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No Price Like Home: Global House Prices, 1870–2012[†]

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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 nineteenth to the mid-twentieth century, but rose strongly and with substantial cross-country variation in the second half of the twentieth 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. (*JEL* C43, N10, N90, R31)

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 nineteenth century was around $2,400 (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, Schularick, and Taylor 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

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play a central role for long-run trends in wealth-to-income ratios and the size of the financial sector (Jordà, Schularick, and Taylor 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 nineteenth 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 nineteenth to the mid-twentieth 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 twentieth 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 shortly after World War II, and in 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 nineteenth to the

mid-twentieth 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 twentieth century (Glaeser and Ward 2009; Case 2007; Davis and Heathcote 2007; Gyourko, Mayer, and Sinai 2013). 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, Blank, and Winnick 1956). Through agglomeration spillovers, rising land prices may also have positive effects on economic growth (Davis, Fisher, and Whited 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 twentieth 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 twentieth 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: Section I describes the data sources and the challenges involved in constructing long-run house price indices. Section II distills new stylized facts from the long-run data: real house prices have risen in advanced economies, albeit with considerable cross-country heterogeneity, and virtually all of the increase occurred in the second half of the twentieth century. These observations are robust to a number of additional checks relating to quality adjustments and sample composition. In Section III, 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 Section IV, we discuss the economic implications of our results. The final section concludes and outlines avenues for further research.

I. 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 nineteenth 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 and Switzerland), the 1890s (the United Kingdom and the United States), and the 1870s (Australia, Belgium, Denmark, France, Germany, the Netherlands, Norway, and Sweden).

Building such a comprehensive dataset required locating and compiling data from a wide range of scattered primary sources, as detailed below and in the online Appendix.

A. *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.

First, house price indices may either be national or cover several cities or regions (Silver 2014). 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, Muth, and Nourse 1963). In online 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.

B. *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 nineteenth 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 of 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 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 1997) 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 Statistics Department (1966).

We also drew upon unpublished data from tax authorities such as the UK 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 online 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.

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

A. *A Global House Price Index*

The arithmetic mean and the median of the 14 house price series are displayed in panel A of Figure 2. One recognizes that CPI-adjusted house prices stayed within a relatively tight range from the late nineteenth to the second half of the twentieth 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.

The relation between house prices and GDP per capita over the past 140 years exhibits a similar hockey-stick pattern. Panel B of Figure 2 shows that house prices remained, by and large, stable before World War I despite rising per capita incomes.

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

[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 online Appendix A.5).

TABLE 1—OVERVIEW OF HOUSE PRICE INDICES

Country	Years	Coverage	Property vintage and 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 (including 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
	1930–1935	Rural	Land only	Average price
	1936–1955	Urban	Land only	Average price
	1955–2012	Urban	Land only	Average price
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 and existing dwellings	SPAR
	1957–2012	Urban	New and 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
	1953–1965	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

