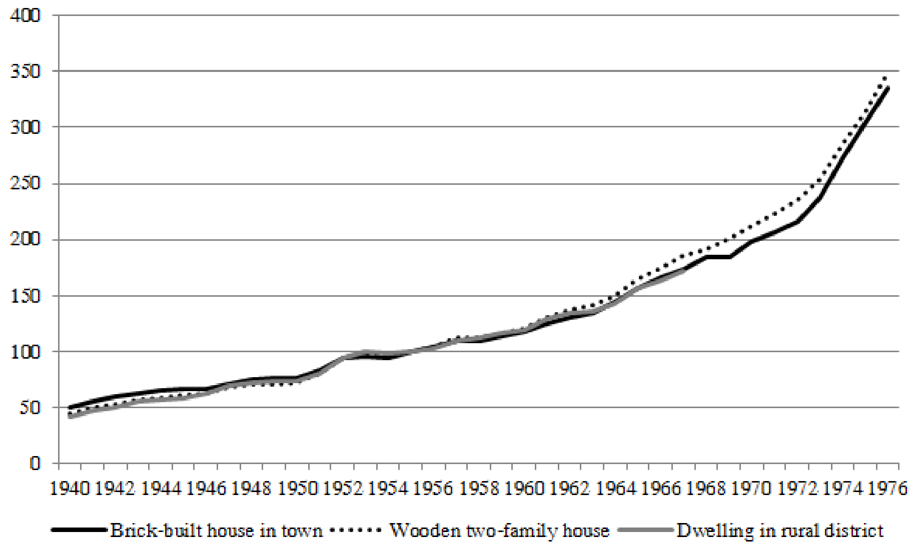


Figure 42: Norway: nominal construction cost indices, 1940–1977 (1955=100)

Period	Series ID	Source	Details
1870–2003	NOR1	Eitrheim and Erlandsen (2004)	*Geographic Coverage*: Four cities; *Type(s) of Dwellings*: All types of existing dwellings; *Data*: Real Property Registers; *Method*: Hedonic weighted repeat sales method.
2004–2012	NOR2	Norges Eiendomsmeglerforbund (2012)	*Geographic Coverage*: Four cities; *Type(s) of Dwellings*: All types of existing dwellings; *Data*: Voluntary reports of real estate agents regarding sales of dwellings; *Method*: Hedonic regression.

Table 23: Norway: sources of house price index, 1870–2012.

Period	Source	Details
1935–1977	Statistics Norway (2013a)	*Geographic Coverage*: Oslo area; *Type(s) of Dwellings*: Wooden two-family houses; *Type of Index*: Input cost index.
1978–2012	Statistics Norway (2013a)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Detached houses of wood; *Type of Index*: Input cost index.

Table 24: Norway: sources of construction cost index, 1935–2012.

B.12 Sweden

House price data

Historical data on house prices in Sweden are available for the time 1875–2012.

The most comprehensive sources for historical data on real estate price in Sweden are presented by Söderberg et al. (2014) and Bohlin (2014). Bohlin (2014) presents an index for multifamily dwellings in Gothenburg for 1875–1957. The index is based on sales price data and tax assessments and constructed using the SPAR method (Söderberg et al., 2014; Bohlin, 2014). Söderberg et al. (2014) also uses the SPAR method to construct an index for multifamily dwellings in inner Stockholm 1875–1957.[136]

In addition, the authors present indices gathered from different sources for Stockholm, Gothenburg, and Sweden for i) single- to two-family houses, and ii) multifamily dwellings for 1957–2012.[137]

A second major source for house prices is available from Statistics Sweden (2014c). The dataset contains a set of annual indices for new and existing one- and two-family dwellings for 12 geographical ares for 1975–2012.[138] The index is constructed combining mix-adjustment techniques and the SPAR method using data from the Swedish real property register (Lantmäteriet).[139]

Figure 43 depicts the nominal indices available for 1875–1957, i.e. the index for Gothenburg (Bohlin, 2014) and the index for inner Stockholm

[136]Both, Söderberg et al. (2014) and Bohlin (2014), also present a repeat sales index which depicts a similar increase in house prices in the long-run. Because the repeat sales analysis still requires further scrutiny, the authors regard the SPAR index as preferable.

[137]The authors combine price information presented by Sandelin (1977) and data collected by Statistics Sweden. For the years since 1975 they rely on Statistics Sweden (2014c).

[138]These areas are: Sweden as a whole, Greater Stockholm, Greater Gothenburg, Greater Malmö, Stockholm production county, Eastern Central Sweden, Småland with the islands, South Sweden, West Sweden, Northern Central Sweden, Central Norrland, Upper Norrland.

[139]For the period 1970–2012 an index is available from the OECD based on Statistics Sweden (2014c). For the period 1975–2012 the Federal Reserve Bank of Dallas also relies on the index for single- and two-family dwellings by Statistics Sweden (2014c).

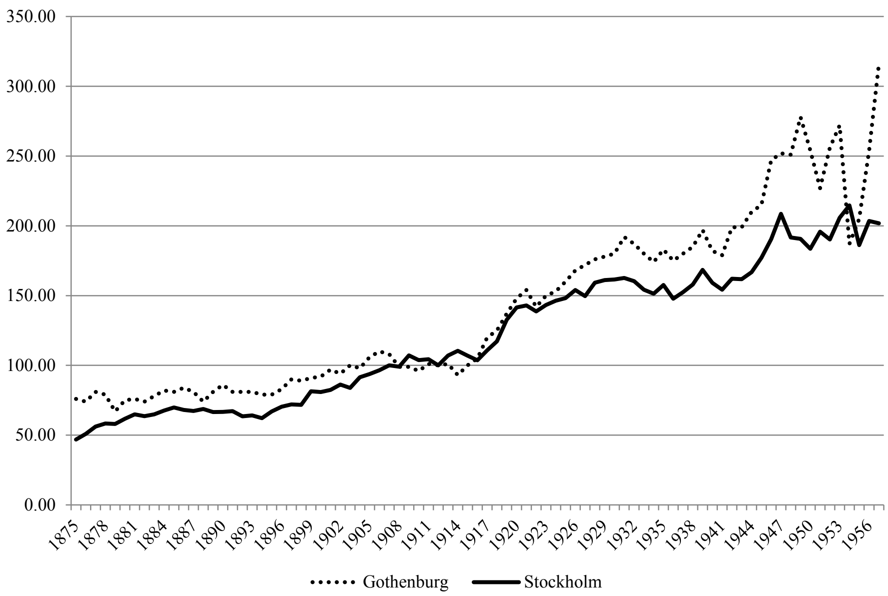


Figure 43: Sweden: nominal house price indices 1875–1957 (1912=100).

(Söderberg et al., 2014). As it shows, the two indices generally move together.[140] The main difference between the two series is the comparably stronger increase in the Gothenburg index after the 1920s and more pronounced fluctuations during the 1950s.[141] The indices appear to by and large be in line with the fundamental macroeconomic trends and developments in the Swedish housing market (Söderberg et al., 2014; Bohlin, 2014; Magnusson, 2000).[142]

Figure 44 shows the nominal indices available for 1957–2012. Again, the indices for Gothenburg and Stockholm follow the same trajectory. The comparison nevertheless suggests that prices for apartment buildings increased less than prices for single- and two-family houses. According to Söderberg et al. (2014), it was rent regulation introduced during the years of World War II that held down the prices for apartment buildings. Hence, they argue, the indices for single- and two-family houses better reflect market prices. The extent to which the increase in prices of apartment houses

[140] Correlation coefficient of 0.954.

[141] The Stockholm index increases at an average annual nominal growth rate of 0.95 percent between 1920 and 1957 while the Gothenburg index increases at an average annual nominal growth rate of 2.05 percent.

[142] Söderberg et al. (2014), however, also reason that the index may not adequately depict the exact extent of the crises and their aftermaths in 1885–1893 and 1907.

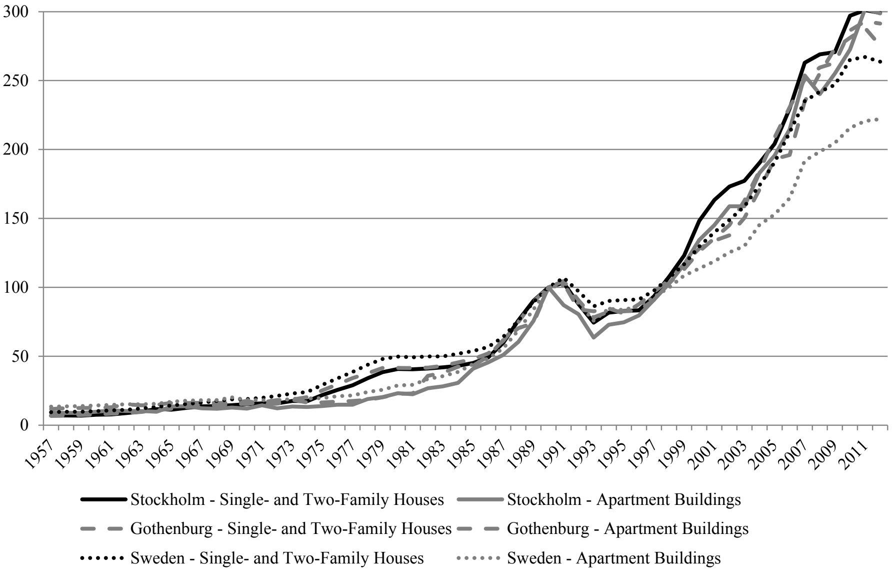


Figure 44: Sweden: nominal house price indices 1975–2012 (1990=100).

were already dampened in earlier years when compared to single-family houses, i.e. prior to 1957, however, cannot be determined (Söderberg et al., 2014).[143]

Our long-run house price index for Sweden 1875–2012 splices the available series as shown in Table 25. As we aim to provide house price indices with the most comprehensive coverage possible, we use a simple average of the index for Gothenburg and the index for Stockholm. While the index prior to 1957 refers to multifamily dwellings only, we nevertheless use the index for single- to two-family dwellings for 1957–2012 as the index for multifamily dwellings may underestimate the increase in house prices particularly during the 1960s and 1970s (see above).

[143]Rent controls were already introduced during World War I, but abolished in 1923. The 1917 law did not freeze rents at certain levels, but was mainly intended to prevent them from increasing in leaps and bounds (Stromberg, 1992). Rent regulation was re-introduced in 1942. Rents were frozen, detailed rent-controls for newly built dwellings introduced, and tenants protected. Tenant protection was further strengthened in the 1968 Rent Act. While the 1942 measures were initially planned to be effective until 1943, they were only fully abolished in 1975 (Magnusson, 2000; Rydenfeldt, 1981; Söderberg et al., 2014).

Construction cost data

Historical data on construction costs in Sweden are available for 1910–2012.

Statistics Sweden (2014a) reports a construction cost index for multi-family dwellings for 1910–2012. The series is based on four main sources. For 1910–1935, Statistics Sweden (2014a) relies on an input cost index constructed by Dickson (1946) for apartment buildings in Stockholm. Dickson (1946), in turn, relies on data collected by Johansson (1944) and the *Svenska Handelsbanken*. For 1936–1949, Statistics Sweden (2014a) uses an input index for apartment buildings in Stockholm constructed by the Royal Housing Board (*Kungl. Bostadsstyrelsen*). For 1950–1968, Statistics Sweden (2014a) uses an input index for apartment buildings in Stockholm constructed by the Royal Board of Social Affairs (*Kungl. Socialstyrelsen*). For 1968–2012, the index is identical to the input price index for apartment buildings in Sweden calculated by Statistics Sweden (Statistics Sweden, 2014a).

The main characteristics of the long-run construction cost index for Sweden 1910–2012 are summarized in Table 26. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by Edvinsson (2005). Between 1950 and 1970, real unit labor costs increased by about 30 percent.

Other housing related and macroeconomic data

Value of housing stock: Waldenström (forthcoming).

Farmland prices: 1870–1930: Bagge et al. (1933); 1967–1987: Statistics Sweden (various years); 1988–2012: Statistics Sweden (2014b).

CPI: 1870–2012: Statistics Sweden (2015).

Period	Series ID	Source	Details
1875–1956	SWE1	Söderberg et al. (2014); Bohlin (2014)	*Geographic Coverage*: Stockholm and Gothenburg; *Type(s) of Dwellings*: Existing multi-family dwellings; *Data*: Tax assessment values from *Stockholms adresskalender* and *Göteborgs adresskalender*, sales price data from register of certificates of title to properties and other archival sources; *Method*: SPAR method.
1957–2012	SWE2	Söderberg et al. (2014)	*Geographic Coverage*: Stockholm and Gothenburg; *Type(s) of Dwellings*: New and existing single- and two-family houses; *Data*: Swedish real property register, Statistics Sweden; *Method*: Mix-adjusted SPAR index.

Table 25: Sweden: sources of house price index, 1875–2012.

Period	Source	Details
1910–1935	Dickson (1946)	*Geographic Coverage*: Stockholm; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.
1936–1949	Royal Board of Housing as reported in Statistics Sweden (2014a)	*Geographic Coverage*: Stockholm; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.
1950–1967	Royal Board of Social Affairs as reported in Statistics Sweden (2014a)	*Geographic Coverage*: Stockholm; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.
1968–2012	Statistics Sweden (2014a)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Apartment buildings; *Type of Index*: Input cost index.

Table 26: Sweden: sources of construction cost index, 1910–2012.

B.13 Switzerland

House price data

Historical data on house prices in Switzerland are available for the time 1901–2012.

For Switzerland, there are three principal sources for historical real estate price data. The first source is Swiss Federal Statistical Office (2013) which inter alia reports average sales prices per square meter for developed lots and building sites in several urban areas since the early 20th century. The most comprehensive coverage is available for the city of Zurich (1899–1990) due to extensive documentation of land transactions in the annual Statistical Abstracts of the city of Zurich. We compute an index based on the five year moving average of the average sales price per square meter of building sites and developed lots in Zurich to smooth out some of the fluctuation stemming from year-to-year variation in the number transaction.

The second source is provided by Wüest and Partner (2012, 40 ff.). The consulting firm produces two price indices - one for multi-family houses and one for commercial property - covering the years since 1930. The index is computed applying a hedonic regression[144] on cross-sectional pooled data.[145] Data are pooled as the number of observations per years varies substantively and hence particularly in years of strong market frictions the single year sample size would be too small to generate reliable price estimates. For the years prior to 2011 the two indices by Wüest and Partner (2012) are constructed from a dataset containing information on 2900 arm's-length transactions of commercial and residential property that took place mostly in large and medium-sized urban centers. The raw data are collected from various insurance companies.[146]

A third important source on real estate prices covering the period 1970–2012 is provided by the Swiss National Bank (SNB) which on a quarterly

[144]The specification controls for quality of the local community (size, agglomeration, purchasing power, etc.), year of construction, square footage, and volume.

[145]The data are pooled such that the estimation for year N also includes the data on transaction of the two previous (N-1, and N-2) and two subsequent years (N+1, N+2).

[146]Such as Generali, Mobiliar, Nationale Suisse, Swiss Life and Zurich Insurance.

basis publishes two mix-adjusted real estate price indices: an index for single-family houses and an index for apartments (sold by the unit). The indices are produced by Wüest and Partner using price information on new and existing properties (Swiss National Bank, 2013). Wüest and Partner rely on a database containing approximately 100,000 entries per year. Each entry provides information on the list prices (not sales prices), location, the size of the respective properties (number of rooms), and whether it at the time was newly constructed or existing stock (Wüest and Partner, 2013).[147]

Figure 45 depicts the nominal indices available for 1901–1975. For the time prior to 1930, it shows that the index computed using the data published by Statistics Switzerland (2013) accords with the general macroeconomic developments and accounts of housing market developments (Böhi, 1964; Woitek and Müller, 2012; Werczberger, 1997; Michel, 1927).[148] Reassuringly, the index by Wüest and Partner (2012) for multifamily properties and the site price index for Zurich (Statistics Switzerland, 2013) consistently move together for the period 1930–1975 and are strongly cor-

[147]For the period 1975–2012, the Federal Reserve Bank of Dallas also uses the Swiss National Banks' index, thus the one developed by Wüest and Partner (Mack and Martínez-García, 2012). The OECD also relies on this index.

[148]Several episodes are noteworthy: first, Switzerland experienced a pronounced building boom during the 1920s, a period of general economic expansion. Wartime rent controls were abolished in 1924. The subsequent increase in rents made homeownership or ownership of rented residential property become more attractive while low mortgage rates further spurred investment in housing (Werczberger, 1997; Böhi, 1964). Between 1930 and 1936 the Swiss economy contracted. While the recession was comparably mild it was rather long-lasting: recovery only began after the devaluation of the Swiss Franc in 1936/37 (Böhi, 1964). Strong private domestic consumption and the continuously high demand for residential housing played an important role to cushion the effect of the recession. While nominal wage rates declined between 1924 and 1933, the drop was less pronounced (minus 6 percent) than the decrease in the cost of living (minus 20 percent) hence increasing the purchasing power of workers. At the same time, building costs were low and credit was easy to obtain since Switzerland was considered a safe haven for capital from countries with unstable currencies (Böhi, 1964; Woitek and Müller, 2012). The outbreak of World War II constituted another major rupture to economic activity in Switzerland. Private investment in housing slumped while construction costs increased. Growth only resumed after the end of the war. During the war years construction activity had remained low. Consequently, the immediate post-war period was characterized by a housing shortage that was further intensified by increasing family formation, high levels of immigration, and generally rising incomes (Böhi, 1964; Werczberger, 1997). Rent controls introduced during the war were gradually abolished until 1954. As a result, rents increased by an impressive 160 percent between 1954 and 1972 and construction activity intensified. A housing shortage persisted, however, until the mid-1970s (Böhi, 1964; Werczberger, 1997).

