Article

Urban Studies

Urban Studies
2018, Vol. 55(16) 3669–3688

DOI: 10.1177/0042098018757414
journals.sagepub.com/home/usj
SAGE

Urban heritages: How history and housing finance matter to housing form and homeownership rates

Timothy Blackwell
University of Sussex, UK

MPIfG Journal Article
Timothy Blackwell, Sebastian Kohl: Urban Heritages: How History and Housing Finance Matter to Housing Form and Homeownership Rates. In: Urban Studies 55(16), 3669-3688 (2018). Sage Publications
The original publication is available at the publisher's web site: https://doi.org/10.1177/0042098018757414
The MPIfG Journal Articles series features articles by MPIfG researchers and visiting scholars published in peer-reviewed journals.
Max Planck Institute for the Study of Societies (MPIfG) Cologne | www.mpifg.de

Sebastian Kohl
Max Planck Institute for the Study of Societies, Germany; Uppsala University, Sociology, Institute for Housing and Urban Research

Abstract

Contemporary Western cities are not uniform, but display a variety of different housing forms and tenures, both between and within countries. We distinguish three general city types in this paper: low-rise, single-family dwelling cities where owner-occupation is the most prevalent tenure form; multi-dwelling building cities where tenants comprise the majority; and multi-dwelling building cities where owner-occupation is the principal tenure form. We argue that historical developments beginning in the 19th century are crucial to understanding this diversity in urban form and tenure composition across Western cities. Our path-dependent argument is twofold. First, we claim that different housing finance institutions engendered different forms of urban development during the late 19th century and had helped to establish the difference between single-family dwelling cities and multi-dwelling building cities by 1914. Second, rather than stemming from countries' welfare systems or 'variety of capitalism', we argue that these historical distinctions have a significant and enduring impact on today's urban housing forms and tenures. Our argument is supported by a unique collection of data of 1095 historical cities across 27 countries.

Keywords

built environment, finance/financialisation, history/heritage, housing, housing finance, urban history

摘要

当代西方城市并不统一，不同国家之间和同一国家内部有着各种不同的住房形式和住房使用形式。本文区分了三种普遍的城市类型：低层单户住宅城市，其中业主自住是最普遍的使用形式；租户占主体的多户住宅城市；以业主自住为主要使用形式的多户住宅城市。我们认为，从 19 世纪开始的历史发展对于理解西方城市形态和使用形式构成的多样性至关重要。我们的路径依赖论点是双重的。首先，我们指出，不同的住房金融机构在 19 世纪末期产生了不同形式的城市开发，并在 1914 年之前促成了单户住宅城市和多住宅城市之间的差异。其次，我们指出，这些历史差异并非源于各国的福利制度或“资本主义多样性”，恰恰相反，它们对当今的城市住房形式和使用权产生了显著而持久的影响。我们的观点得到了 27 个国家 1,095 个历史城市的独特数据支持。

关键词

建成环境、金融/金融化、历史/遗产、住房、住房金融、城市史

Received April 2017; accepted January 2018

Introduction

This paper interrogates a series of simple, related questions: why do urban housing systems differ so markedly both between and within Western countries? Why have some cities historically sprawled as they developed with low-rise, single-family dwellings, as in much of North America, whilst others have taken the form of compact urban agglomerations comprised of multi-dwelling buildings, as in much of mainland Europe? Why are some cities populated predominantly by homeowners whilst, in others, tenants comprise the majority? The significance and relevance of these questions goes beyond mere theoretical intrigue. Indeed, the types of housing and residential urban forms a city exhibits have been shown to have considerable consequences for the modes of transport its citizens use, air quality (Newman and Kenworthy, 1989), electoral geography and unemployment rates (Blanchflower and Oswald, 2013). While geographers have conducted much cross-sectional work on city typologies, less work has been done on understanding where these different urban housing systems derive from historically. This paper aims to address this oversight.

We believe that the answers to the above questions are to be found, in part, in countries' historical urban development and, more specifically, in the role, and form, housing finance institutions played therein. Building on a novel and comprehensive database relating to nearly 1095 cities in 27 countries around 1910, we claim, first, that the development of organised systems of mortgage intermediation which emerged during the *long 19th century* is associated with either single-dwelling building cities with considerable suburbanisation, or more concentrated, multi-dwelling building cities. We claim that informal and deposit-based mortgage finance systems tended to produce the former because they offered more localised and democratised modes of finance with mortgages in smaller tranches (and with generous loan-to-value ratios), whereas more centralised and financially integrated bond-based urban housing finance systems tended to produce the latter city type. Whilst our story concerns the formation of modern Western cities during the large urbanisation waves of the late 19th and early 20th centuries, our second claim is that these historically couched differences in urban form also bear influence on today's Western cities, with certain caveats regarding *path-breaking cities*. Our argument, in essence, is that housing finance played an important conditioning and differentiating role in the developmental trajectories of Western cities during the late 19th century and that these legacies are still visible in the heterogeneous residential urban forms and tenure composition that Western cities display today.

The paper makes a contribution to the growing body of literature on *historical persistence* (Nunn, 2014) and *path dependence* which has recently also been applied to urban and housing system development (Bengtsson and Ruonavaara, 2010; Meen et al., 2016). What unites these works and ours is the conviction that the period of urbanisation during the late 19th and early 20th centuries represents a *critical juncture* for many Western cities. This was a formative period in which the historically differentiated systems of housing and finance

Corresponding author:
Sebastian Kohl, Max Planck Institute for the Study of Societies, Paulstr. 3, Köln, 50676, Germany.
Email: kohl@mpifg.de

provision in different countries, regions and cities throughout the West, left enduring institutional legacies which can go some way in helping to account for cross-national and cross-regional differences in urban form and tenure composition to this day.