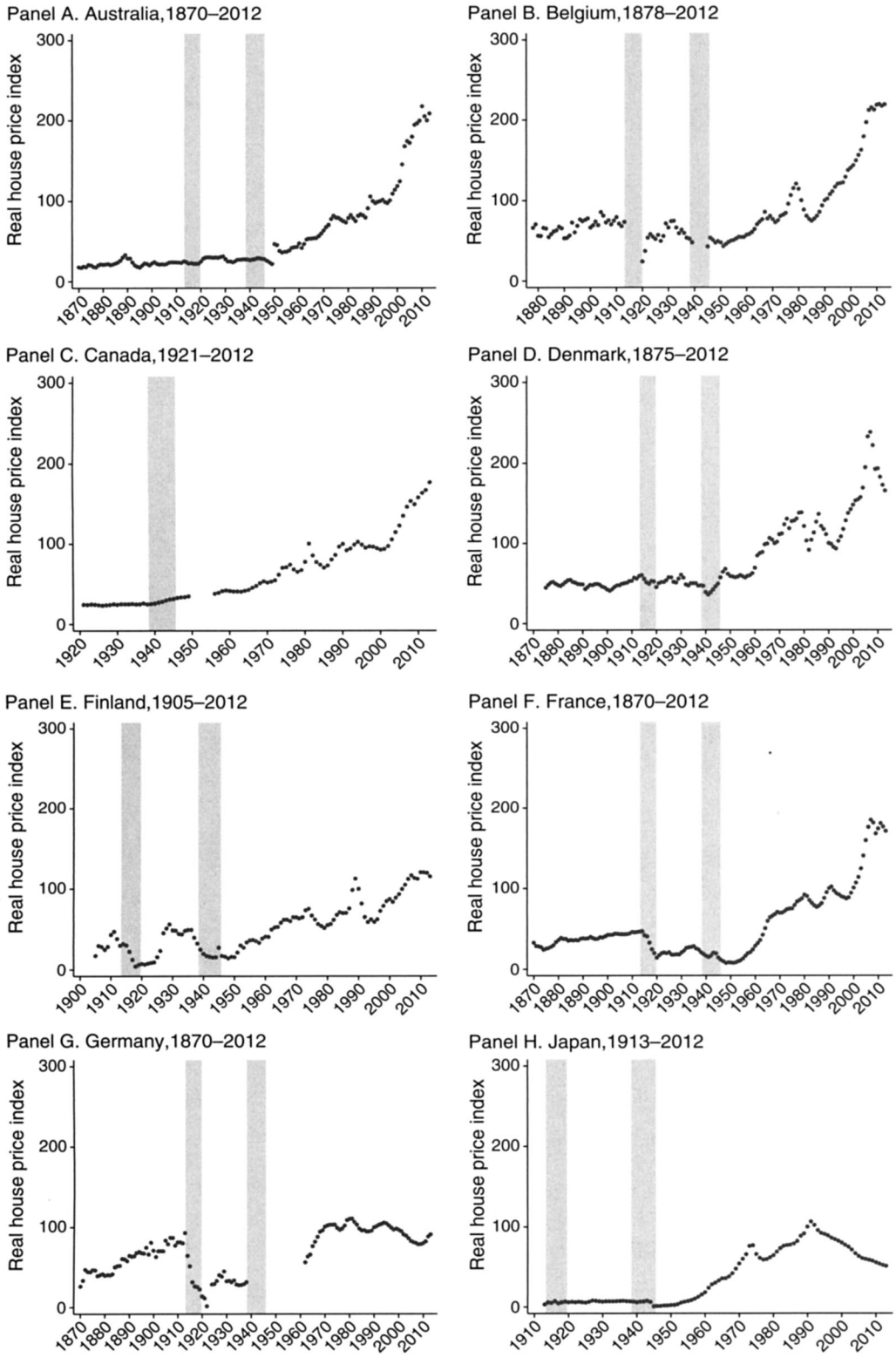

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FIGURE 1. HISTORICAL HOUSE PRICES, 14 COUNTRIES

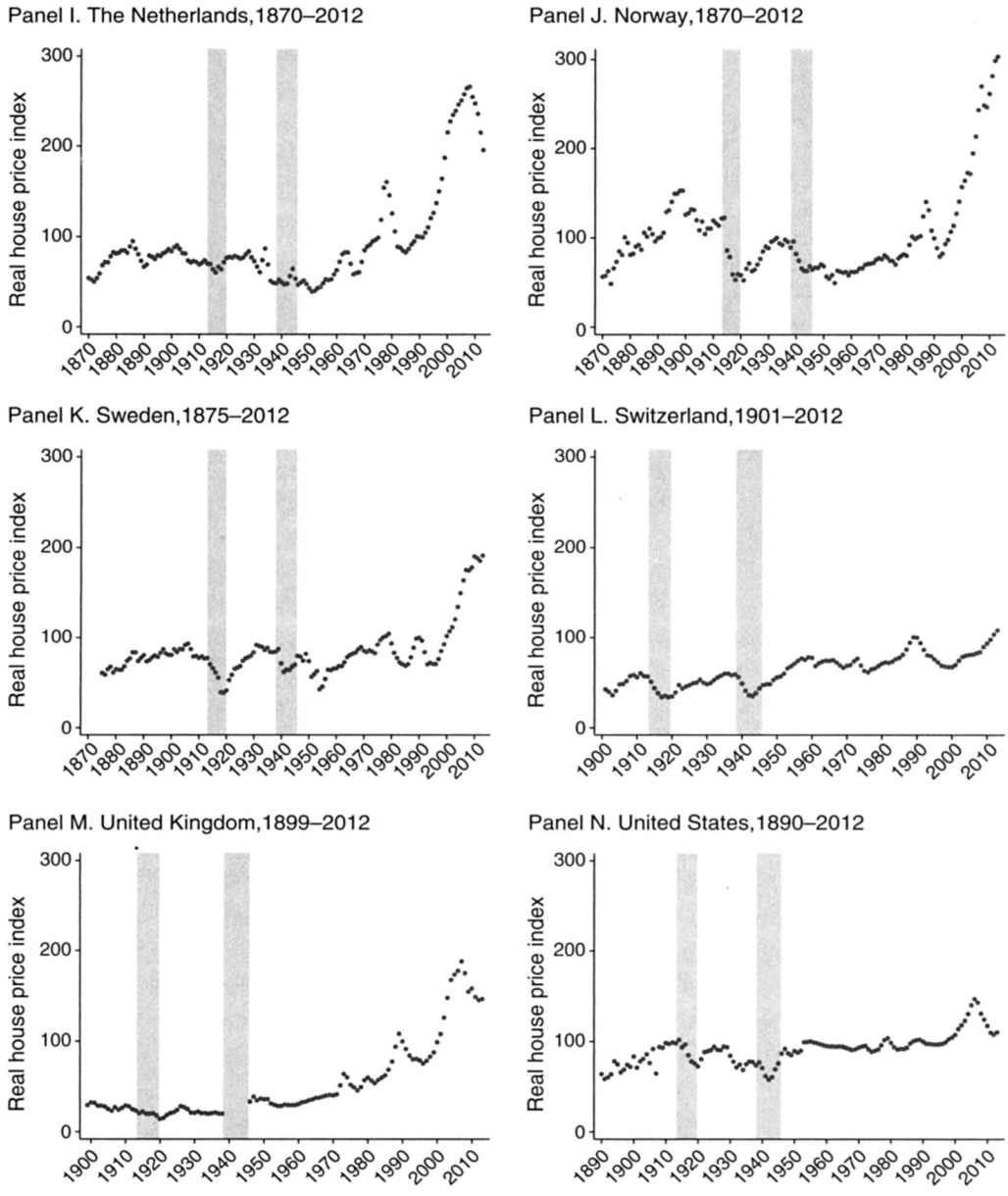

FIGURE 1. HISTORICAL HOUSE PRICES, 14 COUNTRIES (*Continued*)

In the final decades of the twentieth century, house price growth outpaced income growth by a substantial margin.

Table 4 in online Appendix A.5 puts numbers on these phenomena. It shows average annual growth rates of house prices for all countries and for two subperiods. 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.