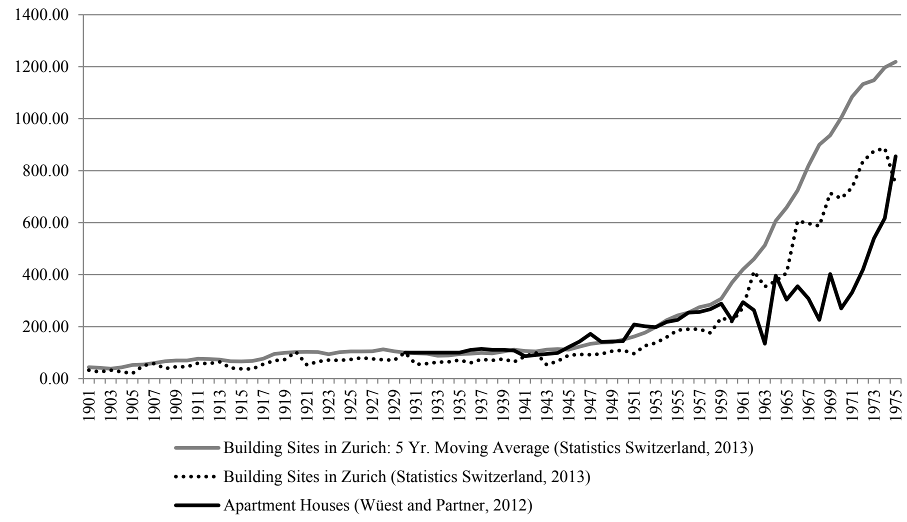


Figure 45: Switzerland: nominal house price indices 1901–1975 (1930=100).

related.[149]

For the 1960s, however, the two indices provide a disjoint and inconsistent picture. In the light of pronounced and uninterrupted economic growth during the 1960s (Woitek and Müller, 2012), the strong fluctuations of house prices as suggested by the Wüest and Partner (2012)-index are rather surprising. One explanation may be poor data quality. A second explanation may be that the index is based on price data for multifamily houses. In 1965, apartment ownership (i.e. purchased by the unit) was legalized for the first time. This, in turn, may have made rental arrangements less attractive and caused uncertainties about the future value of apartment houses as investment property (Werczberger, 1997). Hence, for the years after 1965 the index should not be viewed as depicting boom-bust developments in house prices in general but fluctuations specific to apartment houses. This hypothesis is supported by Statistics Switzerland (2013) index which for the years since 1965 shows and steady positive development for the broader residential property market. However, the index by Statistics Switzerland (2013) may be problematic for another reason: It appears that the index depicts an exaggerated growth trend as house prices are reported to have roughly tripled between 1960 and 1970. As there is no evidence,

[149] Correlation coefficient of 0.85.

discussion or narrative in the literature that reflects such an extreme price development the reported increases appear implausible. While we cannot identify the exact magnitude of house price growth, we can nevertheless assume that Swiss house prices rose during the 1960s. For constructing our long-run index, we therefore rely on the index produced by Wüest and Partner (2012). To smooth out some of the irregular fluctuation, we use a five year moving average of the index.

Figure 46 compares the indices available for 1970–2012, i.e. the index for apartment houses (Wüest and Partner, 2012), the index for single-family houses, and the index for apartments (Swiss National Bank, 2013). As it shows, the three indices generally follow the same trend. For our long-run index, we rely on the index for apartments (Swiss National Bank, 2013) mainly for two reasons: First, the index for apartment houses fluctuates more widely when compared to the indices published by Swiss National Bank (2013). This may be ascribed to the fact that the index is based on a smaller number of observations than the indices by Swiss National Bank (2013). The indices published by Swiss National Bank (2013) may hence be a more reliable indicator of property price fluctuations. Second, we aim to provide house price indices that are consistent over time with respect to property type. As the index for 1930–1969 refers to apartment houses only, we also use the index for apartments for 1970–2012. Our long-run house price index for Switzerland 1901–2012 splices the available series as shown in Table 27.

Construction cost data

Historical data on construction costs in Switzerland are available for 1874–2012.

The earliest data on construction costs in Switzerland is published by Michel (1927). The authors uses data from fire insurance appraisals of newly built residential dwellings in the city of Basel.[150] The appraisals

[150]Michel (1927) excludes all observations based on appraisals of dwellings of particular low quality. Often, these were residential baracks built during the years of World War I. The authors also excludes all observations based on appraisals of luxury houses as these generally not only covered the size and construction value of the house but also of

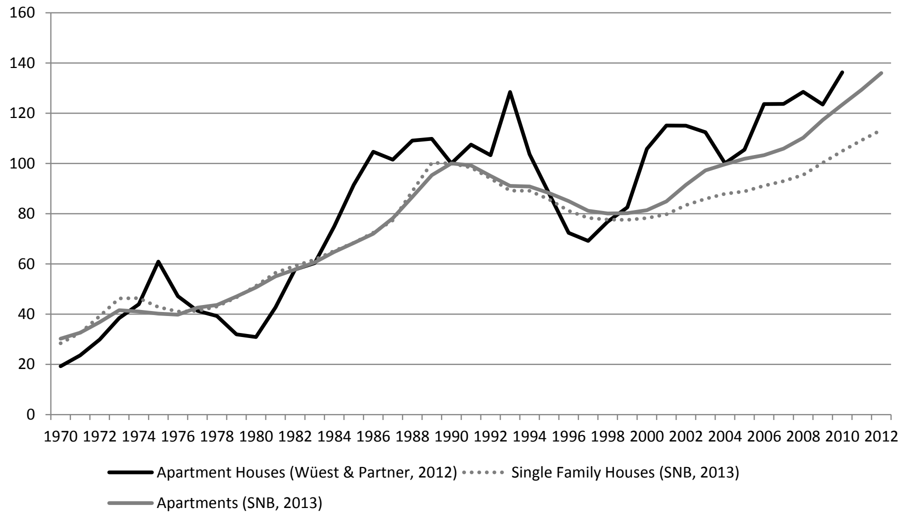


Figure 46: Switzerland: nominal house price indices 1970–2012 (1990=100).

contain information on the size of a building (measured in cubic meter) and the total value of construction. Michel (1927) constructs an index of average construction costs per cubic meter. Relying on more than 125 appraisals per year on average, he reports biannual data for 1874–1916 and annual data for 1916–1924. To obtain an annual index we apply linear interpolation.

A second source for construction costs in Switzerland is the output price index published by Statistics Zurich for 1914–2012 (Stadt Zürich, 2012). The index covers apartment houses in the city of Zurich[151] and is constructed based on quoted prices collected by Statistics Zurich from a sample of building firms (Statistics Zurich, 2014, 1958).[152] For the years they overlap (1914–1924), the two series generally follow a similar trend. Yet the index for Basel shows a comparably larger increase than the index for Zurich.[153]

We use the index (Michel, 1927) for Basel for 1874–1913. Since the

garden pavilions and similar adjacent buildings.

[151]Note that the index house has been re-defined several times since the index was first published in 1932.

[152]Since 1932, the index is based on bids collected from 85 to 150 building firms.

[153]Between 1914 and 1924, the construction cost index for Basel increases by a factor of 1.9. The index for Zurich increases by a factor of 1.7.

house price index relies on data for Zurich between 1901–1929, we rely on the construction cost index for Zurich since 1914. The long-term construction cost index splices the available series as shown in Table 28.

Land price data

Data on land prices for the period 1899–1977 comes from the Swiss Federal Statistical Office (2013) based on data published in the annual Statistical Abstracts of the city of Zurich. The Swiss Federal Statistical Office (2013), for each year, reports the number of transactions of undeveloped lots, the total value and total area of all transactions. This allows to calculate average prices per square meter of undeveloped lots. We compute an index (1914=100) for 1901–1975 based on the five year moving average sales price per square meter of undeveloped lots in Zurich to smooth out some of the fluctuation stemming from year-to-year variations in the number of transactions. Note that the sample size is substantial. On average, the Swiss Federal Statistical Office (2013) reports data on 595 transactions per year.

To compare imputed land prices with observed land prices for Switzerland we calculate a corresponding house price index for Zurich. Specifically, we use the data reported by the Swiss Federal Statistical Office (2013) on transaction prices of developed lots (i.e. including structures) to again calculate an index based on the five year moving average sales price per square meter. Again, the sample is substantial. On average, the Swiss Federal Statistical Office (2013) reports data on more than 1200 transactions per year. This approach allows us to compare an imputed land price based on construction costs and house prices in Zurich with empirical land prices in Zurich in Figure 8.

Other housing related data

Farmland prices: 1953-2012: Swiss Farmers' Union (various years) - Average purchase price of farm real estate per hectare in canton Zurich and canton Bern.

Value of housing stock: Goldsmith (1985, 1981) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1880, 1900, 1913, 1929, 1938, 1948, 1960, 1965, 1973, and 1978.

CPI: 1870–2007: Taylor (2002); 2008–2012: International Monetary Fund (2012).

Period	Series ID	Source	Details
1901–1929	CHE1	Swiss Federal Statistical Office (2013)	*Geographic Coverage* Zurich; *Type(s) of Dwellings*: Developed lots and building sites; *Data*: Sales prices collected by Statistics Zurich; *Method*: Five year moving average of average prices.
1930–1969	CHE2	Wüest and Partner (2012)	*Geographic Coverage*: Nationwide (predominantly large & medium-sized urban centers); *Type(s) of Dwellings*: Apartment houses; *Data*: Insurance Companies; *Method*: Hedonic index.
1970–2012	CHE3	Swiss National Bank (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Apartments; *Data*: List prices; *Method*: Mix-adjustment.

Table 27: Switzerland: sources of house price index, 1901–2012.

Period	Source	Details
1874–1913	Michel (1927)	*Geographic Coverage*: Basel; *Type(s) of Dwellings*: All types of residential dwellings; *Type of Index*: Average construction value per cubic meter.
1914–2012	Stadt Zürich (2012)	*Geographic Coverage*: Zurich ; *Type(s) of Dwellings*: Apartment houses; *Type of Index*: Output price index.

Table 28: Switzerland: sources of construction cost index, 1874–2012.

B.14 United Kingdom

House price data

Historical data on house prices in the United Kingdom is available for 1899–2012.

The earliest available data has been collected by the U.K. Land Registry. In the years 1899–1955, price data were registered by the Land Registry at the occasion of first registrations or transfers of already registered commercial and residential estate in selected - so called compulsory - areas. The database contains information on the value and the number of buildings for both freehold and leasehold property. The value of the land and the number of buildings on it had to be reported by the respective owner. For non-compulsory areas, data are available for the years 1930–1956.[154]

Another early source for house prices covering the period 1920–1938 is provided by Braae (Holmans, 2005, 270 f.). For the years 1920–1927, Braae estimated property values from contract prices for newly constructed properties for local authorities. For the years 1928–1938, the series is based on estimated average construction costs for private dwellings as indicated on building permits issued by local authorities.

For the years since 1930 the Department of Communities and Local Government Department for Communities and Local Government (2013) has gathered house price data from various sources.[155] The data for 1930–1938 are from Holmans (2005, 128) who produces a hypothetical average house price for this period.[156] There is no data available for the years of World War II, i.e. 1939–1945. For the period 1946–1952 DCLG draws on a house price index for modern, existing dwellings constructed by the Co-operative Building Society.[157] For 1952–1965 data for the DCLG dataset

[154]Data kindly provided by Peter Mayer, Land Registry. The Land Registry would take the price paid in a transfer as the market value. On transfers not for money the buying party has to provide an estimate of the market value.

[155]The DCLG index has been transferred to the Office for National Statistics (ONS) in March 2012.

[156]This hypothetical price is derived using data on the average value of new loans and Halifax Building Society's deposit percentages (Holmans, 2005, 272).

[157]The original index by the Co-operative Building Society covers 1946–1970. Holmans

were taken from a survey by the Ministry of Housing and Local Government (MHLG) on mortgage completions for new dwellings (*BS4 survey*).[158] For 1966–2005, data on average house prices were drawn from the so-called five percent survey of building societies. For the years 1966–1992 the *Five Percent Survey* has been conducted under the *Building Societies Mortgage (BSM) Survey*. It is based on a five percent sample drawn from the pool of completed building society house purchase mortgages.[159] The index is mix-adjusted so that changes in the mix of dwellings sold do not affect the average price (Holmans, 2005, 259 ff.). Since the BSM records prices at the mortgage completion state, the index refers to existing dwellings (Holmans, 2005, 259 ff.). For the periods 1993–2002 and 2003–2005 the five percent survey refers to the Survey of Mortgage Lenders. For 2005–2010 data come from the Regulated Mortgage Survey.[160]

Another house price index that, however, only covers more recent years (i.e. since 1995) is provided by the Land Registry. The index relies on the *Price Paid Dataset*, i.e. a record of all residential property transactions conducted in England and Wales. The index thus includes more observations than the one computed by DCLG. The index is calculated using a repeat sales method[161] and is adjusted for quality changes over time. Nevertheless, since the underlying *Price Paid Dataset* only reports few dwelling

(2005) reasons that the price index for modern existing dwellings is likely to refer to houses that were built in the interwar period as there was only little new building for private owners during the war or in the immediate post-war years. The Co-Operative Permanent Building Society was renamed into Nationwide Building Society in 1970.

[158] The *BS4 survey*, conducted by the Ministry of Housing and Local Government (MHLG), is based upon data supplied by several building societies. The index reflects average house prices (Holmans, 2005). The index based on the BS4 survey and the one based on data from the Co-Operative Building Society essentially show the same trajectory for the years they overlap: an acceleration of house prices starting in the early 1960s (Holmans, 2005, Table I.5). This suggests that prices for new and existing dwellings did not vary at a statistically significant level during this period.

[159] Thus, the index calculated from the data (generally referred to as the Department of the Environment (DoE) mix-adjusted index) is not affected by changes in the respective market share of the building societies or changes in their mix of business.

[160] For the period 1970–2012 an index is available from the OECD using the mix-adjusted house price series from the Department for Communities and Local Government. For the period 1975–2012 the Federal Reserve Bank of Dallas also uses the mix-adjusted house price series from the Department for Communities and Local Government (Department for Communities and Local Government, 2013).

[161] The index therefore excludes new houses.

characteristics, the quality adjustment is rather simplistic.[162]

Furthermore, two indices compiled by two principal mortgage banks are available: the index by the Nationwide Building Society (2013) and the index by Halifax (Lloyds Banking Group, 2013). The Nationwide Building Society (2012, 2013) based on data on its own mortgage approvals produces indices for four different categories of houses: i) all houses; ii) new houses; iii) modern houses; and iv) old houses. The index covers the years from 1952 to 2012 and is published on a quarterly basis. Nationwide has changed the methodology of computation several times: the index for 1952–1959 is based on the simple average of the purchase price. For 1960–1973, this has been changed to an average weighted by the floor area of the houses in the sample. For 1974–1982, the average is weighted by ground floor area, property type and geographical region. Since 1983, a hedonic regression is applied.[163] The index by Halifax (since 2009 a subsidiary of the Lloyds Banking Group) is calculated from the company's own database of mortgage approvals, published on a monthly basis, and reaches back to 1983. Several regional sub-indices by types of buyers (all, first-time buyers, home-movers) and by type of property (all, existing, new) are available. The index is calculated using a hedonic regression.[164] Both, the index by Nationwide and by Halifax suffer from sample selection bias as they are solely based on price information from finalized and approved mortgages.[165]

Figure 48 compares the available nominal house price indices for the period prior to 1954. These are the indices calculated from data by the Land Registry (1899–1955) and Braae (1920–1938) and the index by DCLG (1930–2012). It shows that the DCLG and the Braae indices follow the

[162] Several sub-indices covering different property types (i.e. detached, semi-detached, terraced, flat) and different regions, counties, and boroughs are also available (Land Registry, 2013).

[163] The specification controls for several characteristics: location, type of neighborhood, floor size, property design (detached, semi-detached, terraced, etc.), tenure, number of bathrooms, type of garage, number of bedrooms, vintage of the property (Nationwide Building Society, 2012).

[164] The Halifax house price index controls for location, type of property (detached, semi-detached, terraced, bungalow, flat), age of the property, tenure, number of rooms, number of separate toilets, central heating, number of garages and garage spaces, land area, road charge liability, and garden.