The paper also enriches cross-sectional studies of international or intranational variation with regard to homeownership and housing structures (Lauridsen et al., 2009; Lerbs and Oberst, 2012) in order to demonstrate the importance of historical lineages vis-à-vis housing and the built environment. Bo Bengtsson and Hannu Ruonavaara (2010: 193) note that, 'A housing stock produced during several decades, sometimes hundreds of years, of building activity creates a powerful historical heritage,' yet, while the cross-sectional studies identify socio-economic, demographic, transportation or political factors in order to explain higher rates of homeownership, prices, or the incidence of single-family dwellings, they often neglect the long-term impact of urban developments which are beyond the purview of one generation's influence.

Finally, we contribute to the understanding of comparative housing system analysis by disaggregating the almost exclusively national comparisons, which so often gloss over considerable intra-country heterogeneity. By including cities in our multi-level analysis, we move closer to the markets in which housing is financed, produced and consumed, whilst not losing sight of macro- and socio-economic conditions. Our analysis reveals that, contrary to widely held scholarly belief, residential urban form and tenure composition are linked not so much to countries' respective welfare systems or varieties of capitalism (Hoekstra, 2005; Kemeny, 1981), but more to intricacies that lie in urban history and housing finance system development.

The paper is structured as follows. The first section engages with urban and housing studies literature, whilst the second section interrogates how and why, during the major urbanisation waves between 1850 and 1914, Western cities developed so differently. In order to explain this heterogeneity, housing finance institutions are presented as the central differentiating variable. The last section analyses the *heritages* of these city and financial structures by showing that pre-1914 urban housing densities still have an impact on contemporary urban residential housing form and tenure composition in Western cities.

Literature

The focus, scope and disciplinary orientation of mainstream comparative housing research differ markedly, as one might expect. Nevertheless, whether exploring national differences in policy frameworks and the impacts of these on relative levels of homeownership (Kemeny, 1995), on the one hand, or analysing house prices and rents over time (Jordà et al., 2017) on the other, what unites these studies is the fact that their *foci* are typically at the *national level*; which, as our analysis shows later, can be problematic.

The most renowned comparative housing research groups countries into different typologies, such as those with comprehensive or residual housing policies (Donnison and Ungerson, 1982), those with unitary or dualist rental regimes (Kemeny, 1981), those with certain types of welfare state regime and building types (Hoekstra, 2005), or those based on the variations in homeownership and levels of aggregate mortgage indebtedness (Schwartz and Seabrooke, 2008). The most influential of these (Kemeny's) links rental market regimes and relative levels of homeownership to welfare state composition. Whilst the causality is not always explicit in Kemeny's analyses, he argues that, '… if countries that still today enjoy a

functioning integrated [unitary] rental market and have low rates of homeownership begin to experience major declines in welfare … we can expect them to begin to transform into monotenural [sic] home owning societies' (Kemeny, 2005). However, given the manifest internal country heterogeneity, and the locally fixed nature of housing, such methodological nationalism inherent in the aforementioned scholarly contributions is problematic if it cannot determine how much of the internationally observed variance is really due to national, and not local, housing differences.

In more geographically and econometrically leaning literature, differences in housing and the built environment are much more likely to be explained at the level of contemporary *regions* or *cities*, mostly by using a set of cities within countries and adding a range of socio-demographic and economic variables into a (spatial) regression in order to account for observed variation. These studies have found homeownership to be higher in more urbanised settings, with older populations, better price-to-rent ratios, older building stock, higher average incomes and household size, better credit access conditions, higher Catholic populations, and higher unemployment rates (Lauridsen et al., 2009; Lerbs and Oberst, 2012). Even though many of these studies produce high values of explained variance, an evident shortcoming with such approaches is the static cross-sectional nature of enquiry, which is applied to objects that have, often, over a century-long history. Urban and regional systems, as well as housing, both across and within certain cities, have been shown to follow strongly path-dependent developmental trajectories (Kohl, 2016; Meen et al., 2016); the methodological application of static cross-sectional comparisons, then, can only reveal so much. Such studies, therefore, neglect an important dimension: *urban history*.

In historical geography and urban sociology it is common to distinguish different city types, often with regional scopes, that are characterised by clusters of features. This tradition reaches back to Max Weber and Numa Denis Fustel de Coulanges, who both juxtaposed the Western city with its historical tradition of bourgeois self-government, to the more administered cities of the Oriental and Asian Empires. Since these insights, the European – or Western European – city has been characterised by a multitude of specific features such as the dominance of the city centre, public transport, self-government and strong municipal autonomy (White, 1984). In the sphere of housing and the built environment, European cities have generally been characterised by their high tenant populations – both private and social – and by the predominance of multi-dwelling buildings; in contrast to the cities populated by homeowners and built in single-family dwelling form throughout much of North and Latin America.

The phenomenon of tenant inhabited multi-dwelling buildings is not novel, but can be traced back to antiquity (Mumford, 1979). As population growth accelerated rapidly in Europe during the 18th, 19th and 20th centuries, many continental cities expanded in the form of multi-dwelling rental buildings. This peculiar form of continental European city was also exported into colonies, where port cities were often segregated into European-style higher-rise areas of solid building materials and a low-rise native part. Traditionally, in the Chinese, Japanese, Islamic, Russian, Balkan and Latin American city, low-rise constructions of single-family dwellings – not uncommonly owner-occupied – were the predominant form of dwelling arrangement (Pinol and Walter, 2003).