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 online

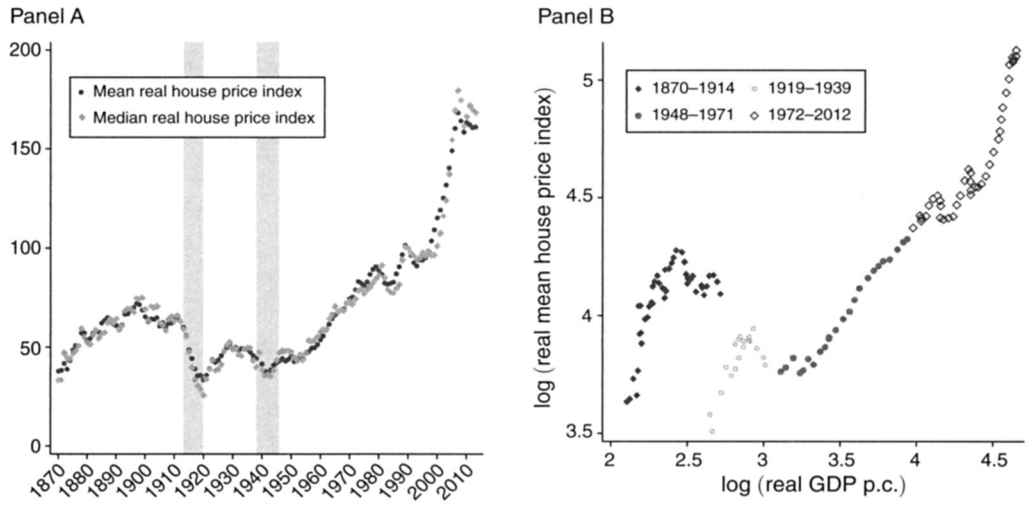

FIGURE 2. AGGREGATE TRENDS

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

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. US house prices have increased at an annual rate of a little less than 1 percent since the 1890s; both the United Kingdom 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 twentieth 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 twentieth century, but the exact year when the heel of the hockey stick is reached differs from country to country (see Table 3 in online Appendix A.2). In 8 out of 14 countries, the structural break most likely took place in the 1960s and 1970s. In the United States 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] 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 online 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.

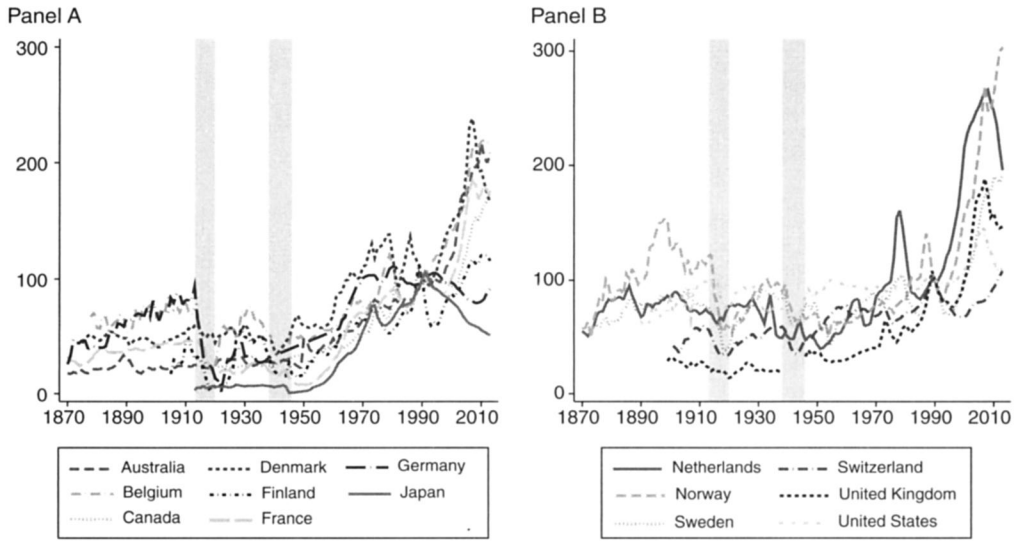

FIGURE 3. HETEROGENEITY

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

B. *Robustness Checks*

Now that we have explored the long-run path of global house prices, we subject it to additional robustness and consistency checks. 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.

Subsamples.—It is conceivable that small and land-poor European countries have a disproportionate influence on the aggregate trends outlined above. We calculated population and GDP weighted indices (online 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 United States, Japan, and Germany. Yet over the past 140 years, the overall trajectory is comparable. Data coverage starts at different dates for different countries. Online 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 twentieth 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

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

destruction on their own territory and countries that did not (i.e., Australia, Canada, Denmark, and the United States).

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 twentieth 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* 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.

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 of 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

[5] The speed of the quality improvement varies over time and across countries. Davis and Heathcote (2007) estimate for the United States 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 1979–1980 and 2002–2003. Stapledon (2007) arrives at similar conclusions. For the United Kingdom, 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 US homes already had running water, 79 percent electric lighting, and 42 percent central heating (Brunsman and Lowery 1943).