[165] Whether any of property transaction enters into the database depends on the buyers' decision to apply for a mortgage by Halifax or Nationwide and the bankers' approval.

same trend for the years they overlap but the Land Registry fluctuates comparably more. While, for example, the Land Registry index suggests an increase in nominal house prices during the first half of the 1930s, the other two series decrease. A possible explanation for this disjunct picture is that the data we use for the Land Registry index has to a very large extent been collected for property in the London area.[166] Therefore, the data may vis-à-vis to the national trend provide a blurred picture, particularly as London during the 1930s recovered much faster from the Great Depression than most northern regions. Yet, for the years prior to the Great Depression, i.e. 1899–1929, house prices in London were comparably less elevated relative to the rest of the country (Justice, December 18, 1999).[167]

[166]During the 1930s, registrations outside London were concentrated on property in southeast England. A 1934 government report found that 73 percent of first registrations outside London were undertaken in the four counties bordering London (see National Archives, TNA/LAR/1/50). The Land Registry also has details of the average number of new titles being created in short periods before May 1938. New titles are not just created on first registrations, but also when part of a title is sold or leased. There is only one northern county (Yorkshire) included in this data. Apart from that, even though Yorkshire is a large county, the number of registrations was small compared to Surrey and Kent for example.

[167]The trajectory of this series is confirmed by additional measures of property values prior to World War I: First, as a measure for house values in the period 1895–1913, Holmans (2005, Table I.20) calculated capital values of house prices combining data on capital values as multiples of annual rental income and data on rents. Second, Offer (1981, 259 ff.) presents data on property sales for the years 1892, 1897, 1902, 1907, 1912. Both series indicate an increase in real estate values throughout the 1890s, a peak early in the 1900s and then fall until the onset of World War I. This trend is also confirmed by contemporary accounts of the housing market (The Economist, 1912, 1914, 1918). Several developments are reported to have played a role in falling property prices: First, as discussed before, the crisis of 1907 contributed to falling property prices. After several years of *"marked depression in the property market"* (The Economist, 1914), the years from 1911 to 1913 marked a brief interlude of rising house prices, which was already reversed in 1913. The Economist (1914) provides several explanations for that: First of all, larger returns could be obtained from other forms of investment. This adversely affected prices in both the market for leasehold and for freehold properties. In all parts of the U.K., builders complained about difficulties of selling particularly middle- and working-class property. In addition, also mortgages, even though readily available, were only offered at rates of about four percent which was considered to be quite high at the time. Furthermore, building and material costs had increased at higher annual rates than rents thereby lowering the return from residential property investment. Consequently, construction activity declined at such a pace that *The Economist* thus forecasted a housing shortage in industrial centers, i.e. in agglomeration of London, the North and Midlands. House prices remained surprisingly stable during the years of World War I, despite a virtual standstill of building activity and a rise in the price of building materials (The Economist, 1918; Needleman, 1965). In response to the increasing housing shortage and the stagnation in construction activities, the government in 1915 introduced rent

Although the underlying data collected from the Registries of Deeds[168] is unfortunately not available, the graphical analysis of nominal hedonic house price indices for 15 towns in the county of Yorkshire for the years 1900–1970 in Wilkinson and Sigsworth (1977) can be used as a comparative to the index calculated from the Land Registry database.[169] Except for the 1930s, the Yorkshire indices generally follow a trend similar to the index calculated from the London centered Land Registry database. Accordingly, it seems that with the exception of the 1930s, the Land Registry data may provide a reasonable approximation of broad trends in national property markets.

Figure 47 depicts the nominal indices for the time of the postwar period. The Halifax (all houses), the DCLG-index, the Nationwide index (all houses) and the index computed from the data by the Land Registry (available since 1995) generally follow the same trend during the periods in which they overlap. For the three decades succeeding World War II, the three available indices (Halifax, Nationwide and DCLG) show a marked increase that peaks in the late 1980s. While the Halifax and the Nationwide indices report a nominal price contraction for the early 1990s the DCLG index only shows a stagnant trend. For years since 1995 all four indices report an impressive acceleration of nominal house prices that continued until the onset of the Great Recession but differ with regard to the mag-

controls which would remain a feature of the housing market for a long time (Bowley, 1945). The housing shortage that continued to persist after the end of World War I was large – both in absolute terms as also with regard to the capacity of the building industry. A substantive increase in building activity occurred as part of a general post-war boom but already came to a halt in the summer of 1920 (Bowley, 1945). During the ensuing postwar depression, property prices due to an increase in interest rates and a scarcity of credit fell further and remained depressed until 1922. Only real estate in the London area recovered somewhat faster (The Economist, 1923, 1927). Also for the 1920s, the trajectory of the Land Registry index seems plausible: Rising real incomes, the rise of building socieities and thus more favorable terms for mortgage financing, and changes in public attitudes toward homeownership as preferred housing tenure all contributed to an increase in demand for owner-occupied housing (Bowley, 1945; Pooley, 1992).

[168] At that time, only two counties had deed registries: Middlesex and Yorkshire. To the best of the authors' knowledge, the Middlesex registry, however, did not normally record the price paid.

[169] Wilkinson and Sigsworth (1977, 23) control for several characteristics such as plot size, square yardage of the land the property stands, sanitary arrangements, garage, age. The 15 towns are: Middlesborough, Redcar, Scarborough, Harrogate, Skipton, Leeds, Bradford, Halifax, Keighley, Dewbury, Barnsley, Doncaster, Hull, Bridlington, Driffield.

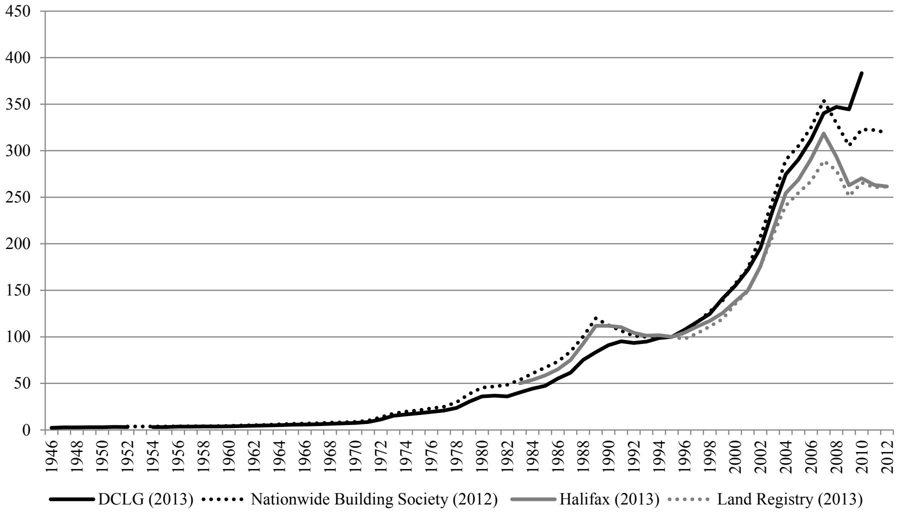


Figure 47: United Kingdom: nominal house price indices 1946–2012 (1995=100).

nitude of the trends. In comparison to the other indices, the DCLG index shows a more pronounced increase in house prices since the mid-1990s. This can be explained by the fact that DCLG in the computation of its index uses price weights while the other three indices rely on transaction weights. As a result, the DCLG-index is biased toward relatively expensive areas, such as South England (Department for Communicities and Local Government, 2012). The Land Registry index generally shows a less pronounced increase in house prices when compared to the other three indices. This may be associated with by the fact that the index is calculated using a repeat sales method and therefore does not include data on new structures (Wood, 2005).

The long-run index is constructed as shown in the Table 29. For the period after 1930, we use the DCLG-index. As discussed above, this source is in comparison to the indices by Halifax and Nationwide considered least vulnerable for possible distortions and biases. For the period after 1995, the here constructed long-run index draws on the index by the Land Registry as it relies on the largest possible data source.

Period	**Series ID**	**Source**	**Details**
1899–1929	GBR1	Land Registry	*Geographic Coverage*: Three cities; *Type(s) of Dwellings*: All kinds of existing properties (residential and commercial); *Data*: Land Registry; *Method*: Average property value.
1930–1938	GBR2	Department for Communities and Local Government (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All dwellings; *Data*: Holmans (2005) using data from Halifax Building Society; *Method*: Hypothetical average house price.
1946–1952	GBR3	Department for Communities and Local Government (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Modern, existing dwellings; *Data*: Co-operative Building Society.
1952–1965	GBR4	Department for Communities and Local Government (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: New Dwellings; *Data*: BS4 survey of mortgage completions; *Method*: Average house prices.
1966–1968	GBR5	Department for Communities and Local Government (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Existing dwellings; *Data*: Building Societies Mortgage Survey (BSM); *Method*: Average house prices.
1969–1992	GBR6	Department for Communities and Local Government (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Existing dwellings; *Data*: Building Societies Mortgage Survey (BSM); *Method*: Mix-adjustment.
1993–1995	GBR7	Department for Communities and Local Government (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: Existing dwellings; *Data*: Five Percent Survey of Mortgage Lenders; *Method*: Mix-adjustment.
1995–2012	GBR8	Land Registry (2013)	*Geographic Coverage*: England and Wales; *Type(s) of Dwellings*: Existing dwellings; *Data*: Land Registry; Method: Repeat sales method.

Table 29: United Kingdom: sources of house price index, 1899–2012.

Period	**Source**	**Details**
1870–1913	Maiwald (1954)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: All types of building ; *Type of Index*: Input cost index.
1914–1954	Fleming (1966)	*Geographic Coverage*: England and Wales; *Type(s) of Dwellings*: Single-family houses built by local authorities; *Type of Index*: Output price index.
1955–2012	Department for Business, Innovation and Skills (2013)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of (private) residential dwellings; *Type of Index*: Output price index.

Table 30: United Kingdom: sources of construction cost index, 1870–2012.

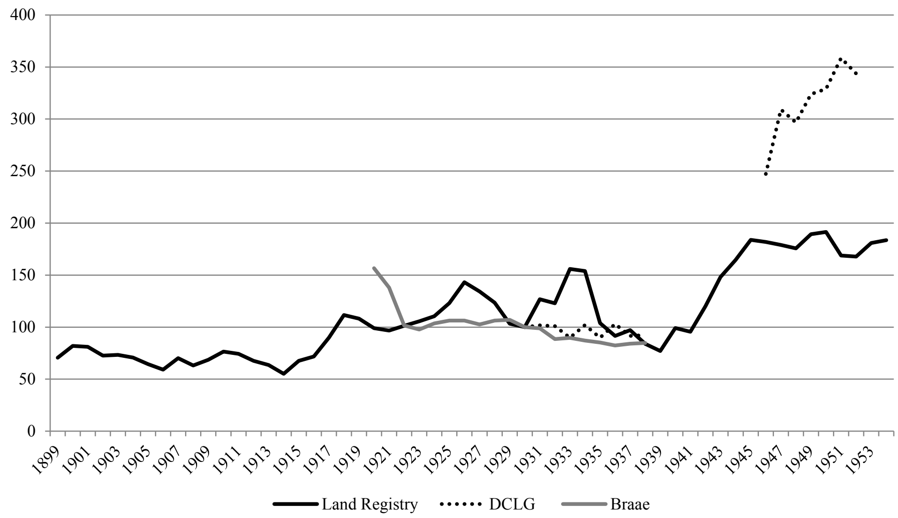


Figure 48: United Kingdom: nominal house price indices 1899–1954 (1930=100).

The resulting index may suffer from two weaknesses: First, before 1930, the index is only based on house prices in the London area and Southeast England. Hence, the exact extent to which the index mirrors trends in other parts of the country remains difficult to determine. Second, the index does not control for quality changes prior to 1969, i.e. depreciation and improvements. To gauge the extent of the quality bias, we can rely on estimates by Feinstein and Pollard (1988) of the changing size and quality of dwellings. If we adjust the growth rates of our long-run index downward accordingly, the average annual real growth rate 1899–2012 of 1.02 percent becomes 0.72 percent in constant quality terms. As this is a rather crude adjustment, however, we use the unadjusted index (see Table 29) for our analysis.

Construction cost data

Historical data on construction costs in the United Kingdom are available for 1870–2012.

Maiwald (1954) constructs a construction cost index for all kinds of buildings for 1845–1938. The input cost index is based on hourly wage rates for adult workers in 39 large towns[170] and an unweighted average series of the price of 10 building materials.[171] The aggregate construction cost index assigns equal weights to wages and material prices.[172] The construction cost index by Maiwald (1954) is not constructed so as to only cover residential dwellings but as a more general index of building costs.

A second index covering construction costs in the London area during the late 19th century (1845–1922) is presented by Jones (1933). The series is constructed as an output price index.[173] Saville (1949) extends the index by Jones (1933) to 1933 and provides a detailed discussion of the properties of these series. Neither the series calculated by Jones (1933) nor the series by Saville (1949) exclusively refers to residential building.

For 1914–1963, Fleming (1966) reports a construction cost index for residential dwelling in England and Wales for which tenders were received by local authorities based on average prices per square foot. For the pre-World War II years, the index refers to non-parlor houses, for post-World War II years, the index refers to three bedroom houses. Since 1951, the index has been adjusted to a standard house size of 900 square feet.[174] For 1955–2012, the Department for Business, Innovation and Skills (2013) publishes an output price index for private housing. For the years the two series overlap, they generally follow the same trend.[175]

A number of additional series for the interwar period are available. For 1920–1938, Bowley (1945) publishes an index for average building costs of local authority houses with three bedrooms. *The Economist* presents an input cost index for all kinds of buildings based on an unweighted average of wages and materials.[176] Figure 49 depicts the nominal indices available

[170] The series covers development in wages of bricklayers, masons, carpenters, joiners, plumbers, plasterers, and painters.

[171] These include stone, bricks, tiles, cement, wood, iron joists, iron girders, lead, linseed oil (paint), and window glass.

[172] Maiwald (1954) relies on date from the *Statistical Abstracts of the United Kingdom*, Laxton's *Builders' Price Book*, the weekly review *The Builder*, *The Economist*, and a report on wholesale and retail prices published by the U.K. Board of Trade.

[173] The index uses data from Laxton's *Builders' Price Book* and is a composite measure of the price of brickwork (including excavator and concretor), carpentry and joinery, masonry, roofing, plumbing, painting and plastering (Saville, 1949).

[174] See Table A.1 (b) in Fleming (1966) for 1914–1939 and Table A.2 (b) for 1939–1963.

[175] Correlation coefficent of 0.86 for 1955–1963.

[176] Wage rates refer to wages in the building industry covering occupations similar

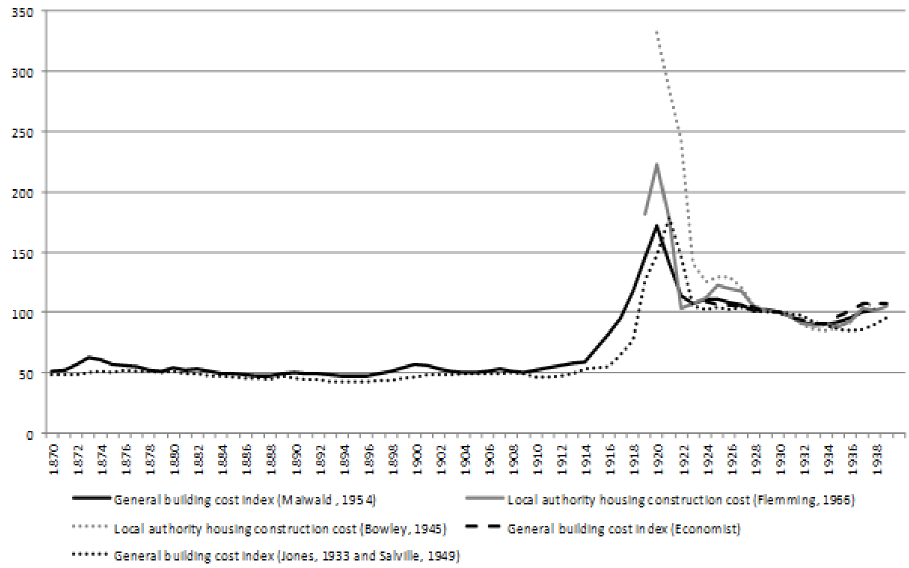


Figure 49: United Kingdom: nominal construction cost indices 1870–1939 (1930=100).

for the time of the pre-World War II period, i.e. the indices by Bowley (1945), Maiwald (1954), Fleming (1966) as well as the index published by the Economist (as reported by Fleming (1966)). All series generally follow the same trend. Yet, the indices based on construction costs of local authority housing fluctuate more widely in the years following World War II compared to the series that cover building costs more generally.

To the extent possible, we use construction cost indices that are constructed so as to cover residential dwellings rather than all types of buildings. The long-run construction cost index therefore splices the available series as shown in Table 30. In addtion, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by the Central Statistical Office (1970, 1965, 1957). Between 1950 and 1970, real construction costs decreased by 21 percent, real unit labor costs fell by 29 percent.

---

to Maiwald (1954) but only relying on data from London and Manchester. Materials included are the same as covered by the index from Maiwald (1954) excluding cement.

Land price data

Data on residential land prices for the period 1983–2010 comes from Homes and Community Agency (2014) and refers to land prices per hectare in England, excluding London. The series is not based on actual land transactions but on estimates of local surveyors. These estimates refer to a "typical" site for a certain region where planning consent for residential development exists and which is serviced to the lot boundary. Data are available by region, the series for England (excluding London) is calculated as simple average of the regional series.

Other housing related and macroeconomic data

Farmland prices: 1870–1914: O'Rourke et al. (1996); 1915–1943: Ward (1960); 1944–2004: U.K. Department for Environment Food and Rural Affairs (2011) - Average price of agricultural land sales per hectare, 2005–2012: RICS[177] - RICS farmland price index.