Studies which focus on the typological features of cities often do so very

descriptively; rarely do they *explain* where different city types come from to begin with. Moreover, they tend to neglect a crucial factor behind city expansion in general, and the multi-dwelling building form in particular: the considerable capital resource mobilisation needed to undertake such enterprises. Whilst, in earlier times, state or religious institutions with networks of private bankers backed the erection of high-rise buildings and city expansion, 19th-century city expansions were, to greater or lesser degrees, organised and financed by private, non-state actors. This, we argue, is when differentiated systems of urban housing finance provision really began to matter for urban form in the West.

More contemporary literature has emphasised the impact of contemporary financial formations on cities and housing patterns, including contributions to this journal (Stephens, 2003). There are also accounts of *form following finance* where the emergence and proliferation of capital-intensive skyscrapers were often preceded by innovations in finance (Willis, 1995). Skyscrapers have even become tools for predicting financial stock-market returns (Löffler, 2013) and macroeconomic forecasting. Mian and Sufi (2016) have demonstrated that the zip-code areas where subprime mortgage lending proliferated most prior to 2007, were the same areas which experienced higher incidences of foreclosure and greater house price depreciation during the ensuing Great Recession. What these works demonstrate is how finance's incessant profit-seeking, and ostensive risk aversion to the impacts of falling prices, have all helped to shape the very development of our cities, both historically and contemporarily.

The link between housing finance institution type and housing form and tenure is central to our analysis below. In order to understand why Western cities exhibit such diversity in terms of housing form and tenure composition, we have a rich body of literature that is country-comparative in the case of housing studies, or subnational and cross-sectional in the case of urban socio-economic and urban geography scholarship. In relation to the latter, this research often provides broadly descriptive historical narratives, with little explanatory power to account for the variety of outcomes brought about by the process of industrial urbanisation. We now attempt to draw inspiration from each of these strands of literature by showing how the *historical housing finance* tradition in countries and regions has produced historically different *city types*. To support this analysis we use data for 1095 cities nested within 27 *countries* around 1910 to show how differences which emerged during the course of the 19th and early 20th centuries left *path-dependent* legacies which still bear influence on the differential building form and tenure composition in Western cities today.

Historical urban building form and housing finance

In a previous study, the authors (Blackwell and Kohl, 2018) have suggested a historically informed typology of different housing finance systems, which we superficially noted appear to correlate with specific types of housing system. Our study notes that, while Anglo-Saxon and North-western European countries tended to develop mortgage institutions reliant on the collection of deposits (*deposit-based*) in order to originate mortgages (such as building societies, savings and loans associations or savings banks) during their rural–urban transitions, central and Northern European countries developed bond emitting (*bond-based*) urban mortgage banks (functionally adapted from the earlier agrarian mortgage banks) to fund their urban expansions, with varying degrees of

state assistance. The housing finance systems in Southern Europe, as in developing countries today, were more characterised by a prevalence of informal networks of lending, outside of institutionalised banking circuits, but as the 20th century wore on these countries too tended to develop predominantly deposit-based housing finance systems in order to fund their urban expansions.

As this study was more concerned with the origins of housing finance systems and how housing finance system heterogeneity can be historically accounted for with reference to *capital mobilisation* imperatives, we left the possibility that differences in housing finance composition could have a bearing on urban housing form empirically unchecked. Our core contention in this paper is that the constitution of housing finance, and how it is intermediated, matters to housing form, and our aim is to investigate this association empirically. Based on historical evidence for each country (see Appendix 3 for country-specific sources), we propose that the *deposit-based* and informal housing finance systems were more likely to construct single-family dwelling cities, more conducive to owner-occupation, whilst the *bond-based* housing finance systems tended to produce compact cities of multi-dwelling buildings, occupied by tenants.

The mechanism behind these linkages between, on the one hand, bond-based mortgage finance and multi-dwelling building construction and, on the other, deposit-based housing finance institutions and single-dwelling building erection is twofold. First, bond-based mortgage banks were able to tap into large reserves of capital by selling bonds on capital markets, and benefit from *economies of scale* when originating the larger mortgages necessitated by larger multi-dwelling building projects. This contrasted with the smaller and localised branch networks of the mutual building societies and savings banks which, whilst increasingly less localised as the 20th century wore on, still relied on members' deposits in order to originate mortgages (i.e. borrowing short-term in the form of deposits in order to be able to originate mortgages over the longer-term). These deposit-based institutions also tended to have generous loan-to-value (LTV) ratios when compared with the larger institutional bond-emitting mortgage originators, which made this form of institutional lending more conducive to prospective owner occupiers (Rodger, 2001: 272).

Second, the bond-based mortgage banks (mainly situated in central cities) were confronted with information asymmetries in contrast to the more established informal or mutualist/savings-banks branch networks that were more locally embedded. Mortgage banks, thus, preferred collateral that was easier to monitor, was more standardised, and was capable of generating stable rental income.