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

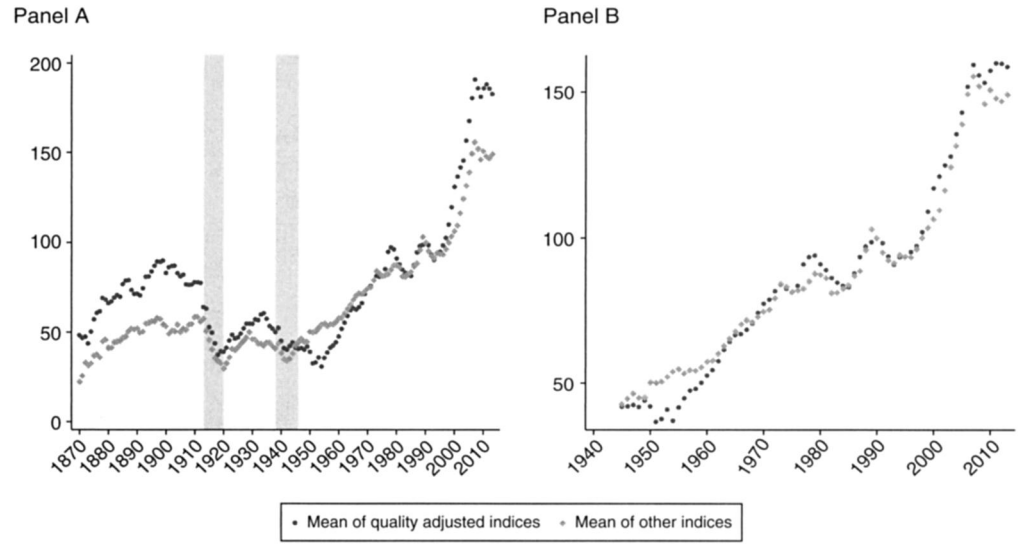

FIGURE 4. QUALITY ADJUSTMENTS

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: France, Japan, Netherlands, Norway, Sweden (panel A); France, Germany, Japan, Netherlands, Norway, Sweden, Switzerland (panel B).

take into account that accurate measurement of quality-adjustments remains a challenge.

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, Department of Economic and Social Affairs, Population Division 2015; US Bureau of the Census 1975). The United Kingdom is the only exception as the country was already highly urbanized at the beginning of the twentieth century.

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. Panel A 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 nonurban prices. Compositional shifts are not responsible for the patterns that we observe.

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, Gottlieb, and Tobio 2012; Glaeser, Kolko, and Saiz 2001). It is

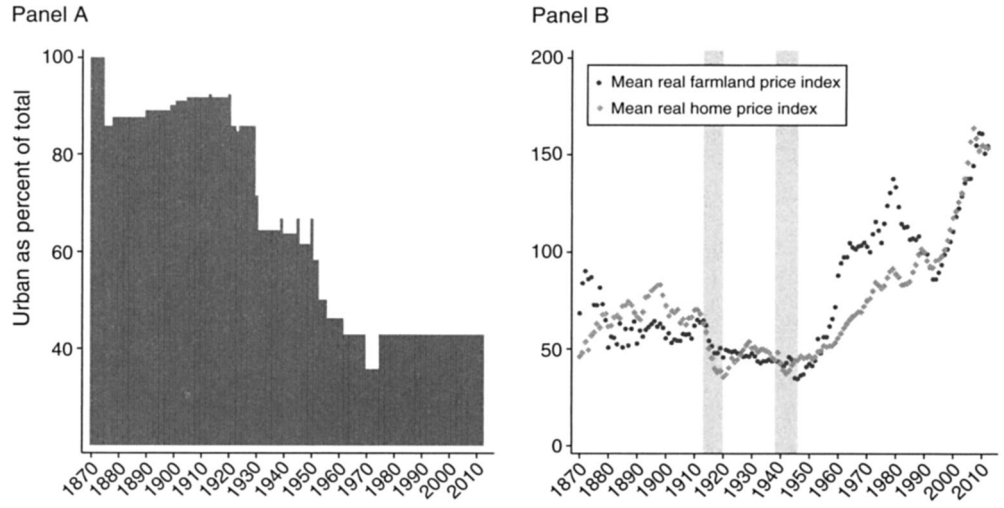

FIGURE 5. COMPOSITION EFFECTS

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

essential, therefore, to separately examine the evidence we have on price trends in rural vis-à-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 nonurban 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] Panel B of Figure 5 plots mean farmland prices for 11 countries against the average house price index for the same eleven-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 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 subsample of five countries for the post-1970 period: Finland, Germany, Norway, the United Kingdom, and the United States.[10] Figure 6 shows that both rural and urban house prices trended strongly upward in recent decades. While the increase in house prices has been most pronounced in cities, it is not exclusively an urban phenomenon.