Value of Housing Stock: Goldsmith (1985) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1875, 1895, 1913, 1927, 1937, 1948, 1957, 1965, 1973, 1977. Data on the value of housing wealth since 1957 is drawn from the Office of National Statistics.[178] To obtain an estimate of the land share in housing value for 2010 we combine data on the total value of residential land in Scotland (Wightman, 2010), the total value of residential land in Northern Ireland (Lyons and Wightman, 2014), the value of residential land (per hectare, by local authority) in England and Wales(Department for Communities and Local Government, 2015) and the amount of residential land in England and Wales (by local authority) in England and Wales (Office for National Statistics, 2010).

[177] Series sent by email, contact person is Joshua Miller, Royal Institution of Chartered Surveyors.

[178] Series sent by email, contact person is Amanda Bell. Even though the series includes data for the whole 1957-2012 period, a number of definitional changes occurred during the transition from the European System of Accounts (ESA) ESA1979 to ESA1995 in 1998. At the time, these series were not joined together and this is likely to indicate a definitional difference.

CPI: 1870–2009: Hills et al. (2010); 2010–2012: International Monetary Fund (2012).

B.15 United States

House price data

Historical data on house prices in the United States are available for 1890–2012.

The standard reference for U.S. house prices is Shiller (2009) and covers 1890–2012. To arrive at a long-run index, Shiller (2009) combines several indices for shorter time periods: for 1890–1934, he relies on an index constructed by Grebler et al. (1956); for 1934–1953, he calculates an average price index for 5 cities; for 1975–1987, he uses the national house price index published by the U.S. Office of Housing Enterprise Oversight (OFHEO); and for the years since 1987, he relies on the national Case-Shiller-Weiss house price index. In this section, we will discuss each of these four series separately and compare them to other available house price series.

The earliest series used by Shiller (2009) is drawn from Grebler et al. (1956) and covers the years 1890–1934. The series is based on data for new and existing owner-occupied single-family dwellings in 22 cities and calculated using an approach similar to the repeat sales method. Grebler et al. (1956) argue that due to the substantive geographical coverage the index provides a good approximation of house prices in the U.S. as a whole. In addition to the index for 22 cities, Grebler et al. (1956) also provide an index for all types of single-family dwellings for Seattle and Cleveland. Data are drawn from the *Financial Survey of Urban Housing* conducted in 1934 (Grebler et al., 1956, 344 f.) for which owners were asked to indicate the year of acquisition and the price paid as well as the estimated value of their house in 1934.[179] The index thus traces changes in the value of individual houses and circumvents the problem of unobserved heterogeneity. Yet,

[179]The authors then calculate relatives for each year for each city, i.e. the ratio of the price of the house at time of acquisition and the value in 1934, determine median relatives for each year and convert the resulting index to a 1929 base.

a major drawback of this method of data collection is that homeowners' value estimates for 1934 may be systematically biased. Notably, it may not account for quality changes of the structure. Grebler et al. (1956) argue that value losses due to depreciation – by and large – tend to outweigh value gains due to structural additions or alterations during this period. To correct for depreciation gross of improvements, the authors also present a depreciation-adjusted index.[180] Note that Shiller (2009) uses the non-adjusted index for 1890–1934 to construct his long-run index.

Besides the Grebler et al. (1956)-index used by Shiller (2009), five more indices exist that cover the decades prior to or the time of the Great Depression. Their geographical coverage is, however, rather limited. First, Garfield and Hoad (1937), also relying on the *Financial Survey of Urban Housing*, provide indices computed from three-year moving averages of prices for new owner-occupied six-room, single-family farm houses in Cleveland and Seattle for 1907–1930. Grebler et al. (1956) suggest that in comparison to their index, the series computed by Garfield and Hoad (1937) may be more consistent as they are based on more homogenous data, i.e. on price data for wooden dwellings of a similar size, most of which were built based on similar plans and also in similar locations. Second, an index by Wyngarden (1927) is based on the median ask or list price from three districts in Ann Arbor, MI, for the period 1913–1925.[181] Wyngarden (1927) claims that although the level of list and ask prices is generally higher than the actual transaction price, the index consistently measures changes in actual transaction prices as it can be assumed that the listing price bears a generally constant relationship to the actual transaction price. The index by Wyngarden (1927) is computed using a repeat sales method and price data for all kinds of existing properties for 1918–1947.[182] Third, Fisher (1951) provides an index for Washington, DC, based on ask price data for existing single-family houses from newspaper advertisements collected for

[180]Grebler et al. (1956) assume a curvilinear rate of depreciation and apply an annual compound rate of depreciation of 1.374 percent (Grebler et al., 1956, 349 ff.).

[181]The raw data was provided by Carr and Tremmel, a local real estate agent at that time. These districts are the University District, the Old Town District, and the Western District Wyngarden (1927, 12).

[182]However, according to Wyngarden (1927, 12) "[r]esidential properties were far in the majority, and single-family dwellings were the predominant type."

an unpublished study by the National Housing Agency.[183]. Fourth, a real estate price index for Manhattan (residential and commercial) covering the period 1920–1930 comes from Nicholas and Scherbina (2011).[184] They use data on real estate transactions from the Real Estate Record and Builders' Guide and apply a hedonic method controlling for type of property, i.e. tenements, dwellings, lofts, and an "other" category with the latter also including commercial buildings. Fifth, Fishback and Kollmann (2015) revisit the trajectory of house prices during the years of the Great Depression. Using data from the Home Owners' Loan Corporation City Survey on housing values, they construct a new national-level house price index for 1929–1940. The resulting index improves the existing data for this period particularly in two respects: Relying on data for 106 cities, the index provides a substantially larger geographic coverage than data series reported by previous studies. In addition, the index is constructed as a hedonic price index controlling for a set of housing and neigborhood characteristics and thus provides a more reliable picture of quality-adjusted price changes.

For the period 1934–1953, the Shiller-index is calculated as an average of five individual indices; for Chicago, Los Angeles, New Orleans, and New York as well as the index for Washington, D.C by Fisher (1951). The indices for Chicago, Los Angeles, New Orleans and New York are computed from annual median ask prices as advertised in local newspapers.

For the period 1953–1975, Shiller (2009) relies on the home purchase component of the U.S. Consumer Price Index. It is calculated from price data for one-family dwellings purchased with FHA-insured loans and controls for age and square footage obtained from the Federal Housing Administration (FHA) by mix-adjustment.[185] Gillingham and Lane (June 1982, 10), however, suggest that *"the data represents a small and specialized segment of the housing market"* and hence may not be representative

[183]According to Fisher (1951, 52), the study was undertaken in 100 metropolitan areas. However, the series gathered for Washington, DC, represents the longest series with respect to the time period covered.

[184]According to the authors, even though Manhattan is geographically a small era having 1.5 percent of the total U.S. population in 1930, it contained about 4 percent of total U.S. real estate wealth at that time (Nicholas and Scherbina, 2011, 1).

[185]For further details, see Greenlees (1982).

of general changes in real estate prices (Greenlees, 1982).[186] Davis and Heathcote (2007) specifically conclude that the index may underestimate house price appreciation during the 1960s and 1970s.

For the period 1975–1987, Shiller (2009) uses the weighted repeat sales home price index originally published by the U.S. Office of Housing Enterprise Oversight (OFHEO).[187] The index is calculated from price data for individual single-family dwellings on which conventional conforming mortgages were originated and purchased by Freddie Mac (FHLMC) or Fannie Mae (FNMA).[188] While the index provides comprehensive geographical coverage, it however only reflects price developments of one particular housing type: single-family houses that are debt financed and comply with the requirements of the FNMA and the FHLMC.[189]

For the years since 1987, Shiller (2009), for the construction of his long-run index, draws on the Case-Shiller-Weiss index (CSWI) and its successors.[190] The CSW national index is constructed from nine regional indices (one for the each of the nine census divisions) using the repeat sales method and price data for existing single-family homes in the U.S.[191]

Figure 50 shows the above presented nominal house price indices for various parts of the U.S. and the time prior to World War II. The indices under consideration appear to follow the same trends: It shows that the

[186] In particular, Gillingham and Lane (June 1982, 11) argue that the data suffers from three major drawbacks that may result in a time lag and a downward bias of the house price index: "Processing delays often mean that several months elapse between the time a house sale occurs and the time it is used in the CPI. For some geographic areas, especially those in the Northeast, the number of FHA transactions is very small. In addition, the FHA mortgage ceiling virtually eliminates higher priced homes from consideration."

[187] Now published by the Federal Housing Finance Agency (2013).

[188] The index controls for price changes due to renovation and depreciation as well as for price variance associated with infrequent transactions.

[189] For the period 1975–2012, the Federal Reserve Bank of Dallas uses the OFHEO/FHFA index (Mack and Martínez-García, 2012). For the period 1970–2012, an index is available from the OECD using the all transaction index provided by the FHFA.

[190] These are the Fiserv Case-Shiller-Weiss index and the S&P/Case-Shiller Home Price Index (S&P Dow Jones Indices, 2013).

[191] Transactions that do not reflect market values, i.e. because the property type has changed, the property has undergone substantial physical changes, or a non-arms-length transaction has taken place, were excluded from the sample.

years prior to World War I were a period of relative nominal price stability. Prices began to moderately increase after World War I. The period of rising prices was accompanied by an increase in general construction activity. A veritable real estate boom is described to have occurred in Florida and Chicago (White, 2009; Galbraith, 1955). However, even though the upswing was felt in in other regions across the country, it is hardly detectable in the inflation-adjusted Shiller-index. White (2009) therefore argues that for the 1920s, the Shiller-index may have a substantial downward bias the size of which is difficult to assess. This notion is supported by the comparison of the various indices available for the 1920s (cf. Figure 50). Overall, the performance of U.S. real estate prices in the 1920s and 1930s continues to be debated. While the Shiller (2009)-index suggests a recovery of real house prices during the 1930s, a series constructed by Fishback and Kollmann (2012) indicates that during the Great Depression house prices fell back to their early 1920s level.

As indicated above, Fishback and Kollmann (2015) report new estimates of house prices for 1929, and 1932–1940. Figure 51 depicts the three series available for this period: i) the (unadjusted) Grebler et al. (1956) index used by Shiller (2009) spliced with the index for 5 cities as constructed by Shiller (2009); ii) an index combining the adjusted Grebler et al. (1956) series with index for 5 cities as constructed by Shiller (2009); and iii) the hedonic index calculated by Fishback and Kollmann (2015). Whereas the two Grebler et al. (1956)-Shiller (2009) hybrids suggest a decrease in nominal house prices of a little more than 20 percent between 1929 and 1933, the new data by Fishback and Kollmann (2015) depict a decrease of about 40 percent. In addtion, the index by Fishback and Kollmann (2015) shows that house prices remained significantly below pre-Depression levels until 1940. By contrast, according to the two Grebler et al. (1956)-Shiller (2009) series, house prices had recovered to a little more than 90 percent of pre-Depression values by 1940.

Immediately after the end of World War II, in the second half of the 1940s, the U.S. entered a brief but substantial house price boom. The index by Shiller (2009, 236 f.) clearly reflects this demand-driven price hike of the post-war years. However, for the period 1934–1953, the Shiller-index

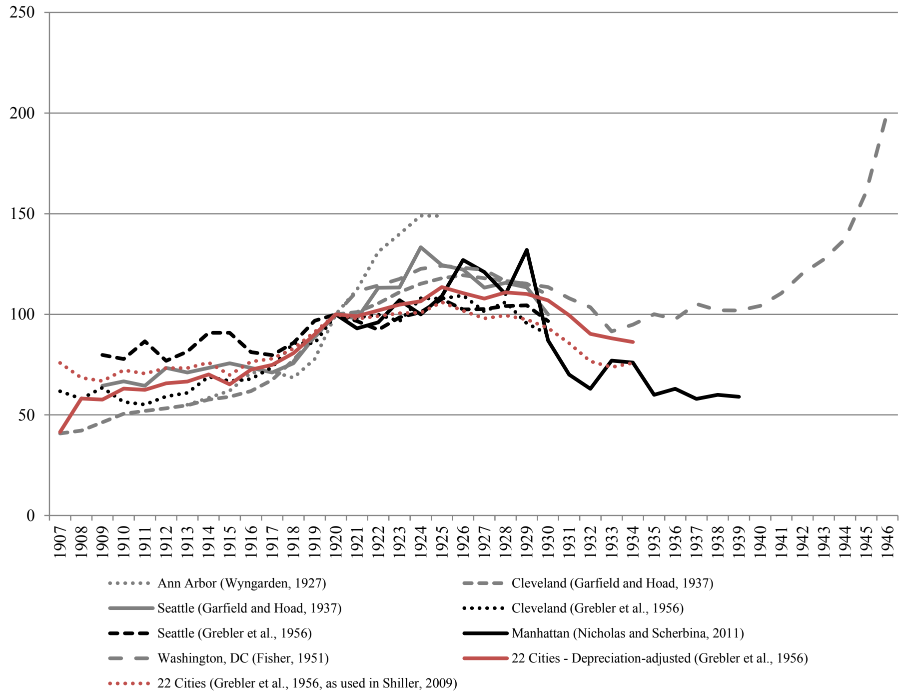


Figure 50: United States: nominal house price indices 1907–1946 (1920=100).

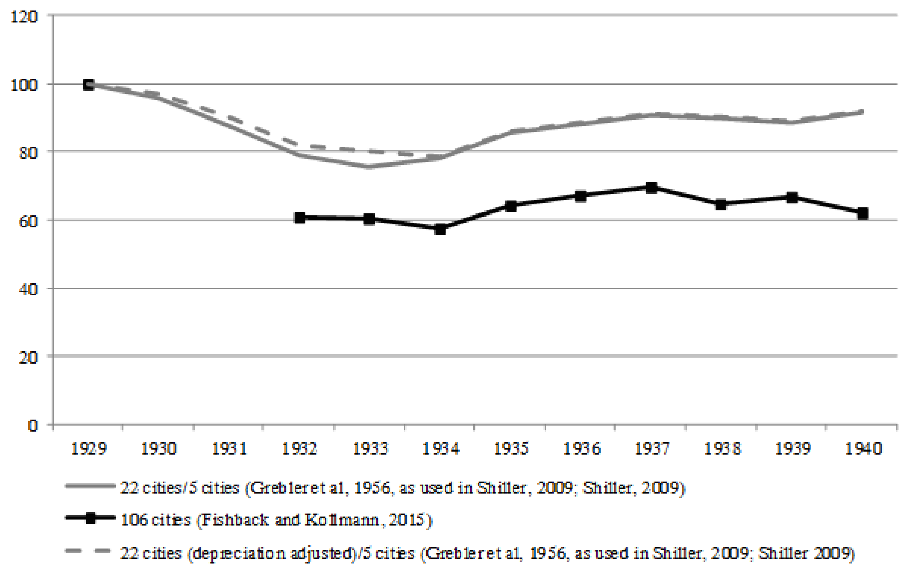


Figure 51: United States: nominal house price indices 1929–1940 (1929=100).

is, as discussed above, calculated from price data for only five cities and may thus not fully represent the broader national trends. This suspicion is countered by Shiller (2009) who – drawing on additional evidence collected from various sources – comes to the conclusion that the price boom in the after war years was not a geographically limited phenomenon but indeed represented a nationwide development even though the boom may have generally been weaker than the index suggests. While Glaeser (2013) confirms that the post-World War II decades were an ideal setting for a housing boom or even bubble due to changes in mortgage finance and an increase in household formation, he finds that prices did not trend upwards between the 1950s and 1970s since housing supply substantially increased. According to the index by Shiller (2009), house prices indeed remained by and large stable between the mid-1950s and the 1970s. Yet, as noted above, it has been suggested that the index may be downward biased during this period (Davis and Heathcote, 2007; Gillingham and Lane, June 1982).

When turning to Figure 52 that depicts the development of the nominal OFHEO and the CSW index, it shows that the two indices can due to their joint movement be considered as reasonable substitutes. However, the CSW index points toward a weaker growth of real estate prices during the first half of the 1990s but catches up until 2000. Moreover, while both indices indicate a remarkable acceleration of house prices for the years 2000-2006/7 the reported magnitudes vary: For this period the CSW index in comparison to the OFHEO index reports a more pronounced increase. The two indices also provide diverging turning point information; while the CSW index peaks in 2006 the OFHEO does so only in 2007. Shiller (2009, 235) suggests that these differences arise mainly due to the fact that the OFHEO-index is computed from data on actual sales prices as well as on refinance appraisals while the CSW-index for this period is solely based on sales data. Assuming that refinance appraisals generally are more conservative while at the same time having more inertia, it appears plausible that the OFHEO-index vis-à-vis the CSW-index may report very pronounced market movements with a minor delay. Leventis (2007) provides a different explanation and argues that the divergence between the CSW- and the OFHEO-index is caused by incongruent geographic coverage S&P Dow

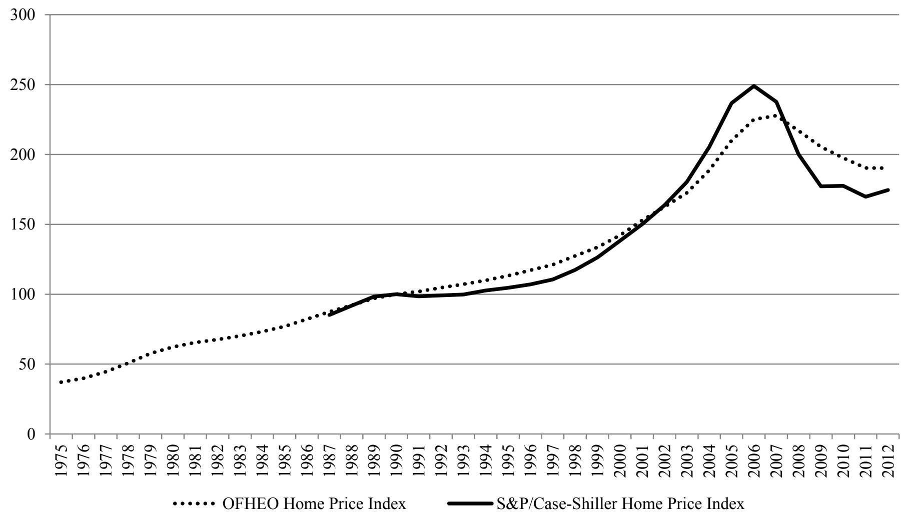


Figure 52: United States: nominal house price indices 1975–2012 (1990=100).