By the First World War, cities throughout the industrialising world had subsumed considerable waves of rural migrants and had developed much of the institutional apparatus for maintaining urban transport networks, waterworks, sewage systems, and electricity and gas infrastructure that we recognise today. Both in terms of population, built-up areas and residential housing, cities throughout Europe witnessed considerable expansions. Whilst cities were expanding everywhere, they did not do so homogeneously. Different city forms were emerging which would pique the interest of housing observers and reformers. One such reformer, the German economist and city planner Rudolf Eberstadt, noted that the further east one travelled in Europe, the more likely one was to see higher urban population and building densities (Eberstadt, 1920). Around the same time, a Swedish Housing Commission noted the existence of what it termed a *West European single-family area*, which included Great Britain, the Low

Countries and the Rhineland (Bostadsräkning, 1920: 83). An extensive British Board of Trade investigation into housing conditions in over 100 cities in Germany, France, Belgium, Britain and the USA around 1907 also observed a similar geographical cleavage line (Board of Trade, 1908).

At a time when housing statistics were in their infancy, reformers often relied on recording the ratio of *persons per building* (as opposed to dwelling or household) in a city and we found this metric to be the most comprehensive and harmonisable comparative measure in the housing census material of the 27 different countries we surveyed (see detailed sources in Appendix 1). The metric is convenient first because it approximates the size of the building needed, on average, to house a city's residents, with higher-storey buildings producing a higher ratio than single-dwelling buildings. Second, as a smaller area is generally needed for multi-storey buildings, the metric implicitly approximates the extent of urban sprawl. Third, as apartment ownership was not very common prior to the inter-war years in Europe, this metric is also able to approximate the rate of homeownership: generally speaking, then, the higher the number of persons per building, the lower the incidence of homeownership. This metric is by no means perfect. The inference that a higher ratio of persons per building implies more rented multi-dwelling buildings can be distorted by unequal distributions of vacancies and overcrowding, for instance. Robustness tests with alternative measures, however, and the widespread use of this metric among historical housing reformers means that we are fairly confident about the validity of this measure (see Appendix 1).

Using this scale, and disregarding outliers, the lower quartile within our unique sample contains cities with ratios of between four and five persons per building. With a median value of 8.8, we take this first half of cities to represent the single-family dwelling type because, with family sizes larger than the contemporary nuclear family, this number averages (roughly) one family per house. The third quartile reaches 15 persons per building, which we take to approximate the traditional multi-storey city with everything beyond this indicative of cities constructed and extended with considerable multi-dwelling building shares. The maximum value in our sample is reached in Central and Eastern European cities such as Berlin or Lodz with up to 118 persons per building. The exceptionally high figures for some Eastern European cities reflect the state of overcrowding. Figure 1 shows the variety of urban form for the European cities in the 1910s.

Figure 1 shows a periphery of single-family dwelling cities in the Balkans, Southern and North-western Europe, whilst multi-dwelling building cities dominate roughly the area between Rome, Stockholm and Eastern Prussia, with the remaining cities in Europe falling somewhere in between. Thus, across the north-western part of Europe, reaching up to the North Sea fringes of Scandinavia, one finds a clear dominance of single-family dwelling cities, while the area extending east from the Rhineland reaches the other extreme of multi-dwelling building cities.

The grey-scale country backgrounds in Figure 1 indicate the central historical dimension we use to explain differences in housing form. The circulation of outstanding mortgage bonds per capita in 1898 in France (Hecht, 1900) approximates the extent of mortgage banking (as opposed to deposit-based or informal lending). While all former colonies and Great Britain remained largely devoid of mortgage bonds at that time, Southern European countries were generally late in developing their first banks. By contrast, countries in Central and Northern Europe, from where mortgage banks spread,

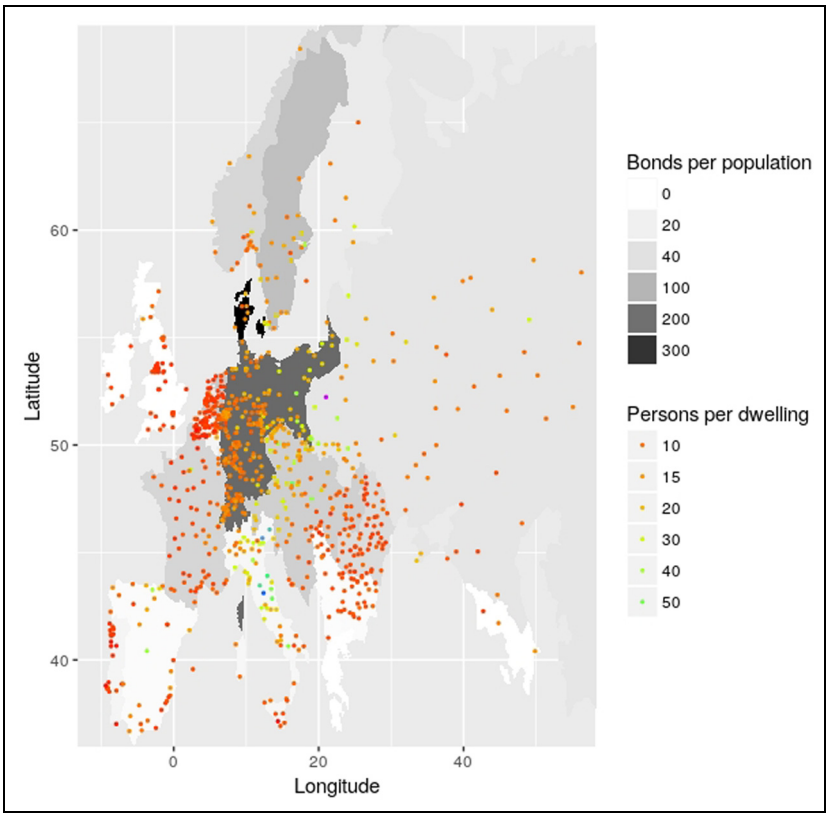

Figure 1. Persons per building and bonds per population, Europe, early 20th century.
Source: See Appendix 1.

tend to have higher levels of mortgage bonds, with mortgage banks constituting up to 50% of the domestic urban mortgage market. In addition to country-wide mortgage bond coverage, we identified the 117 cities in our sample which had, by 1914, developed at least one private or public mortgage bank (Hecht, 1900): even though not all of their lending was necessarily regionally orientated, locally they had a transaction and information cost advantage.