[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, Denmark, Finland, Germany, Japan, the Netherlands, Norway, Switzerland, the United Kingdom, and the United States. See online Appendix B for sources and description.

[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.

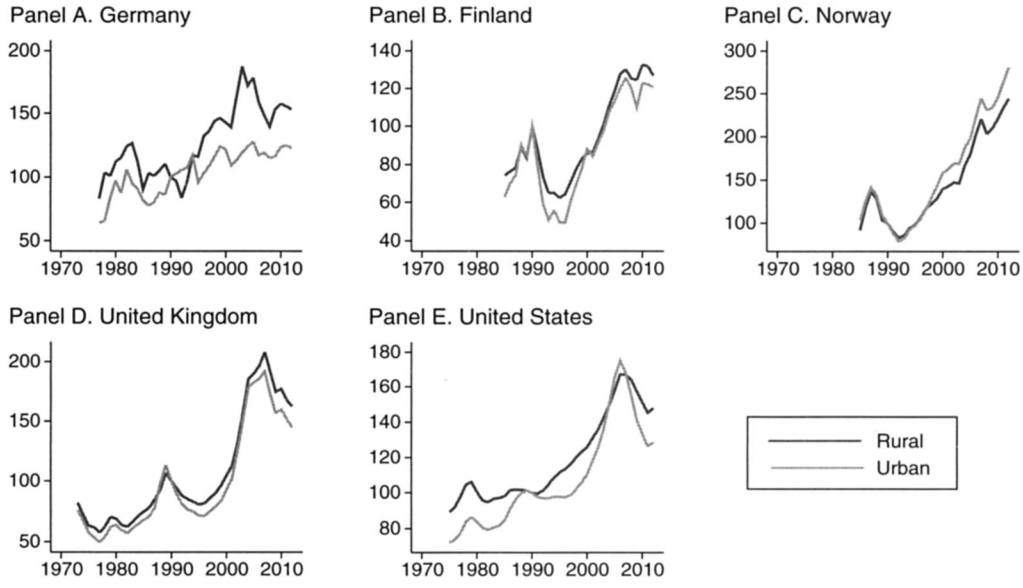

FIGURE 6. URBAN AND RURAL HOUSE PRICES SINCE THE 1970S, FIVE COUNTRIES

Notes: Index, 1990 = 100. Data for Germany 1977–2012, Finland 1985–2012, Norway 1985–2010, United Kingdom 1973–1999, United States 1975–2000.

III. Decomposing Long-Run House Prices

What accounts for the surge of house prices in the second half of the twentieth century? As a house is a bundle of the structure and the underlying land, a 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 online 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. The production of houses requires combining land Z_t and residential structures X_t according to a Cobb-Douglas technology $F(Z_t, X_t) = (Z_t)^{\alpha}(X_t)^{1-\alpha}$, 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

[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.