Jones Indices (2013, 29). In addition, Leventis (2007) points towards the differences in the weighting methods applied by CSW and OFHEO. He argues that once appraisal values are removed from the OFHEO data set and geographical coverage and weighting methods are harmonized, the two indices behave almost identical for the years after 2000. Due to the broader geographical coverage of the OFHEO index vis-à-vis the CSW index the here constructed long-run index uses the OFHEO-index for the post-1987 period.

Our long-run house price index for the United States 1890–2012 splices the available series as shown in Table 31.

A drawback of the index is that it does not represent constant-quality home prices throughout the whole 1890–2012 period. This is particularly the case for 1940–1952 (see discussion above). For 1890–1929, we use the depreciation-adjusted index computed by Grebler et al. (1956) to somewhat reduce the quality bias. In a previous version of this paper, we relied on the adjusted index by Grebler et al. (1956) for 1890–1934 and combined it with the index for 5 cities reported by Shiller (2009) for 1935–1952. Recall from Section 2 that we choose constant quality indices wherever available. In this version, we therefore use the new estimates by Fishback and Kollmann (2015) for 1929, and 1932–1940. To construct an annual

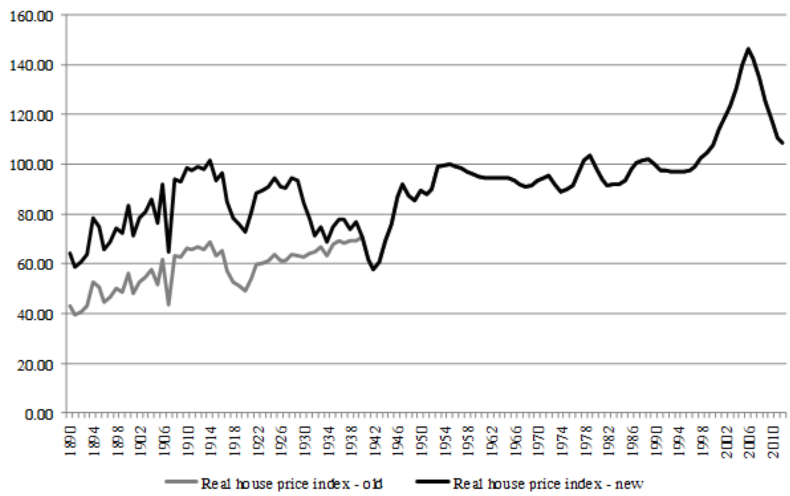


Figure 53: United States: old and revised house price index 1890–2012 (1990=100).

index, we interpolate between 1929 and 1932 using growth rates in nominal house prices as indicated by the adjusted Grebler et al. (1956)-index while taking the 1929 and 1932 point estimates by Fishback and Kollmann (2015) as given. Figure 53 depicts the two resulting CPI-adjusted long-run indices side by side. Moreover, for 1940–1952, the index has a rather limited geographic coverage that may result in a bias of unknown size and direction. Finally, as suggested by Gillingham and Lane (June 1982) and Davis and Heathcote (2007), the index for 1953–1974 may suffer from a downward bias.

Construction cost data

Historical data on construction costs in the United States are available for 1889–2012.

The earliest series on construction costs for residential buildings covering 1889–1953 is constructed by Grebler et al. (1956, Table B-10). For 1910–1953, Grebler et al. (1956) rely on the Boeckh residential construction cost index. The series refers to construction costs of frame and brick one- to six-family houses in 20 cities. Grebler et al. (1956) extend the series back to 1889 using several data series on prices of building materials and on wage rates in the construction sector.[192] The resulting input cost index is calculated as weighted average of these series using analyses of construction costs of "typical houses selected in various parts of the country" Housing and Home Finance Agency (1948, 31) from the National Housing Agency to determine the respective weights.[193]

A second source for 1930–2012 is Davis and Heathcote (2007). The authors calculate a price index for residential structures based on data from the U.S. Bureau of Economic Analysis. The series reflects replacement values of residential structures.

A third source for construction costs for the period 1909–2012 are the indices for construction costs and building costs constructed by the Engineering News Record (Engineering News Record, 2013). The series are constructed as input cost indices combining data on three main building materials (steel, cement, and lumber) and wages in the construction sector in 20 cities. The two series are identically except for wage rates where the construction cost index includes skilled labor wages whereas the building cost index is based on data of common labor wage rates. Note that both series represent more general input cost indices and are not constructed so as to specifically reflect changes in construction costs of residential buildings. There are several other long-run series available reflecting construction costs more general as well as non-residential construction costs (e.g. series constructed by the Associated General Contractors, the Department of Commerce, and the American Appraisal Company (U.S. Bureau of the Census, 1975, Series N118–137)).

To the extent possible, we use i) construction cost indices that are constructed so as to cover residential dwellings rather than all types of buildings or ii) indices of replacement values of residential structures. Note also that for the years since 1975, the index for replacement costs of structures by

[192] Data are derived from the Historical Statistics of the United States (1949). The wage series refers to union wage rates in 39 cities 1907–1912, for 1889–1906 wage rates and prices of building materials are based on data from the so-called Aldrich report (Senate Committee on Finance, 1893) and the continuation of this study by the Department of Commerce and Labor (Department of Commerce and Labor, 1908). For 1889-1909, the price series is based on data from the Aldrich report and the continuation of these series by the Department of Labor. See notes to Grebler et al. (1956, Table B-10) for details.

[193] Weights: wages: 1.0; material: 1.5, see notes to Grebler et al. (1956, Table B-10).

Davis and Heathcote (2007) is constructed so as to match the house prices series published by the Federal Housing Finance Agency (2013) that we use for constructing our long-run house price index (see Table 31). The long-term construction cost index therefore splices the available series as shown in Table 32. In addition, we calculate real unit labor costs in the construction sector for 1950–1970 based on national accounts data published by Bureau of Economic Analysis (2016). Between 1950 and 1970, real unit labor costs increased by about 2 percent.

Land price data

Data on residential land prices for the 1930–2012 comes from Davis and Heathcote (2007). Their index, however, is neither based on actual transactions or appraisals but is an imputed land price. Hence, similar to our decomposition in Section 4, the authors infer land prices from data on house prices and the value of structures.

Other housing related and macroeconomic data

Farmland prices: 1870–1985: Lindert (1988) - Farmland value per acre; 1986–2012: U.S. Department of Agriculture (2013) - Farmland value per acre.

Value of housing stock: Goldsmith (1962) provides estimates of the value of total housing stock, dwellings, and land for the following benchmark years: 1900, 1912, 1922, 1929, 1933, 1939, 1945, 1950, and 1958. Davis and Heathcote (2007) provide estimates for the total market value of housing stock, dwellings and land for 1930–2000. Data on the value of household wealth including the value of housing, and underyling land for 2001–2012 is drawn from Piketty and Zucman (2014).

CPI: 1870–2007: Taylor (2002); 2008–2012: International Monetary Fund (2012).

Period	Series ID	Source	Details
1890–1928	USA1	Grebler et al. (1956)	*Geographic Coverage*: 22 cities; *Type(s) of Dwellings*: Owner-occupied existing and new single-family dwellings; *Data*: Financial Survey of Urban Housing, assessment of home owners; *Method*: Repeat sales method.
1929–1940	USA2	Fishback and Kollmann (2015)	*Geographic Coverage*: 106 cities; *Type(s) of Dwellings*: Existing single-family dwellings; *Data*: HOLC city survey; *Method*: Hedonic index.
1941–1952	USA3	Shiller (2009)	*Geographic Coverage*: Five cities; *Type(s) of Dwellings*: Existing single-family houses; *Data*: Newspaper advertisements and Fisher (1951); *Method*: Average of median home prices.
1953–1974	USA4	Shiller (2009)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: New and existing dwellings; *Data*: Federal Housing Administration data as used in the home purchase component of the CPI; *Method*: Weighted, mix-adjusted index.
1975–2012	USA5	Federal Housing Finance Agency (2013) (former OFHEO House Price Index)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: New and existing single-family houses; *Data*: FNMA and FHLMC; Method: Weighted repeat sales method.

Table 31: United States: sources of house price index, 1890–2012.

Period	Source	Details
1889–1909	Grebler et al. (1956)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of dwellings; *Type of Index*: Input cost index.
1910–1929	Boeckh residential construction cost index as reported in Grebler et al. (1956)	*Geographic Coverage*: Urban areas; *Type(s) of Dwellings*: 1–6-family houses; *Type of Index*: Input cost index.
1930–2012	Davis and Heathcote (2007)	*Geographic Coverage*: Nationwide; *Type(s) of Dwellings*: All types of dwellings; *Type of Index*: Replacement values.

Table 32: United States: sources of construction cost index, 1889–2012.

B.16 Summary of house price series

The sources of the respective series are listed in Tables 5–31.

Frequency

Country	Series	Annual	Other	Adjustment
Australia	AUS1	✓		
	AUS2	✓		
	AUS3	✓		
	AUS4	✓		
	AUS5	✓		
	AUS6	✓		
	AUS7	✓		
	AUS8		✓	Average of quarterly index
Belgium	BEL1	✓		
	BEL2	✓		
	BEL3	✓		
	BEL4	✓		
	BEL5	✓		
Canada	CAN1	✓		
	CAN2	✓		
	CAN3		✓	Average of quarterly index
Denmark	DNK1	✓		
	DNK2	✓		
	DNK3		✓	Average of quarterly index
Finland	FIN1	✓		Three year moving average of annual data
	FIN2	✓		
	FIN3		✓	Average of quarterly index
France	FRA1	✓		
	FRA2	✓		
	FRA3		✓	Average of quarterly index
Germany	DEU1	✓		
	DEU2	✓		
	DEU3	✓		
	DEU4	✓		
	DEU5		✓	Average of quarterly index
	DEU6		✓	Average of quarterly index
Japan	JPN1	✓		
	JPN2	✓		

	JPN3		✓	Average of semi-annual index
The Netherlands	NLD1		✓	Interpolate biannual index
	NLD2		✓	Average of monthly index
	NLD3		✓	Average of monthly index
Norway	NOR1	✓		
	NOR2	✓		
Sweden	SWE1	✓		
	SWE2	✓		
Switzerland	CHE1	✓		Five year moving average of annual data
	CHE2	✓		Five year moving average of annual index
	CHE3		✓	Average of quarterly data
United Kingdom	GBR1	✓		
	GBR2	✓		
	GBR3	✓		
	GBR4	✓		
	GBR5	✓		
	GBR6	✓		
	GBR7	✓		
	GBR8		✓	Average of monthly index
United States	USA1	✓		
	USA2	✓		Interpolate missing values (1930,1931)
	USA3	✓		
	USA4	✓		
	USA5		✓	Average of quarterly index

Covered area

Country	Series	Nationwide	Other	Coverage
Australia	AUS1		✓	Melbourne
	AUS2		✓	Melbourne
	AUS3		✓	Six capital cities
	AUS4		✓	Six capital cities
	AUS5		✓	Six capital cities
	AUS6		✓	Six capital cities
	AUS7		✓	Six capital cities
	AUS8		✓	Eight capital cities
Belgium	BEL1		✓	Brussels Area
	BEL2		✓	Brussels Area
	BEL3	✓		
	BEL4	✓		
	BEL5	✓		
Canada	CAN1	✓		
	CAN2	✓		
	CAN3		✓	Five cities
Denmark	DNK1	✓		Rural areas
	DNK2	✓		
	DNK3	✓		
Finland	FIN1		✓	Helsinki
	FIN2		✓	Helsinki
	FIN3	✓		
France	FRA1		✓	Paris
	FRA2	✓		
	FRA3	✓		
Germany	DEU1		✓	Berlin
	DEU2		✓	Hamburg
	DEU3		✓	Ten cities
	DEU4		✓	Western Germany
	DEU5		✓	Urban areas in Western Germany
	DEU6		✓	Urban areas in Western Germany
Japan	JPN1		✓	Six cities
	JPN2		✓	All cities
	JPN3		✓	All cities
The Netherlands	NLD1		✓	Amsterdam
	NLD2	✓		

	NLD3	✓		
Norway	NOR1		✓	Four cities
	NOR2		✓	Four cities
Sweden	SWE1		✓	Two Cities
	SWE2		✓	Two Cities
Switzerland	CHE1		✓	Zurich
	CHE2		✓	Nationwide, predominantly large & medium-sized urban centers
	CHE3	✓		
United Kingdom	GBR1		✓	Three cities
	GBR2	✓		
	GBR3	✓		
	GBR4	✓		
	GBR5	✓		
	GBR6	✓		
	GBR7	✓		
	GBR8		✓	England & Wales
United States	USA1		✓	22 cities
	USA2		✓	106 cities
	USA3		✓	Five cities
	USA4	✓		
	USA5	✓		

Property type

Country	Series	Single-Family	Multi-Family	All Kinds of Dwellings	Other	Property Type
Australia	AUS1			✓		
	AUS2			✓		
	AUS3			✓		
	AUS4			✓		
	AUS5			✓		
	AUS6			✓		
	AUS7	✓				
	AUS8	✓				
Belgium	BEL1	✓				
	BEL2	✓				
	BEL3				✓	Small & medium sized dwellings
	BEL4				✓	Small & medium sized dwellings
	BEL5	✓				
Canada	CAN1			✓		
	CAN2				✓	All kinds of real estate (residential & non-residential)
	CAN3				✓	Bungalows and two story executive buildings
Denmark	DNK1				✓	Farms
	DNK2	✓				
	DNK3	✓				
Finland	FIN1				✓	Building sites for residential use
	FIN2		✓			
	FIN3		✓			
France	FRA1		✓			
	FRA2			✓		
	FRA3			✓		
Germany	DEU1				✓	All kinds of real estate (residential & non-residential)
	DEU2				✓	All kinds of real estate (residential & non-residential)
	DEU3				✓	All kinds of real estate (residential & non-residential)
	DEU4				✓	Land only
	DEU5	✓				

	DEU6	✓				
Japan	JPN1				✓	Land only
	JPN2				✓	Land only
	JPN3				✓	Land only
The Netherlands	NLD1				✓	All kinds of real estate (residential & non-residential)
	NLD2			✓		
	NLD3			✓		
Norway	NOR1			✓		
	NOR2			✓		
Sweden	SWE1		✓			
	SWE2				✓	Single- and two family houses
Switzerland	CHE1				✓	All kinds of real estate (residential & non-residential)
	CHE2		✓			
	CHE3				✓	Apartments
United Kingdom	GBR1				✓	All kinds of real estate (residential & non-residential)
	GBR2			✓		
	GBR3			✓		
	GBR4			✓		
	GBR5			✓		
	GBR6			✓		
	GBR7			✓		
	GBR8			✓		
United States	USA1	✓				
	USA2	✓				
	USA3	✓				
	USA4			✓		
	USA5	✓				

Property vintage

Country	Series	Existing	New	New & Existing	Other
Australia	AUS1	✓			
	AUS2	✓			
	AUS3	✓			
	AUS4	✓			
	AUS5	✓			
	AUS6	✓			
	AUS7			✓	
	AUS8			✓	
Belgium	BEL1	✓			
	BEL2	✓			
	BEL3	✓			
	BEL4	✓			
	BEL5	✓			
Canada	CAN1	✓			
	CAN2	✓			
	CAN3	✓			
Denmark	DNK1	✓			
	DNK2	✓			
	DNK3			✓	
Finland	FIN1			✓	Land only
	FIN2	✓			
	FIN3	✓			
France	FRA1	✓			
	FRA2	✓			
	FRA3	✓			
Germany	DEU1	✓			
	DEU2	✓			
	DEU3	✓			
	DEU4			✓	Land only
	DEU5			✓	
	DEU6			✓	
Japan	JPN1			✓	Land only
	JPN2			✓	Land only
	JPN3			✓	Land only
The Netherlands	NLD1	✓			
	NLD2	✓			
	NLD3	✓			
Norway	NOR1	✓			