While Figure 1 suggests a certain relationship between bond-based housing systems and countries' city average of persons per building, we now use additional data in multi-level models to explore this association further. The multi-level model also corrects for the heterogeneity of variance across different countries in terms of persons per buildings: while countries with a dominance of single-family dwellings have a standard deviation of below 4 (and a mean around 5), Germany, Russia or Italy have more than 15 (and a mean above 15). Using the complete 1095 cities, a null model on persons per building with cities nested within 27 countries[1] from 1914 finds that 32.5% of variance is at the country level, while the majority is due to city-level variation.

In Table 1, we successively fill up the null model first with the country-level variable – measuring bond circulation in a first model.

Table 1. Multi-level regression on persons per building in cities around 1910.

	Dependent variable:			
	Persons per building 1910			
	(1)	(2)	(3)	(4)
Bonds	0.027**	0.022*	−0.001	0.017
	(0.012)	(0.011)	(0.050)	(0.032)
Population 1910		0.00001***	0.00000***	
		(0.00000)	(0.00000)	
Mortgage bank		5.182***	4.443***	5.350***
		(0.821)	(1.543)	(0.936)
Capital city 1800			−0.021	
			(1.543)	
University 1800			3.043**	
			(1.304)	
Bishop's seat 1800			−0.158	
			(1.154)	
Commune 1800			4.085***	
			(1.257)	
Defortification date				0.019***
				(0.007)
Constant	8.810***	7.884***	12.389**	−25.810*
	(1.154)	(1.130)	(5.676)	(13.558)
Observations	1066	1056	361	204
Log likelihood	−3761.688	−3674.199	−1345.100	−654.017
Akaike Inf. Crit.	7531.375	7360.399	2710.200	1320.034
Bayesian Inf. Crit.	7551.262	7390.172	2749.089	1339.942

Note: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

In a second model, we add the city-level variable 'mortgage bank presence' (Yes/No) which measures more adequately the city-specific effects of mortgage bonds. We further control for city population around 1910 because larger cities – although not uniformly – generally have a higher proportion of multi-dwelling buildings. In a third model specification, we add lagged historical variables from the year 1800 by merging our data with existing collections (Dincecco and Onorato, 2016). We believe this is necessary, as it can quite convincingly be argued that pre-existing historical conditions, rather than the emergence of bond-issuing mortgage banks in the 19th century, set cities on different trajectories. As big cities usually attracted more absolute, and even relative, population growth, it could be the case that it was the initial size of the city before the rapid urbanisations of the 19th century that attracted mortgage banks to finance city expansion. We therefore control for the population size in 1800 and a range of structural historical measures which could explain why cities in 1910 could have higher numbers of persons per building, such as their function as a capital, a bishop's seat, a university city, and whether they historically had free city status. Invariant variables such as the elevation, and sea or river location were found to be insignificant and therefore excluded. These variables make most sense for 398 available cities in 17 European countries, with a bias towards the bigger cities by 1910 with a longer historical past (Model 3).

In a final fourth model, we test whether our mortgage history explanation holds when controlled for a rival explanation to account for high-rise cities: the presence of a defensive city wall. Non-continental and peripheral Northern European cities either went unfortified or lost their city walls very early on, which, the city wall hypothesis maintains, allowed such cities to grow horizontally. Continental European cities with enceintes, on the other hand, tended to grow vertically according to this logic. As far as we are aware, no research has systematically interrogated this association, but there are implicit articulations in much urban studies literature (Weber, 1995: 67). As intuitive as it may first appear, the city wall explanation has problems accounting for the highly fortified, though low-rise, Dutch and Belgian cities or the weakly fortified, though moderately high-rise, Scandinavian ones. As Peter Clark (2001: 1215) notes, 'Taking central and western Europe, walled settlements were fewest in the east and thickest in the most urbanized regions (Flanders, the Rhineland).' Yet, as our analysis shows, these very same heavily fortified regions are within the low-rise, single-family dwelling areas. Even aside from this, the ostensive growth-inhibition mechanism implied by the presence of a city wall has been disproven historically for 52 large German cities (Weber, 1995). Indeed, some dense German cities never had a city wall. As we cannot isolate the effect of the presence or absence of city walls in continental or non-continental cities from the mortgage-institution effect, we have collected defortification dates of formerly fortified cities to see whether later defortification leads to higher density values in 1910.[2] We test this hypothesis together with our mortgage variables for a subsample of the available 204 European cities (covering major cities in Germany, Austria, Switzerland, Belgium, Holland and France).