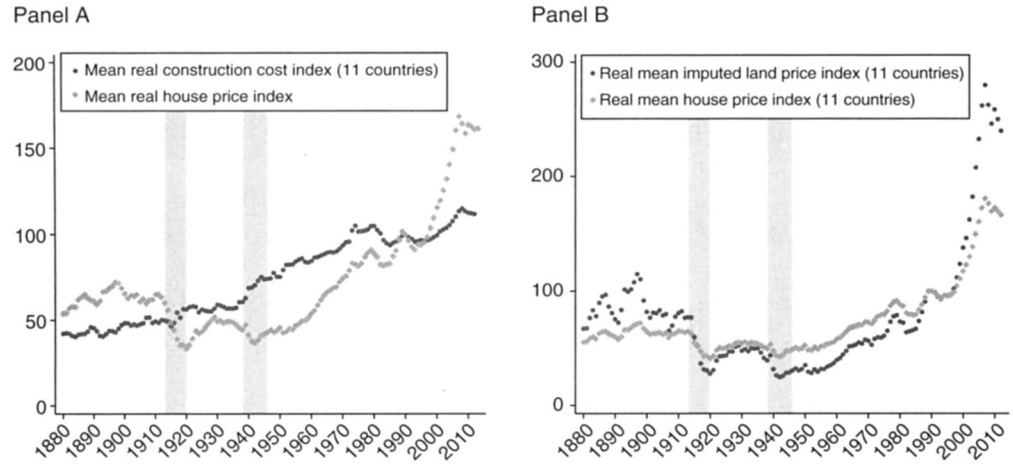

FIGURE 7. DECOMPOSITION: LAND PRICES AND CONSTRUCTION COSTS

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

how the house price depends on the price of land and on construction costs. The implied growth rate of house prices reads

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

and the imputed land price can be traced out by employing

$$\frac{p^Z_{t+1}}{p^Z_t} = \left(\frac{p^H_{t+1}}{p^H_t}\right)^{\frac{1}{\alpha}} \left(\frac{p^X_{t+1}}{p^X_t}\right)^{\frac{\alpha-1}{\alpha}}. \tag{2}$$

With information on house prices and construction costs, equation (2) can be applied to impute the price of residential land. The decomposition therefore allows us to identify the relative importance of construction costs and land prices as drivers of long-run house prices.[12]

A. *Construction Costs*

Panel A 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

[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 online 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 online Appendix A.5 plots historical construction costs for each country. Online Appendix B.1 describes the data sources and discusses the methodological challenges involved in constructing long-run construction cost series.

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 United States, 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 twentieth century.

B. *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 post-World War II era: Australia, Belgium, Japan, the United Kingdom, Switzerland, and the United States—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 online Appendix A.5 and show a substantial increase of residential land prices in the last decades of the twentieth 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 online Appendix A.4 demonstrates that our results are robust to changing α within reasonable limits.[15]

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

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

[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 United Kingdom, and the United States (see online 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.

[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.

[16] Figure 13 in online 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 online Appendix.

[17] Since our aim is to compare empirical and imputed data, we are forced to exclude the residential land price series for the United States (online Appendix Figure 16), which itself was imputed in a similar exercise by Davis

TABLE 2—SHARE OF LAND IN TOTAL HOUSING VALUE

	Australia	Canada	France	Germany	Japan	Netherlands	United Kingdom	United States
1880			0.25	0.13				
1890					0.40			
1900	0.54			0.18	0.40			0.21
1913–1914	0.43		0.30	0.20	0.43			0.20
1920								0.20
1930	0.40		0.30	0.17	0.52		0.23	0.20
1940				0.17	0.46		0.19	0.20
1950	0.49		0.32	0.17	0.65	0.15	0.17	0.13
1960	0.40		0.30	0.17	0.85		0.12	0.13
1970		0.48	0.30	0.25	0.86		0.15	0.19
1980	0.40	0.52	0.41		0.81		0.11	0.27
1990	0.62	0.47	0.42	0.36	0.90			0.40
2000	0.63	0.49	0.39	0.32	0.81	0.57		0.36
2010	0.71	0.53	0.59	0.37	0.77	0.53	0.54	0.38

Note: Dates are approximate.

Source: See online Appendix B.

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.

C. *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 twentieth 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 twentieth and early twenty-first 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 a factor of $\frac{p^Z_{2012}}{p^Z_{1950}} = 7.5$, while construction costs exhibited factor growth of $\frac{p^X_{2012}}{p^X_{1950}} = 1.5$. The share of house price growth that can be attributed to land price growth may therefore

and Heathcote (2007). We also exclude Japan as the Japanese house price index captures the price change of urban residential land plots (see online Appendix B). For Switzerland, we rely on an alternative house price series covering house prices in Zurich so as to be able to compare imputed and empirical land prices in Zurich (for details see online Appendix B.13).