	NOR2	✓		
Sweden	SWE1			✓
	SWE2			✓
Switzerland	CHE1	✓		
	CHE2	✓		
	CHE3	✓		
United Kingdom	GBR1	✓		
	GBR2	✓		
	GBR3	✓		
	GBR4		✓	
	GBR5	✓		
	GBR6	✓		
	GBR7	✓		
	GBR8	✓		
United States	USA1		✓	
	USA2	✓		
	USA3	✓		
	USA4			✓
	USA5			✓

Priced unit

Country	**Series**	**Per Dwelling**	**Per Square Meter**	**Other**	**Unit**
Australia	AUS1			✓	Per Room
	AUS2				
	AUS3				
	AUS4				
	AUS5				
	AUS6				
	AUS7				
	AUS8				
Belgium	BEL1		✓		
	BEL2		✓		
	BEL3	✓			
	BEL4	✓			
	BEL5	✓			
Canada	CAN1	✓			
	CAN2	✓			
	CAN3	✓			

Denmark	DNK1	✓			
	DNK2	✓			
	DNK3	✓			
Finland	FIN1		✓		
	FIN2		✓		
	FIN3		✓		
France	FRA1	✓			
	FRA2	✓			
	FRA3	✓			
Germany	DEU1	✓			
	DEU2		✓		
	DEU3		✓		
	DEU4		✓		
	DEU5	✓			
	DEU6	✓			
Japan	JPN1			✓	Cannot be determined from the source
	JPN2			✓	Cannot be determined from the source
	JPN3		✓		
The Netherlands	NLD1	✓			
	NLD2	✓			
	NLD3	✓			
Norway	NOR1	✓			
	NOR2			✓	Cannot be determined from the source
Sweden	SWE1	✓			
	SWE2	✓			
Switzerland	CHE1		✓		
	CHE2	✓			
	CHE3	✓			
United Kingdom	GBR1	✓			
	GBR2	✓			
	GBR3	✓			
	GBR4	✓			
	GBR5	✓			
	GBR6	✓			
	GBR7	✓			

	GBR8	✓
United States	USA1	✓
	USA2	✓
	USA3	✓
	USA4	✓
	USA5	✓

Method

Country	Series	Repeat Sales	Mix-Adjusted	Hedonic	SPAR	Mean/ Median	Other	Method
Australia	AUS1					✓		
	AUS2					✓		
	AUS3					✓		
	AUS4						✓	Estimate of Fixed Price
	AUS5					✓		
	AUS6					✓		
	AUS7		✓					
	AUS8		✓					
Belgium	BEL1					✓		
	BEL2					✓		
	BEL3					✓		
	BEL4					✓		
	BEL5		✓					
Canada	CAN1						✓	Estimated replacement value
	CAN2					✓		
	CAN3					✓		Based on price information of standardized dwellings
Denmark	DNK1					✓		Adjusted for size of property
	DNK2					✓		
	DNK3				✓			
Finland	FIN1					✓		
	FIN2					✓		
	FIN3		✓	✓				
France	FRA1	✓						
	FRA2	✓						
	FRA3		✓	✓				
Germany	DEU1					✓		
	DEU2					✓		
	DEU3					✓		
	DEU4					✓		
	DEU5		✓					
	DEU6		✓					
Japan	JPN1					✓		
	JPN2					✓		
	JPN3					✓		

The Nether-lands	NLD1	✓						
	NLD2	✓				✓		
	NLD3				✓			
Norway	NOR1	✓		✓				
	NOR2			✓				
Sweden	SWE1				✓			
	SWE2		✓		✓			
Switzerland	CHE1					✓		
	CHE2			✓				
	CHE3		✓					
United Kingdom	GBR1					✓		
	GBR2						✓	Hypothetical average price
	GBR3					✓		
	GBR4					✓		
	GBR5					✓		
	GBR6		✓					
	GBR7		✓					
	GBR8	✓						
United States	USA1	✓						
	USA2			✓				
	USA3					✓		
	USA4		✓					
	USA5	✓						

References

Abelson, P. (1985): "House and Land Prices in Sydney: 1925 to 1970," *Urban Studies*, 22, 521–534.

Abelson, P. and D. Chung (2005): "The Real Story of Housing Prices in Australia from 1970 to 2003," *The Australian Economic Review*, 3, 265–281.

Abildgren, K. (2006): "Monetary Trends and Business Cycles in Denmark 1875–2005," *Danmarks Nationalbank Working Papers*, 43/2006.

Anderson, G. D. (1992): *Housing Policy in Canada: Lecture Series*, Vancouver: Centre for Human Settlements, University of British Columbia for Canada Mortgage and Housing Corporation.

Antwerpsche Hypotheekkas (1961): *Waarde der Onroerende Goederen: Evolutie en Huidig Peil*, Antwerp: Antwerpsche Hypotheekkas.

Association of German Municipal Statisticians (various years): *Statistisches Jahrbuch Deutscher Städte / Statistisches Jahrbuch Deutscher Gemeinden*, Association of German Municipal Statisticians.

Australian Bureau of Statistics (2009): "House Price Indexes: Concepts, Sources and Methods, Australia," `http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/6464.0`.

——— (2013): "House Price Indexes: Eight Capital Cities," `http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/6416.0Mar%202013?OpenDocument`.

——— (2015): "Australian National Accounts: National Income, Expenditure and Product. Table 5. Expenditure on Gross Domestic Product (GDP), Implicit price deflators," `http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/5206.0Jun%202015?OpenDocument`.

Bagge, G., E. Lundberg, and I. Svennilson (1933): *Wages, Cost of Living and National Income in Sweden 1860–1930*, no. 2 in Stockholm Economic Studies, London: P.S. King & Son Ltd.

Bai, J. and P. Perron (2003): "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics*, 18, 1–22.

BAILEY, M. J., R. F. MUTH, AND H. O. NOURSE (1963): "A Regression Method for Real Estate Price Index Construction," *Journal of the American Statistical Association*, 58, 933–942.

BANK FOR INTERNATIONAL SETTLEMENTS (2013): "Property Price Statistics," `http://www.bis.org/statistics/pp.htm`.

BANK OF FINLAND (1946): "Bank of Finland Building Cost Index," *Bank of Finland Monthly Bulletin*, 20, 35–36.

——— (1952): "Bank of Finland Building Cost Index Renewed," *Bank of Finland Monthly Bulletin*, 16, 33–34.

——— (1955): "Building Cost Index," *Bank of Finland Monthly Bulletin*, 14, 37.

BANK OF JAPAN (1966): *Hundred Year Statistics of the Japanese Economy*, Tokyo: Bank of Japan.

——— (1970a): *Supplement to Hundred-Year Statistics of the Japanese Economy: English Translation of Explanatory Notes*, Tokyo: Bank of Japan.

——— (1970b): *Supplement to Hundred-Year Statistics of the Japanese Economy: English Translation of Footnotes*, Tokyo: Bank of Japan.

——— (1986a): *Bank of Japan: The First Hundred Years: Appendices*, Tokyo: Bank of Japan.

——— (1986b): *Bank of Japan: The First Hundred Years: Materials*, Tokyo: Bank of Japan.

BANK OF NORWAY (2015): "HMS Price Index for Norway 1516–2003," `http://www.norges-bank.no/en/Statistics/Historical-monetary-statistics/Consumer-price-indices/`.

BEAUVOIS, M., A. DAVID, F. DUBUJET, J. FRIGGIT, C. GOURIEROUX, A. LAFERRERE, S. MASSONNET, AND E. VRANCKEN (2005): "INSEE Methodes. The Notaires-INSEE Housing Prices Indexes: Version 2 of Hedonic Models," *INSEE Methodes*, 111.

Belgian Association of Surveyors (2013): "ABEX Construction Cost Index," http://www.abex.be/modules/icontent/index.php?page=13/.

Bergen, D. (2011): *Grond te koop? Elementen voor de vergelijking van prijzen van landbouwgronden en onteigeningsvergoedingen in Vlaanderen en Nederland*, Brussels: Department Landbouw en Visserij.

Böhi, H. (1964): "Hauptzüge einer schweizerischen Konjunkturgeschichte," *Swiss Journal of Economics and Statistics*, 1-2, 71–105.

Bohlin, J. (2014): "A Price Index for Residential Property in Göteborg, 1875–2010," in *Historical Monetary and Financial Statistics for Sweden: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620–2012*, ed. by R. Edvinsson, T. Jacobsen, and D. Waldenström, Stockholm: Ekerlids, vol. 2.

Bosworth, B. and G. L. Perry (1994): "Productivity and Real Wages: Is There a Puzzle?" *Brookings Papers on Economic Activity*, 317–344.

Bowley, M. (1945): *Housing and the State 1919–1944*, London: George Allen and Unwin Ltd.

Bureau of Economic Analysis (2016): "National Income and Product Accounts," http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1reqid=9&step=1&isuri=1.

Butlin, M. (1977): "A Preliminary Annual Database 1900/01 to 1973/74," *Reserve Bank of Australia Research Discussion Paper*.

Butlin, N. G. (1962): *Australian Domestic Product, Investment, and Foreign Borrowing 1861-1938/39*, Cambridge, MA : Cambridge University Press.

——— (1964): *Investment in Australian Economic Development, 1861–1900*, Cambridge: Cambridge University Press.

Buyst, E. (1992): *An Economic History of Residential Building in Belgium between 1890 and 1961*, Leuven: Leuven University Press.

Canadian Real Estate Association (1981): *Annual Report 1981*, Ottawa: Canadian Real Estate Association.

Caron, F. (1979): *An Economic History of Modern France*, London: Methuen.

Carthaus, V. (1917): *Zur Geschichte und Theorie von Grundstückskrisen in deutschen Grossstädten mit besonderer Berücksichtigung von Gross-Berlin*, Jena: Gustav Fischer.

Case, B., H. O. Pollakowski, and S. M. Wachter (1991): "On Choosing Between House Price Index Methodologies," *American Real Estate and Urban Economics Association Journal*, 19, 286–307.

Case, B. and J. M. Quigley (1991): "The Dynamics of Real Estate Prices," *Review of Economics and Statistics*, 22, 50–58.

Case, B. and S. Wachter (2005): "Residential Real Estate Price Indices as Financial Soundness Indicators: Methodological Issues," in *Real Estate Indicators and Financial Stability*, Basel: Bank for International Settlements, no. 21 in BIS Papers, 197–211.

Case, K. E. and R. J. Shiller (1987): "Prices of Single-Family Homes Since 1970: New Indexes for Four Cities," *New England Economic Review*, Sept./Oct., 45–56.

Central Statistical Office (1957): *National Income and Expenditure 1957*, London : H.M.S.O.

——— (1965): *National Income and Expenditure 1965*, London : H.M.S.O.

——— (1970): *National Income and Expenditure 1970*, London : H.M.S.O.

Centre for Urban Economics and Real Estate, University of British Columbia (2013): "Canadian Cities Housing and Real Estate Data," `http://www.sauder.ubc.ca/Faculty/Research_Centres/Centre_for_Urban_Economics_and_Real_Estate/Canadian_Cities_Housing_and_Real_Estate_Data`.

Conseil General de l'Environnement et du Developpement Durable (2013a): "House Prices in France : Property Price Index, French Real Estate Market Trends, 1200–2013," http://www.cgedd.developpement-durable.gouv.fr/house-prices-in-france-property-a1117.html.

——— (2013b): "Long Run Data Series, 1800–2010," http://www.cgedd.developpement-durable.gouv.fr/rubrique.php3?id_rubrique=137.

Daly, M. T. (1982): *Sydney Boom Sydney Bust: The City and Its Property Market 1850–1981*, Sydney: George Allen and Unwin.

Danmarks Nationalbank (various years): *Monetary Review*, Copenhagen: Danmarks Nationalbank.

Danmarks Nationalbanken (2003): *Mona - A Quarterly Model of the Danish Economy*, Copenhagen: Danmarks Nationalbank.

Davis, M. A. and J. Heathcote (2007): "The Price and Quantity of Residential Land in the United States," *Journal of Monetary Economics*, 54, 2595–2620; data located at Land and Property Values in the U.S., Lincoln Institute of Land Policy http://www.lincolninst.edu/resources/.

De Bruyne, J.-P. (1956): "L'Evolution des Prix des Immeubles Urbains de l'Agglomeration Bruxelloise de 1878 a 1952," *Bulletin de l'Institut de Recherches Economiques et Sociales*, 22, 57–93.

De Haan, J., E. van der Wal, and P. de Vries (2008): "The Measurement of House Prices: A Review of the Sale-Price-Appraisal-Ratio-Method," http://www.cbs.nl/NR/rdonlyres/1392243B-5BF2-4C56-8A4B-6C0C1A1CC6EE/0/20080814sparmethodart.pdf.

De Vries, J. (1980): "Die Benelux-Länder 1920–1970," in *Die europäischen Volkswirtschaften im zwanzigsten Jahrhundert*, ed. by C. M. Cipolla and K. Borchard, Stuttgart: Fischer Verlag.

Dechent, J. (2006a): "Häuserpreisindex - Entwicklungsstand und aktualisierte Ergebnisse," *Wirtschaft und Statistik*, 12/2006, 1285–1295.

——— (2006b): "Zur Entwicklung eines Baukostenindex," *Wirtschaft und Statistik*, 172–181.

Dechent, J. and S. Ritzheim (2012): "Preisindizes für Wohnimmobilien: Ergebnisse für 2011 und Einfürung eines Online-Erhebungsverfahrens," *Wirtschaft und Statistik*, 10/2012, 891–897.

Department for Business, Innovation and Skills (2013): "BIS Prices and Cost Indices: Output Price Indices," https://www.gov.uk/government/publications/bis-prices-and-cost-indices.

Department for Communicities and Local Government (2012): "Housing Statistical Release," http://webarchive.nationalarchives.gov.uk/20120919132719/www.communities.gov.uk/documents/statistics/pdf/2066836.pdf.

Department for Communities and Local Government (2013): "House prices from 1920, annual house price inflation, United Kingdom, from 1970," https://www.gov.uk/government/statistical-data-sets/live-tables-on-housing-market-and-house-prices.

——— (2015): "Land Value Estimates for Policy Appraisal," https://www.gov.uk/government/publications/land-value-estimates-for-policy-appraisal.

Department of Commerce and Labor (1908): *Bulletin of the Department of Labor No. 77*, Washington, D.C.: United States Government Printing Office.

DER SPIEGEL (1961): "Baulandpreise: Nochmal davongekommen," *DER SPIEGEL*, 32–33.

Deutsche Bauzeitung (1921): "Wege zur Milderung der Wohnungsnot in Deutschland," *Deutsche Bauzeitung*, 55, 250–251.

——— (1922): "Gedanken zum Reichsmieten-Gesetz," *Deutsche Bauzeitung*, 56, 29–30.

——— (1923): "Über die Wirkung der Wohnungs-Zwangswirtschaft in Deutschland," *Deutsche Bauzeitung*, 57, 27–28.

Deutsche Bundesbank (2014): "Methodische Erläuterungen zu den Indikatoren," http://www.bundesbank.de/Navigation/DE/Statistiken/IWF_bezogenen_Daten/FSI/Methodische_Erlaeuterungen/methodische_erlaeuterungen.html.

Deutsches Volksheimstättenwerk (1959): *Handhabung des Preisstops, Grundstückspreisentwicklung und Anwendung des Baulandbeschaffungsgesetzes*, vol. 14 of *Wissenschaftliche Untersuchungen und Vorträge*, Cologne: Deutsches Volksheimstättenwerk.

Dickson, H. (1946): *Byggnadskostnader och byggnadsmaterialmarknader*, no. 4 in Meddelanden, Stockholm: Statens Kommitte för Byggnadsforskning.

Duclaud-Williams, R. H. (1978): *The Politics of Housing in Britain and France*, London: Heinemann.

Duon, G. (1946): *Documents Sur le Problem du Logement a Paris*, vol. 1 of *Etudes Economiques*, Paris : Imprimerie Nationale.

Edvinsson, R. (2005): *Growth, Accumulation, Crisis: With New Macroeconomic Data for Sweden*, Almqvist and Wiksell International.

Eichholtz, P. M. (1994): "A Long-Run House Price Index: The Herengracht Index, 1628–1973," *Real Estate Economics*, 25, 175–192.

Eiendomsverdi, Eiendomsmeglerforetakenes forening, and Finn.no (2013): "Eiendomsmeglerbransjens boligprisstatistikk," http://www.nef.no/xp/pub/mx/filer/boligprisstatistikk/markedsrapporter/05-Finn-13-05mai_639635.pdf.

Eitrheim, O. and S. K. Erlandsen (2004): "House Price Indices for Norway, 1819–2003," in *Historical Monetary Statistics for Norway 1819–2003*, ed. by O. Eitrheim, J. T. Klovland, and J. F. Ovigstad, Oslo: Norges Bank, no. 35 in Norges Bank Skriftserie / Occasional Papers.

Elsinga, M. (2003): "Encouraging Low Income Home Ownership in the Netherlands: Policy Aims, Policy Instrument and Results," Paper presented at the ENHR-conference 2003 in Tirana, Albania.

Engineering News Record (2013): "1Q Cost Report Economic Analysis," http://enr.construction.com/economics/quarterly_cost_reports/.

Ensgraber, W. (1913): *Die Entwicklung der Bodenpreise Darmstadts in den letzten 40 Jahren*, Leipzig: A. Deichert.