Adding the bond variable lessens the country-level variation in comparison with the null model. It increases the model's fit and produces a significant positive effect, although one that is low in magnitude. Adding the contemporary population size and the mortgage-bank dummy variable on the city level both increases the model fit and shows a significant effect, but leaves the bond-effect intact. The presence of mortgage banks in cities is conditionally associated with a higher number of persons per building by 5.6. Model 3 for the European continent only adds the lagged historical variables: the more a city historically relied on the function of being a capital, university, bishop's seat or free city, the more likely it was to have a higher incidence of multi-dwelling buildings by 1910. While together these additional city-level variables make the country-level bond variable insignificant, they leave the city-based mortgage-bank variable significant and positive. Thus bond circulation in a country is not conditionally associated with the overall level of multi-dwelling urban buildings at a country level, but only with cities in the purview of mortgage banks. While the city-based variables lower the residual city-level variance, the country-level bond variable leaves the country-specific variance almost untouched. The fourth model in Table 1 tests the mortgage-bank influence in light of the competing city-wall explanation: while later defortification has indeed a positive, though small effect on city density by 1910, the effect of present mortgage banks remains intact. Higher exposure to bonds is conditionally associated with cities, higher-rise buildings after a nation's first large urbanisation waves, even when controlling for the two rival explanations: city walls and more historical background factors.

To be clear, we find a conditional association but we cannot claim that bond-based mortgage banks were *necessary* for the

development of high-rise, multi-dwelling building cities during the long 19th century. There are obvious counterexamples as, for example, in Edinburgh or Glasgow, where tenements proliferated during the late 19th century without the assistance of bond-based mortgage banks. The explanation for this lies in the dominance of Trusts and Life Insurance companies within these localities (Rodger, 2001). In other words, there were (and still are) functionally alternative methods and means of mobilising the capital resources necessary to build multi-dwelling units (on a large scale) as part of city expansions. New York and Chicago also provide examples of cities which extensively developed the multi-dwelling form, but where the European-style mortgage banks were absent. Here, during the early 20th century, a novel system of mortgage securitisation developed, but quickly failed (Goetzmann and Newman, 2010: 1): high-rise rental buildings during the 1920s in New York 'were largely the manifestation of a widespread financial phenomenon' (Goetzmann and Newman, 2010: 3). This system, then, provided a functionally alternative means of mobilising vast capital resources for the purposes of rapid, high-rise city expansion. These securities, unlike the European system of mortgage banking, were solely private, off balance sheet, and burgeoned largely free from regulatory oversight. Thus, they were quite distinct from the *Federal Farm Loan* system of the previous decades, which was more akin to the European bond-based system of mortgage lending (Snowden, 2010).

Long-term effects of historical finance and urban form today

The previous section established that the local presence of mortgage banks is associated with cities' building density by 1910, even independently of their urban lineage prior to the 19th century. In this section, we demonstrate that the historical legacy of the urban housing stock, as well as particular housing finance systems in cities, can still be felt in contemporary Western cities. The long-term legacy of building form and mortgage finance are in no way self-evident, given that private mortgage finance was, to greater or lesser degrees, superseded by state mediated housing finance between the 1920s and 1960s in many countries. Also the automobile revolution exerted centrifugal pressures on many previously compact European cities (Newman and Kenworthy, 1989) and Soviet cities underwent major transformations. In many cities, war devastated large parts of the residential urban housing stock and studies have revealed both continuities and discontinuities resulting from these exogenous shocks (Caruana Galizia and Wolf, 2016). Finally, the 20th-century urbanisation waves occurred at times of higher household wealth, which opened up more possibilities vis-à-vis the extension of cities.

To approximate the impact of historical building form on contemporary cities' housing forms and homeownership rates, we connect our 1910 data to contemporary homeownership averages of cities, narrowly defined as the administrative cities, using the harmonised Eurostat urban data for Europe and adding the city – not metropolitan – data for Canada, the USA and Sweden. Most cities in the sample have grown in area and population and are therefore not geographically identical. We use this, however, to put our claim about historical influences to a stricter test: if we find an association with urban history, then we can confidently say that it holds in spite of a further 100 years of urban development. A first consequence of a city's housing past can be found in the significant and strong negative correlation of -0.57 of its historical building density and its current single-family house share.[3]