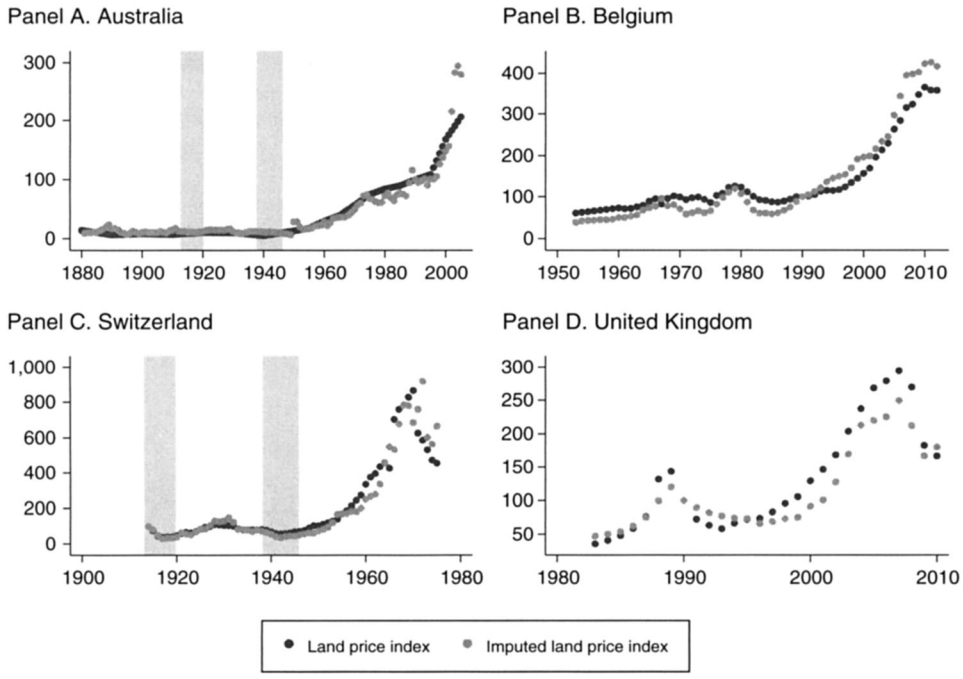

FIGURE 8. IMPUTED LAND PRICES: INDIVIDUAL COUNTRIES

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.

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 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 (United Kingdom) 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 United States, 90 percent for Australia, 92 percent for Norway, 93 percent for France, and 95 percent for Canada.

[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 $\alpha\frac{\ln\left(\frac{P^L_{2012}}{P^L_{1950}}\right)}{\ln\left(\frac{P^H_{2012}}{P^H_{1950}}\right)} + (1-\alpha)\frac{\ln\left(\frac{P^X_{2012}}{P^X_{1950}}\right)}{\ln\left(\frac{P^H_{2012}}{P^H_{1950}}\right)} = 1.$

IV. 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-twentieth century and have risen strongly in the last decades of the twentieth century. Second, the late twentieth 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 twentieth 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 1881; 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, Blank, and Winnick 1956). Davis, Ortalo-Magné, and Rupert (2007) as well as Davis and Heathcote (2007) have already taken issue with the data underlying this view and show that US 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 twentieth 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 twentieth 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 flat-lined 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.

[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).

Our findings suggest that higher land prices likely played a critical role for the increase of housing wealth in the late twentieth 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 twentieth 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 UK Office of National Statistics, Statistics Netherlands (CBS), and Statistics Bureau, Ministry of Internal Affairs and Communications (2013). The resulting trends are displayed in Table 2. The data show a substantial increase of the land component in total housing wealth. In the United States, the land share in the total value of housing roughly doubled over the course of the twentieth 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 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, Fisher, and Whited (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 spillovers. The empirical analysis in Davis, Fisher, and Whited (2014) suggests that in the United States' 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, Wang, and Zha (2013) further demonstrates real effects of land price changes at the business cycle frequency.

[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).

[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 nineteenth 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 twenty-first century, we may be more concerned with the price of residential land, but the underlying mechanism remains the same.

V. 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-twentieth century, real house prices rose strongly during the second half of the twentieth 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 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.

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