European Central Bank (2013): "Residential Property Prices Documentation," https://stats.ecb.europa.eu/stats/sdw/docu/databases/ecb/RPP_metadata.pdf.

European Commission (2013): "Handbook on Residential Property Price Indices (RPPIs)," *eurostat Methodologies and Working papers.*

Eurostat (1996): *Methodological Aspects of Construction Price Indices*, Luxemburg: Office of Official Publications of the European Communities.

Federal Housing Finance Agency (2013): "House Price Indexes," http://www.fhfa.gov/Default.aspx?Page=87.

Federal Statistical Office of Germany (1991): *Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe S.15, Revidierte Ergebnisse 1950-1990*, Wiesbaden: Federal Statistical Office of Germany.

——— (2012): *Preisindizes für die Bauwirtschaft*, Fachserie 17, Reihe 4, Wiesbaden: Federal Statistical Office of Germany.

——— (various years,a): *Kaufpreissammlung für landwirtschaftliche Betriebe und Stückländereien*, Fachserie B: Land- und Forstwirtschaft, Fischerei, Wiesbaden: Federal Statistical Office of Germany.

——— (various years,b): *Kaufwerte für Bauland*, Fachserie 17 Reihe 5, Wiesbaden: Federal Statistical Office of Germany.

——— (various years,c): *Kaufwerte für landwirtschaftlichen Grundbesitz*, Fachserie 3: Land- und Forstwirtschaft, Fischerei, Wiesbaden: Federal Statistical Office of Germany.

Federation Francaise du Batiment (2015): "Indice FFB du Cout de la Construction," http://www.ffbatiment.fr/federation-francaise-du-batiment/le-batiment-et-vous/en_chiffres/indices-index/Chiffres_Index_FFB_Construction.html.

Feinstein, C. H. and S. Pollard (1988): *Studies in Capital Formation in the United Kingdom, 1750–1920*, Oxford: Clarendon Press.

Firestone, O. J. (1951): *Residential Real Estate in Canada*, Toronto: University of Toronto Press.

Fishback, P. V. and T. Kollmann (2012): "New Multi-City Estimates of the Changes in Home Values, 1920-1940," *NBER Working Paper*, 18272.

——— (2015): "Hedonic Housing Indexes during the Great Depression," *unpublished manuscript.*

Fisher, C. and C. Kent (1999): "Two Depressions, One Banking Collapse," *Reserve Bank of Australia Research Discussion Paper*, 1999-06.

Fisher, E. M. (1951): *Urban Real Estate Markets: Characteristics and Financing*, New York: National Bureau of Economic Research.

Fleming, M. (1966): "The Long-Term Mesurement of Construction Costs in the United Kingdom," *Journal of the Royal Statistical Society*, 129, 534–556.

Friggit, J. (2002): "Long Term Home Prices and Residential Property Investment Performance in Paris in the Time of the French Franc, 1840–2011," http://www.cgedd.developpement-durable.gouv.fr/IMG/doc/house-price-france-1840-2001_cle5a8666.doc.

Führer, K. C. (1995): "Managing Scarcity: The German Housing Shortage and the Controlled Economy 1914–1990," *German History*, 13, 326–354.

GALBRAITH, J. K. (1955): *The Great Crash 1929*, Boston: Mifflin.

GARFIELD, F. R. AND W. M. HOAD (1937): "Construction Costs and Real Property Values," *Journal of the American Statistical Association*, 32, 643–653.

GARLAND, J. M. AND R. W. GOLDSMITH (1959): "The National Wealth of Australia," in *The Measurement of National Wealth*, ed. by R. W. Goldsmith and C. Saunders, Chicago: Quadrangle Books, Income and Wealth Series VIII, 323–364.

GILLINGHAM, R. AND W. LANE (June 1982): "Changing the Treatment of Shelter Costs for Homeowners in the CPI," *Monthly Labor Review*, 9-14.

GLAESER, E. L. (2013): "A Nation of Gamblers," *NBER Working Paper*, 18825.

GLAESZ, C. (1935): *Hypotheekbanken en Woningmarkt in Nederland*, Nederlandsch Economisch Instituut, 15, Haarlem : Bohn.

GOLDSMITH, R. W. (1962): *The National Wealth of the United States in the Postwar Period*, Princeton: Princeton University Press.

——— (1981): "A Tentative Secular National Balance Sheet for Switzerland," *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*, 117, 175–187.

——— (1985): *Comparative National Balance Sheets: A Study of Twenty Countries, 1688–1978*, Chicago: University of Chicago Press.

GREBLER, L., D. M. BLANK, AND L. WINNICK (1956): *Capital Formation in Residential Real Estate: Trends and Prospects*, Princeton: Princeton University Press.

GREENLEES, J. S. (1982): "An Empirical Evaluation of the CPI Home Purchase Index, 1973–1978," *AREUA Journal*, 10, 1–24.

GRYTTEN, O. H. (2004): "A Consumer Price Index for Norway, 1516–2003," in *Historical Monetary Statistics for Norway 1819–2003*, Oslo: Norges Bank.

——— (2010): "The Economic History of Norway," in *EH.Net Encyclopedia*, ed. by R. Whaples, http://eh.net/encyclopedia/the-economic-history-of-norway/.

Guet, J. (1969): "Les indices du cout de la construction," *Economie et statistique*, 2, 75–79.

Hansen, S. A. and K. E. Svendsen (1968): *Dansk Pengehistorie, 1700–1914*, Copenhagen: Danmarks Nationalbank.

Hausbesitzer-Zeitung für die Rheinprovinz (1922a): "Die zunehmende Ueberfremdung Bayerns," *Hausbesitzer-Zeitung für die Rheinprovinz*, 3.

——— (1922b): "Wie sich Häuser verzinsen," *Hausbesitzer-Zeitung für die Rheinprovinz*, 11.

Heikkonen, E. (1971): *Asuntopalvelukset Suomessa 1860–1965*, Kasvututkimuksia III, Helsinki: Suomen Pankin Taloustieteellisen Tutkimuslaitoksen Julkaisuja.

Hills, S., R. Thomas, and N. Dimsale (2010): "The UK Recession in Context - What Do Three Centuries of Data Tell Us?" *Quarterly Bulletin of the Bank of England*.

Hjerppe, R. (1989): *The Finnish Economy 1860–1985: Growth and Structural Change*, Studies on Finland's economic growth, Helsinki: Bank of Finland.

Holmans, A. (2005): *Historical Statistics of Housing in Britain*, Cambridge: Cambridge Center for Housing and Planning Research.

Homes and Community Agency (2014): "Residential Land Value Data," http://www.homesandcommunities.co.uk/ourwork/residential-land-value-data.

Horstmann, K. (1959): "Neuberechnung von Preismesszahlen für Wohngebäude," *Wirtschaft und Statistik*, 586–.

Housing and Home Finance Agency (1948): *Housing Statistics Handbook*, Washington, D.C.: United States Government Printing Office.

Husbanken (2011): "The History of the Norwegian State Housing Bank," http://www.husbanken.no/english/the-history-of-the-norwegian-state-housing-bank/.

Hyldtoft, O. (1992): "Denmark," in *Housing Strategies in Europe, 1880–1930*, ed. by C. G. Pooley, Leicester: Leicester University Press.

International Monetary Fund (2012): "World Economic Outlook. Series "Inflation, average consumer prices (index)"," http://imf.org/external/pubs/ft/weo/2012/01/weodata/index.aspx.

——— (2015): "IMF eLibrary Data: International Financial Statistics," http://data.imf.org/?sk=7CB6619C-CF87-48DC-9443-2973E161ABEB.

Janssens, P. and P. de Wael (2005): *50 Jaar Belgische Vastgoedmarkt: Waar Geschiedenis Tot Toekomst Vergroeit*, Brussels: Roularta Books.

Johansson, A. (1944): "Byggnadsproduktionens förutsättningar efter ett vapenstillestand. Utredningar angaende ekonomisk eferkrigsplanering," *Statens Offentliga Utredningar*, 1944.

Jones, G. (1933): *Increasing Return, Part II: The London Building Industry*, Cambridge, MA : Cambridge University Press.

Jordà, O., M. Schularick, and A. M. Taylor (2016): "The Great Mortgaging: Housing Finance, Crises, and Business Cycles," *Economic Policy*, 31, 107–152.

Justice, J. (December 18, 1999): "Bricks Are Worth Their Weight in Gold. A Century of House Prices," *The Guardian*.

Koch, G. (1961): "Der geprellte Bausparer: Die Familienheim-Politiker bekommen kalte Füsse," *DIE ZEIT*, 28/1961.

Kristensen, H. (2007): *Housing in Denmark*, Copenhagen: Centre for Housing and Welfare - Realdania Research.

Land Registry (2013): "House Price Index," http://www.landregistry.gov.uk/public/house-prices-and-sales.

Leeman, A. (1955): *De Woningmarkt in Belgie 1890–1950*, Kortrijk: Uitgeverij Jos. Vermaut.

Lescure, M. (1992): "France," in *Housing Strategies in Europe, 1880–1930*, ed. by C. G. Pooley, Leicester: Leicester University Press.

Leväinen, K. I. (1991): *A Calculation Method for a Site Price Index*, Helsinki: The Association of Finnish Cities.

——— (2013): *Kiinteistö- ja Toimitilajohtaminen*, Helsinki: Helsinki University Press.

Leventis, A. (2007): "A Note on the Difference between the OFHEO and S&P/Case-Shiller House Price Indexes," http://www.fhfa.gov/webfiles/670/notediff2.pdf.

Lindert, P. H. (1988): "Long-Run Trends in American Farmland Values," *Agricultural History*, 62, 45–85.

Lloyds Banking Group (2013): "Halifax House Price Index," http://www.lloydsbankinggroup.com/media1/economic_insight/halifax_house_price_index_page.asp.

Lunde, J., A. H. Madsen, and M. L. Laursen (2013): "A Countrywide House Price Index for 152 Years," *mimeo.*

Lyons, R. and A. Wightman (2014): "A Land Value Tax for Northern Ireland," http://www.andywightman.com/docs/NICVA_LVT.pdf.

Mack, A. and E. Martínez-García (2012): "A Cross-Country Quarterly Database of Real House Prices: A Methodological Note," *FRB Dallas Globalization and Monetary Policy Institute Working Paper*, 99.

Magnusson, L. (2000): *An Economic History of Sweden*, London: Routledge.

Maiwald, K. (1954): "An Index of Building Costs in the United Kingdom, 1845–1938," *The Economic History Review*, 7, 187–203.

Manitoba Agriculture, Food and Rural Initiatives (2010): *Manitoba Agriculture Yearbook 2009*, Winnipeg: Manitoba Agriculture, Food and Rural Initiatives.

Matti, W. (1963): "Hamburger Grundeigentumswechsel und Bauland 1903–1907 und 1955–1962," *Hamburg in Zahlen: Monatsschrift des Statistischen Landesamtes der Freien und Hansestadt Hamburg.*

Michel, O. (1927): *Die Preisentwicklung der Basler Wirtschaftsliegenschaften von 1899–1924*, Bern: Staempfli & Cie.

Ministry of Land, Infrastructure, Transport, and Tourism (2009): "Land Price Trends in 2009 as Indicated by the Public Notice of Land Prices (Overview)," http://tochi.mlit.go.jp/english/wp-content/uploads/2013/04/Land_price_public_notice_20094.pdf.

——— (2015): "Construction Cost Deflator," http://www.mlit.go.jp/toukeijouhou/chojou/csg/chapter_5.htm.

Miron, J. R. and F. Clayton (1987): *Housing in Canada 1945–1986: An Overview and Lessons Learned*, Ottawa: Canada Mortgage and Housing Corporation.

Mitchell, B. (2013): "International Historical Statistics, 1750–2010 [Online]," http://www.palgraveconnect.com/pc/doifinder/10.1057/9781137305688.

Möckel, R. (2007): "Bodenwert," in *Lexikon der Immobilienwertermittlung*, ed. by S. Sander and U. Weber, Köln: Bundesanzeiger Verlag, 170–174.

Nagarja, C.H., L. B. and S. Wachter (2014): "Repeat Sales House Price Index Methodology," *Journal of Real Estate Literature*, 22, 23–56.

Nakamura, K. and Y. Saita (2007): "Land Prices and Fundamentals," *Bank of Japan Working Paper Series*, 07-E-08.

Nanjo, T. (2002): "Developments in Land Prices and Bank Lending in Interwar Japan: Effects of the Real Estate Finance Problem on the Banking Industry," *Bank of Japan Monetary and Economic Studies*, 20, 117–142.

National Institute of Statistics and Economic Studies (2012): "Comptes du Logement 2011: Tableaux de Donnees 2011 et Series Chronologiques 1984–2011," http://www.statistiques.developpement-durable.gouv.fr/publications/p/references/comptes-logement-2011-premiers-resultats-2012.html.

Nationwide Building Society (2012): "Nationwide House Price Index," http://www.nationwide.co.uk/hpi/Nationwide_HPI_Methodology.pdf.

——— (2013): "UK House Prices Since 1952," http://www.nationwide.co.uk/hpi/datadownload/data_download.htm.

Needleman, L. (1965): *The Economics of Housing*, London: Staples Press.

Neutze, M. (1972): "The Cost of Housing," *Economic Record*, 48, 357–373.

Nicholas, T. and A. Scherbina (2011): "Real Estate Prices During the Roaring Twenties and the Great Depression," *UC Davis Graduate School of Management Research Paper*, 18-09.

Nielsen, A. (1933): *Dänische Wirtschaftsgeschichte*, Jena: Gustav Fischer.

Norges Eiendomsmeglerforbund (2012): "Boligprisstatistikk," http://www.nef.no/xp/pub/topp/boligprisstatistikk.

OECD (2013): "Table 9B. Balance-sheets for non-financial assets," http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE9B.

——— (2016): "Aggregate National Accounts, SNA 2008 (or SNA 1993): Gross domestic product," http://dx.doi.org/10.1787/data-00001-en.

OECD and European Community (1996): "Sources and Methods: Construction Price Indices," http://www.oecd.org/industry/business-stats/2372435.pdf.

Offer, A. (1981): *Property and Politics 1870–1914: Landownership, Law, Ideology, and Urban Development in England*, Cambridge: Cambridge University Press.

Office for National Statistics (2010): "Land Use Statistics (Generalised Land Use Database)," http://data.gov.uk/dataset/land_use_statistics_generalised_land_use_database.

Officer, L. H. (2007): "What Was the Consumer Price Index Then? A Data Study," http://www.measuringworth.com/docs/cpistudyrev.pdf.

Økonomiministeret (1966): *Inflationens Arsager: Betænkning Afgivet af det Økonomiministeren den 2. juli 1965 Nedsatte Udvalg*, Copenhagen: Statens Trykningskontor.

O'Rourke, K., A. M. Taylor, and J. G. Williamson (1996): "Factor Price Convergence in the Late Nineteenth Century," *International Economic Review*, 37, 499–530.

Østrup, F. (2008): *Finansielle Kriser*, Copenhagen: Thomson.

Piketty, T. and G. Zucman (2014): "Capital Is Back: Wealth-to-Income Ratios in Rich Countries, 1700–2010," *Quarterly Journal of Economics*, 129, 1255–1310.

Pollakowski, H. O. (1995): "Data Sources for Measuring House Price Changes," *Journal of Housing Research*, 6, 377–388.

Pooley, C. G. (1992): "England and Wales," in *Housing Strategies in Europe, 1880–1930*, Leicester: Leicester University Press.

Poterba, J. M. (1991): "House Price Dynamics: The Role of Tax Policy and Demography," *Brookings Papers on Economic Activity*, 2/1991, 143–203.

POULLET, G. (2013): "Real Estate Wealth by Institutional Sector," *NBB Economic Review*, Spring 2013, 79–93.

PRAK, N. AND H. PRIMUS (1992): "The Netherlands," in *Housing Strategies in Europe, 1880–1930*, ed. by C. G. Pooley, Leicester: Leicester University Press.

PRICE, R. (1981): *An Economic History of Modern France, 1830–1914*, London: Macmillan Press Ltd., revised ed.

PROVINCE OF MANITOBA (2012): "Agriculture Statistics," http://www.gov.mb.ca/agriculture/statistics/yearbook/71_value_farmland_bldgs.pdf.

PUGH, C. (1987): "The Political Economy of Housing Policy in Norway," *Scandinavian Housing and Planning Research*, 4, 227–241.

ROTHKEGEL, W. (1920): *Untersuchungen über Bodenpreise, Mietpreise und Bodenverschuldung in einem Vorort von Berlin*, Berlin: Duncker & Humblot.

RYDENFELDT, S. (1981): "The Rise, Fall, and Revival of Swedish Rent Control," in *Rent Control: Myths & Realities*, ed. by W. Block and E. Olsen, Vancouver: The Fraser Institute.

RYMES, T. K. (1967): *Fixed Capital Flows and Stocks, Manufacturing, Methodology, Canada 1926-1960*, Hull: Queen's Printer.

SAARNIO, M. (2006): "Housing Price Statistics at Statistics Finland," Paper presented at the OECD-IMF Workshop on Real Estate Price Indices, Paris, France.

SANDELIN, B. (1977): *Prisutveckling och Kapitalvinster på Bostadsfastigheter*, Gothenburg: University of Gothenburg.