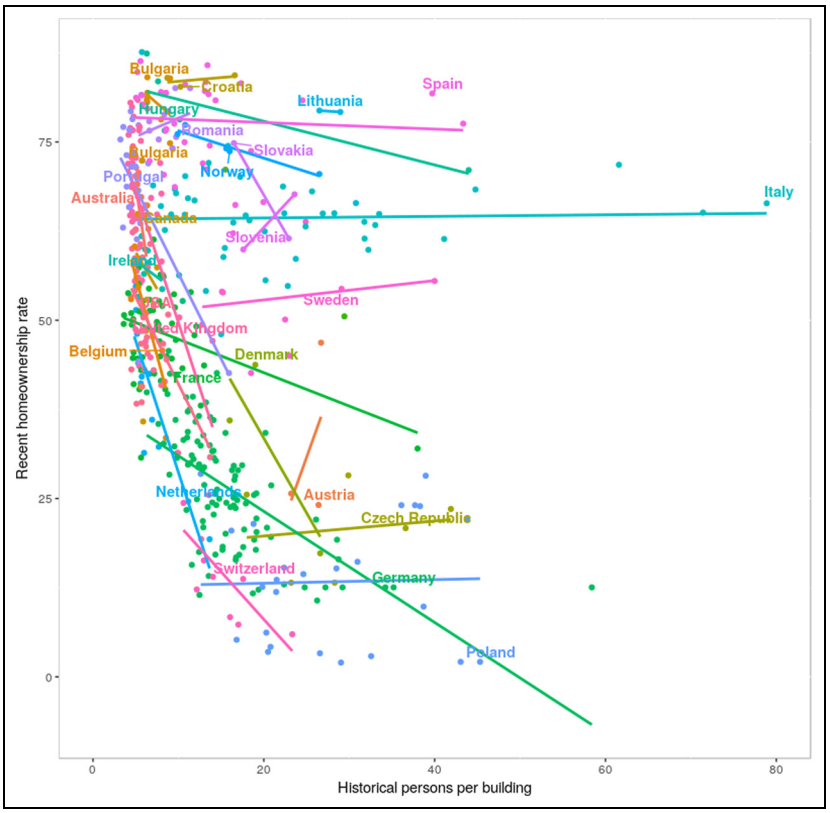

Figure 2. Historical urban density and contemporary homeownership rates.
Sources: Eurostat (Urban Audit); Australia (Census 2000), Sweden (SCB, 2016), USA (city data book 2007).

Current homeownership, by contrast, is not significantly associated with historical numbers of persons per building in the complete sample, but with country-group-specific differences. As the country-specific regression lines in Figure 2 indicate, Western European and Anglo Saxon countries show a significant negative association of historical building density and current homeownership rates, whereas Southern, Eastern and some Northern European countries display no association at all. In the latter countries' cities, owner-occupied flats of various legal forms constituted a third form of urban housing in addition to the opposition of owner-occupied single-family-house cities and rental-flat cities.

To test this bivariate relationship in a multivariate, multi-level context, in Table 2, we draw on averaged homeownership rates for existing data between 1990 and 2015, for reasons of data availability and to estimate a between-effect panel model – as we are mostly interested in structural differences. As these measures change only gradually with low volatility, averaging is not too distortive. When cities were incorporated into larger ones, we took the larger contemporary city average as a modern equivalent, leaving us with a sample of 499 cities nested within 30 countries. For robustness, we also collected the metropolitan Eurostat data, but as there is a 0.94 and 0.89 correlation between the averaged urban and metropolitan homeownership and single-

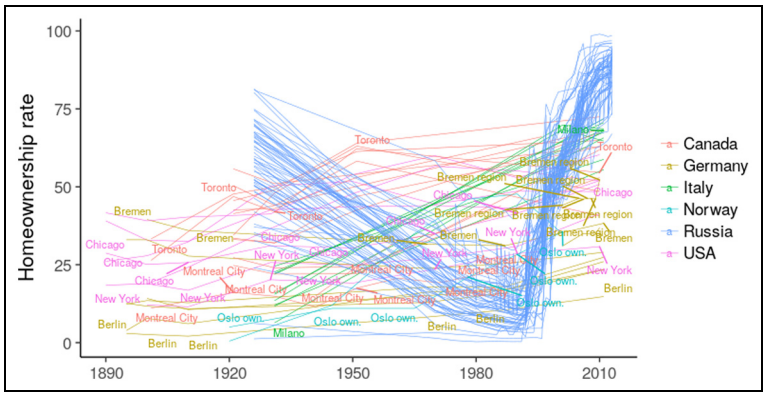

Figure 3. Urban homeownership trajectories.
Source: Canada (Choko and Harris, 1990); Germany (Petrowsky, 1993), Zensus 2011; Italy (Niceforo, 1931), Eurostat; Norway (Folke- og boligtellingene, SSB); Russia Census 1926, Urban Passport, percent private square metre; USA (Census data). We thank the Leibniz Institute for Regional Geography, Leipzig, for making some of these data available to us.

family-house rates, respectively, we only report results for the city-level analysis below. Using the homeownership rate in cities as a dependent variable is limited, but as extreme values are hardly realised – most falling between the 30% and 80% range – an ordinary least squares (OLS) estimation is used.

A null multi-level model on cities' homeownership rate averages reveals that now 70% of the variance plays out at the country level and the remainder on the city level. In a first model specification, we add the lagged building variable from 1910 and find a significant negative influence: one additional person per building in 1910 is associated with a homeownership rate that is higher by 0.129 percentage points. In a second model we add the two mortgage regime variables, bond circulation per capita at the country level and mortgage bank presence at the city level. We also control for the historical city population and find general homeownership decreasing effects through all three channels of historical influence: the higher the population, bond circulation and inhabitants per building in European cities 100 years ago, the lower their homeownership rates today. In a simple linear-regression model (not shown), these three variables alone explain 62% of the overall variance (80% including country fixed-effects). In the third model, we add the social expenditure per GDP as a welfare state proxy,[4] in line with the welfare regime housing typologies which make this a major national-level variable. Notably, it turns out to be without significant effect on cities' homeownership rate or the overall model. A final model, controlling for the specific developments in post-Soviet countries, confirms the results.

While a broad association between building and finance history and contemporary urban building stock and homeownership can be observed, the magnitude of the homeownership effects are rather small and very country-specific, hiding different historical trajectories of which we can empirically trace three different types: suburbanisation in the owner-occupied single-family houses, the extension of horizontal ownership in the form of cooperatives or condominiums and the conversion of existing public or private dwellings into homeownership forms. While cities' homeownership rates are higher nowadays than across the last century almost without exception, their levels and

Table 2. Multi-level regression on contemporary cities' homeownership rate (averaged 1990–2015).