SAVILLE, J. (1949): "The Measurement of Real Cost in the London Building Industry, 1923–1939," *Bulletin of Economic Research*, 1, 67–80.

SCHOLLIERS, P. (1982): "Verschuivingen in het Arbeidersconsumptiepatroon, 1890–1930," *Journal of Belgian History*, 13, 273–312.

SENATE COMMITTEE ON FINANCE (1893): *Report on Wholesale Prices, on Wages, and on Transportation. Senate Report No. 1394, 52d Congress, 2d Session*, vol. 1, Washington, D.C.: United States Government Printing Office.

SHILLER, R. J. (1993): "Measuring Asset Values for Cash Settlement in Derivative Markets: Hedonic Repeated Measures Indices and Perpetual Futures," *Journal of Finance*, 48, 911–931.

——— (2009): *Irrational Excuberance*, New York: Broadway Books, 2nd revised and updated ed.

SILVER, M. (2012): "Why House Price Indexes Differ: Measurement and Analysis," *IMF Working Paper*, 12/125.

SÖDERBERG, J., S. BLÖNDAL, AND R. EDVINSSON (2014): "A Price Index for Residential Property in Stockholm, 1875–2012," in *Historical Monetary and Financial Statistics for Sweden: House Prices, Stock Returns, National Accounts, and the Riksbank Balance Sheet, 1620–2012*, ed. by R. Edvinsson, T. Jacobsen, and D. Waldenström, Stockholm: Ekerlids, vol. 2.

S&P DOW JONES INDICES (2013): "S&P/Case-Shiller Home Price Indices Methodology," http://www.standardandpoors.com/servlet/BlobServer?blobheadername3=MDT-Type&blobcol=urldata&blobtable=MungoBlobs&blobheadervalue2=inline3B+filename3Dmethodology-sp-cs-home-price-indices.pdf&blobheadername2=Content-Disposition&blobheadervalue1=application2Fpdf&blobkey=id&blobheadername1=content-type&blobwhere=1244264149702&blobheadervalue3=UTF-8.

STADIM (2013): "Stadimindexen," http://www.stadim.be/index.php?page=stadimdexen&hl=nl.

STADT ZÜRICH (2012): "Zürcher Index der Wohnbaupreise," https://www.stadt-zuerich.ch/prd/de/index/statistik/preise/wohnbaupreisindex.secure.html.

Stapledon, N. (2007): "Long Term Housing Prices in Australia and Some Economic Perspectives," Ph.D. thesis, University of New South Wales, Sydney.

——— (2012a): "Historical Housing-Related Statistics for Australia 1881–2011 – A Short Note," *UNSW Australian School of Business Research Paper*, 52/2012.

——— (2012b): "Trends and Cycles in Sydney and Melbourne House Prices from 1880 to 2011," *Australian Economic History Review*, 52, 203–217.

Statistical Office of the City of Helsinki (various years): *Helsinki Statistical Yearbook*, Helsinki: Statistical Office of the City of Helsinki.

Statistics Belgium (2013): "Bouw En Industrie - Verkoop Van Onroerende Goederen 1986–2012," http://statbel.fgov.be/nl/modules/publications/statistiques/economie/downloads/bouw_en_industrie_verkoop_onroerende_goederen.jsp.

Statistics Berlin (various years): *Statistisches Jahrbuch der Stadt Berlin*, Berlin: Statistics Berlin.

Statistics Canada (1983): "Historical Statistics of Canada," http://www.statcan.gc.ca/pub/11-516-x/sections/4057757-eng.htm.

——— (2013a): "New Housing Price Index, 2007 Base: Technical Note," http://www23.statcan.gc.ca/imdb-bmdi/document/2310_D1_T2_V4-eng.pdf.

——— (2013b): "Price Indexes of Apartment and Non-Residential Building Construction, by Type of Building and Major Sub-Trade Group," http://www5.statcan.gc.ca/cansim/a47.

——— (2013c): "Table 327-0005 - New Housing Price Indexes, Monthly (Index), CANSIM (database)," http://www5.statcan.gc.ca/cansim/a26.

——— (2014): "Table S60-64: Principal statistics of the construction industry (construction contractors), 1934 to 1976," http://www.statcan.gc.ca/pub/11-516-x/sections/4057757-eng.html.

——— (various years): *Statistical Review*.

Statistics Copenhagen (1937): *Statistisk Maanedsskrift*, vol. 13, Copenhagen: Statistics Copenhagen.

Statistics Denmark (1958): *Landbrugets Priser 1900–1957*, no. 1 in Statistiske Undersogelser, Copenhagen: Statistics Denmark.

——— (2013): "EJEN5: Price Index for Sales of Property (2006=100) by Category of Real Property (Quarter)," www.statbank.dk/EJEN5.

——— (2015): *Documentation of Statistics for Construction Cost Index for Residential Buildings 2015 Quarter 2*, Copenhagen: Statistics Denmark.

——— (various years,a): *Statistical Ten-Year Review*, Statistics Denmark.

——— (various years,b): *Statistical Yearbook*, Statistics Denmark.

Statistics Finland (2001): *Rakennuskustannusindeksi 2000=100: Käyttäjän käsikirja*, no. 42 in Käsikirjoja, Helsinki: Statistics Finland.

——— (2011): "Prices of Dwellings in Housing Companies," http://www.stat.fi/til/ashi/2011/02/ashi_2011_02_2011-07-29_laa_001_en.html2.Methodologicaldescription.

——— (2013): "Real Estate Prices," http://www.stat.fi/til/kihi/index_en.html.

——— (various years): *Statistical Yearbook of Finland*, Helsinki: Statistics Finland.

Statistics France (2015a): "Documentation: Indice du cout de la construction (ICC)," http://www.bdm.insee.fr/bdm2/documentationGroupe.action?codeGroupe=1&page=liste.

——— (2015b): "Indice du cout de la construction des immeubles a usage d'habitation (ICC)," http://www.bdm.insee.fr/bdm2/affichageSeries.action?bouton=OK&idbank=000008630&codeGroupe=1.

Statistics Japan (2012): "Historical Statistics of Japan," http://www.stat.go.jp/english/data/chouki/index.htm.

——— (2013a): "Historical Statistics of Japan: National Accounts," http://www.stat.go.jp/english/data/chouki/03.htm.

——— (2013b): "Japan Statistical Yearbook 2013," http://www.stat.go.jp/english/data/nenkan/index.htm.

Statistics Netherlands (1959): "The Preparation of a National Balance Sheet: Experience in the Netherlands," in *The Measurement of National Wealth*, ed. by R. W. Goldsmith and C. Saunders, Chicago: Quadrangle Books, Income and Wealth Series VIII, 119–146.

——— (2000): "Een nieuw prijsindexcijfer voor de bouwkosten van nieuwe woningen," http://www.cbs.nl/NR/rdonlyres/0DA1AFF8-8D5C-4220-A605-1813B1881918/0/Een_nieuwe_prijsindex.pdf.

——— (2009a): "Landbouwgrond; koop - en pachtprijzen, regio, 1990–2001," http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=37411LLB&D1=a&D2=1-3&D3=0&D4=4,9,14,19,24,29,34,39,44,49,54-55&HD=131202-0917&HDR=T&STB=G1,G2,G3.

——— (2009b): "Methodebeschrijving Outputprijsindexcijfer van Nieuwbouwwoningen," http://www.cbs.nl/NR/rdonlyres/24DC74BD-AD6C-482D-A4D8-902687BF13CE/0/Methodenbeschrijving_PINW2005100.pdf.

——— (2013a): "Historie Bouwnijverheid vanaf 1899," http://statline.cbs.nl.

——— (2013b): "Landbouw en Visserij; 1899–1999," http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=37858&D1=424-425,432-437&D2=a&HD=131202-0920&HDR=T&STB=G1.

——— (2013c): "New Dwellings; Input Price Indices Building Costs," http://statline.cbs.nl/StatWeb/?LA=en.

——— (2013d): "Prijzen Bestaande Koopwoningen," http://www.cbs.nl/nl-NL/menu/themas/prijzen/cijfers/default.htm.

Statistics Norway (1965): *Nasjonalregnskap 1865-1960*, Oslo: Statistisk Sentralbyra.

——— (1979): *Nasjonalregnskap 1962–1978*, Oslo: Statistisk Sentralbyra.

——— (1981): *Nasjonalregnskap 1949–1962*, Oslo: Statistisk Sentralbyra.

——— (2011): "Transfers of Agricultural Properties," https://www.ssb.no/statistikkbanken/selectvarval/Define.asp?subjectcode=&ProductId=&MainTable=Tinglyst9&nvl=&PLanguage=1&nyTmpVar=true&CMSSubjectArea=jord-skog-jakt-og-fiskeri&KortNavnWeb=laeiti&StatVariant=&checked=true.

——— (2013a): "Construction Cost Index for Residential Buildings," https://www.ssb.no/en/priser-og-prisindekser/statistikker/bkibol/.

——— (2013b): "House Price Index," http://www.ssb.no/en/priser-og-prisindekser/statistikker/bpi.

Statistics Sweden (2014a): "Construction Costs 1910–2013," http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Prices-and-Consumption/Building-price-index-and-Construction-cost-index-for-bu/Construction-cost-index-for-buildings-CCI--input-price-index/Aktuell-Pong/12529/72178/.

——— (2014b): "Real Estate Price Index for Agricultural Real Estate (1992=100) by Region. Years 1988–2013," http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START__BO__BO0501__BO0501A/FastpiLantbrukRegAr/?rxid=e0bbbee4-571e-42d8-9575-8e3b5c334cec.

——— (2014c): "Real Estate Price Index for One- or Two-Dwelling Buildings for Permanent Living (1981=100) by Region. Years 1975–2013," http://www.statistikdatabasen.scb.se/pxweb/

en/ssd/START__BO__BO0501__BO0501A/FastpiPSRegAr/?rxid=1b182879-62d6-4d6b-8cbc-42bea3fbfdd9.

——— (2015): "Price Level in Sweden 1830–2014," http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Prices-and-Consumption/Consumer-Price-Index/Consumer-Price-Index-CPI/Aktuell-Pong/33779/Consumer-Price-Index-CPI/33837/.

——— (various years): "Priser på Jordbruksfastigheter," *Statistika meddelanden*, P20.

Statistics Switzerland (2013): "Bodenpreise," http://www.bfs.admin.ch/bfs/portal/de/index/dienstleistungen/history/01/00/05/04.html.

Statistics Zurich (1958): "Der Zürcher Baukostenindex auf neuer Grundlage," *Schweizerische Bauzeitung*, 76, 693–694.

——— (2014): "Zürcher Index der Wohnbaupreise 2014," https://www.stadt-zuerich.ch/prd/de/index/statistik/publikationen-angebote/publikationen/Periodika/Zuercher_Index_der_Wohnbaupreise/ZIW_2014.html.

Stromberg, T. (1992): "Sweden," in *Housing Strategies in Europe, 1880–1930*, ed. by C. G. Pooley, Leicester: Leicester University Press.

Subocz, I. U. (1977): "Housing Price Indices," Master's thesis, University of British Columbia Faculty of Commerce & Business Administration.

Swiss Farmers' Union (various years): *Statistische Erhebungen und Schätzungen über Landwirtschaft und Ernährung*, Brugg: Swiss Farmers' Union.

Swiss Federal Statistical Office (2013): "Stadt Zürich: Handänderungen von Grundstücken nach Art des Kaufs 1899–1990," http://www.bfs.admin.ch/bfs/portal/de/index/infothek/lexikon/lex/2.Document.81325.xls.

Swiss National Bank (2013): "Q4-3 Immobilienpeisindizes - Gesamte Schweiz," *Statistisches Monatsheft*, Juli 2013.

Taylor, A. M. (2002): "A Century of Purchasing-Power Parity," *Review of Economics and Statistics*, 84, 139–150.

Teuteberg, H. J. (1992): "Germany," in *Housing Strategies in Europe, 1880–1930*, ed. by C. G. Pooley, Leicester: Leicester University Press.

The Economist (1912): "Sales Of Land And House Property In 1911," *The Economist*, January 6, 1912.

——— (1914): "Land And House Property In 1913," *The Economist*, January 17, 1914.

——— (1918): "Land And Property In 1917," *The Economist*, January 12, 1918.

——— (1923): "Land And Property In 1922," *The Economist*, January 27, 1923.

——— (1927): "Land And Property In 1926," *The Economist*, January 29, 1927.

The New York Times (April 10, 1923): "Invite Speculation in Berlin Flats: Drop in the Mark Brings Out Something Novel in Enterprises Far Afield." *The New York Times*, 31.

Toyo Keizai Shinposha (1991): *Kanketsu showa kokusei soran*, vol. 2, Tokyo: Toyo Keizai Shinposha.

U.K. Department for Environment Food and Rural Affairs (2011): "Agricultural Land Sales and Prices in England," `http://archive.defra.gov.uk/evidence/statistics/foodfarm/farmgate/agrilandsales/`.

Urquhart, M. (1993): *Gross National Product, Canada, 1870-1926: The Derviation of Estimates*, Kingston and Montreal: McGill-Queen's University Press.

Urquhart, M. and K. Buckley (1965): *Historical Statistics of Canada*, Cambridge: Cambridge University Press.

U.S. Bureau of the Census (1975): *Historical Statistics of the United States: Colonial Times to 1970*, Washington : U.S. Dept. of Commerce, Bureau of the Census.

U.S. Department of Agriculture (2013): "Land Use, Land Value and Tenure," http://www.ers.usda.gov/topics/farm-economy/land-use,-land-value-tenure.aspx.Up4ei2RYQqQ.

Van den Eeckhout, P. (1992): "Belgium," in *Housing Strategies in Europe, 1880–1930*, ed. by C. G. Pooley, Leicester: Leicester University Press, 190–220.

Van der Heijden, J. J., H. Visscher, and F. Meijer (2006): "Development of Dutch Building Control (1982–2003): Towards Certified Building Control," Paper presented at XXIII FIG Congress 2006 in Munich.

Van der Schaar, J. (1987): *Groei en Bloei van het Nederlandse Volkshuisvestingsbeleid*, Delft: Delftse Universitaire Pers.

Van der Wee, H. (1997): "The Economic Challenge Facing Belgium in the 19th and 20th Centuries," in *The Economic Development of Belgium Since 1870*, ed. by H. Van der Wee and J. Blomme, Cheltenhem: Edward Elgar Publishing.

van Leeuwen, B. (2004): "Wage Differentials and Economic Growth in India, Indonesia, and Japan, 1800-2000," http://www.iisg.nl/hpw/globalhistory.php.

Van Zanden, J. L. (1997): *Een klein Land in de 20e eeuw: Economische Geschiedenis van Nederland 1914–1995*, Utrecht: Het Spectrum.

Van Zanden, J. L. and A. van Riel (2000): *Nederland 1780–1914: Staat, instituties en economische ontwikkeling*, Amsterdam: Uitgeverij Balans.

Vandevyvere, W. and A. Zenthöfer (2012): “The Housing Market in the Netherlands,” *European Commission Economic Papers*, 457/2012.

Vorholt, H. (1995): “Zur Neuberechnung der Baupreisindizes auf Basis 1991,” *Wirtschaft und Statistik*, 21–80.

Wagemann, E. (1935): *Konjunkturstatistisches Handbuch 1936*, Berlin: Hanseatische Verlagsanstalt.

Waldenström, D. (forthcoming): “The National Wealth of Sweden 1810–2014,” *Scandinavian Economic History Review*.

Wall Street Journal (April 5, 1927): “German Real Estate Value: Credit Lifting of Official Rent Restrictions and Return to More Normal Conditions,” *Wall Street Journal*, 7.

——— (February 4, 1921): “Investments in Germany Should Be Avoided,” *Wall Street Journal*, 12.

Ward, J. T. (1960): “A Study of Capital and Rent Values of Agricultual Land in England and Wales between 1858 and 1958,” Ph.D. thesis, University of London.

Werczberger, E. (1997): “Home Ownership and Rent Control in Switzerland,” *Housing Studies*, 12, 337—353.

White, E. N. (2009): “Lessons from the Great American Real Estate Boom and Bust of the 1920s,” *NBER Working Paper*, 15573.

Wightman, A. (2010): “A Land Value Tax for Scotland: Fair, Efficient, Sustainable. A Report Prepared By Andy Wightman for the Green MSPs in thr Scottish Parliament,” `http://www.andywightman.com/docs/LVTREPORT.pdf`.

Wilkinson, R. K. and E. M. Sigsworth (1977): “Trends in Property Values and Transactions and Housing Finance in Yorkshire since 1900,” *Social Science Research Council Report*.

Woitek, U. and M. Müller (2012): “Wohlstand, Wachstum und Konjunktur,” in *Wirtschaftsgeschichte der Schweiz im 20. Jahrhundert*, ed. by P. Halbeisen, M. Müller, and B. Veyrassat, Basel: Schwabe Verlag.

WOOD, R. A. (2005): "A Comparison of UK Residential House Price Indices," *BIS Papers*, 21.

WÜEST AND PARTNER (2012): *Immo-Monitoring 2012-1*.

——— (2013): "Asking Price Index Methodology," http://www.wuestundpartner.com/online_services/immobilienindizes/angebotspreisindex/information/index_e.phtml.

WYNGARDEN, H. (1927): "An Index of Local Real Estate Prices," *Michigan Business Studies*, 1.