	Dependent variable:			
	Recent homeownership rate			
	(1)	(2)	(3)	(4)
Persons per building 1910	−0.129***	−0.052	−0.046	−0.048
	(0.043)	(0.039)	(0.039)	(0.039)
Bonds 1898		−0.070***	−0.069***	−0.069***
		(0.013)	(0.013)	(0.013)
Mortgage banks 1900		−2.304**	−2.112*	−2.111*
		(1.107)	(1.116)	(1.116)
Population 1910		−0.00001***	−0.00001***	−0.00001***
		(0.00000)	(0.00000)	(0.00000)
Social Exp./GDP			−0.380	0.092
			(0.576)	(0.629)
Eastern Europe				12.060
				(7.702)
Constant	57.960***	62.654***	80.168***	53.974*
	(3.687)	(3.299)	(26.332)	(30.290)
Observations	499	491	431	431
Log likelihood	−1816.156	−1723.637	−1506.732	−1505.533
Akaike Inf. Crit.	3640.312	3461.275	3029.464	3029.066
Bayesian Inf. Crit.	3657.162	3490.650	3061.993	3065.661

Note: *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$.

trajectories are quite country-specific as Figure 3 shows: US, Canadian and German cities have seen a gradual and slow increase in homeownership rates, with initial level differences hardly changing. The distinction between cities and suburbs (or urban Eurostat regions) allows tracing processes of owner-occupied suburbanisation: Bremen's homeownership rate, throughout one of the highest among German cities, is even higher once the suburbanised region is included, and the difference is even larger for North American cities such as Montreal.

In Norwegian (and other Nordic) cities, in turn, the classical ownership form has increased rather slowly, while much of the urban homeownership increase occurred in the form of the owner-cooperatives. Initially regulated, it turned into a functionally equivalent form of condominia. The Italian trajectory also bespeaks of an increase of homeownership in the condominium form, mostly at the cost of private rental, while the Russian (or socialist) trajectory abolished private rental property during the Revolution, gradually replaced remaining owner-occupied single-family houses and then privatised most of the public stock after 1990. These different housing developments help to explain why the homeownership legacy depends on the country groups.

Conclusion

This paper has argued the need to look at patterns of residential urban development and growth which took place over a century ago in order to understand the differences in contemporary Western cities we observe today. Using a comprehensive data set, we discover a bifurcation of different city-types vis-à-vis housing forms. North-west

European and peripheral cities tend to consist of predominantly low-rise single-family dwellings, whereas Central and Northern European cities contain much more in the way of multi-dwelling buildings. We argued that housing finance institutions, which proliferated throughout the 19th century and beyond, played an important role in shaping city extensions and reconstructions during this era of industrial urbanisation.

We found that the historical building density that we measured through the persons per building metric around 1910 is associated with contemporary urban single-family dwelling and homeownership rates: the more a city developed multi-dwelling buildings in the 19th century, the lower the single-family dwelling and homeownership rate today. However, the prediction of today's urban homeownership rates with the historical building form produces some systematic outliers, namely certain Scandinavian, Southern European and Eastern European cities. For, in spite of the fact that many of the large towns and cities in these regions inherited a multi-dwelling building tradition, the sale of housing units to private tenants in Western Europe from 1945 onwards and to public tenants in Eastern Europe from the 1990s onwards produced a dominance of owner-occupation in their contemporary cities. The historical process through which apartment ownership spread in countries of Roman law, cooperative ownership in Scandinavian countries, and privatised state or cooperative housing in Eastern Europe was often linked to historical moments of weak or welfare-retreating states and appears to have been influenced by long periods of rent control.

What explains the observed path dependence in housing and the built environment in Western cities? One first mechanism operates through the path dependent development of financial institutions themselves: once bond-based mortgage banks arose in a country, they tended to defend their market share against newcomers and continued to make up a share of the mortgage market that was mostly tied to the financing of larger rental buildings; until the 1970s, when financial liberalisation eroded many specialised mortgage circuits (Ball, 1990). A second mechanism operates through the housing stock itself: once larger, multi-dwelling buildings became established in the urban housing stock, future demand was generally focused on multi-dwelling buildings for which large, bond-issuing mortgage institutions supplying large developers and institutional landlords were well suited. A similar logic also applies to the West European *single-family area*. Once smaller houses became dominant, future demand also focused on smaller houses for which smaller, deposit-based mortgage institutions were sufficient. Third, the persistence in ownership and building form are most probably built upon even more lasting demographic and infrastructural conditions: once previous generations have accumulated considerable housing wealth, they are likely to pass it on and thus maintain a high regional homeownership rate (Petrowsky, 1993); once infrastructures such as an extended public transport system are built, they are likely to hold cities together in a more compact form.

Finally, our research has posed a challenge to established typological categories in the fields of housing research and comparative political economy, which are often centred at the national level and which treat private homeownership as the diametric opposite of public welfare. Our multi-level analysis delineates both historical and contemporary cities and provides both state- and city-level comparisons: while historically up to two-thirds of the variance played out at the city level, it is still about one-third even for today's urban homeownership rates. This speaks in favour of an analysis that goes *below* the national level. While we are not in principle against sub-city-level

analyses as proposed by Meen et al. (Meen et al., 2016), this seems only feasible for some major cities given our current data collection. Our analysis also challenges the widespread idea that national welfare levels have a trade-off effect on countries' homeownership levels (or vice versa). In a multi-level analysis of the major European cities, this variable is much too weak to justify a larger theory explicitly linking housing and welfare in the context of Western housing systems.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article

ORCID iD

Timothy Blackwell https://orcid.org/0000-0002-3086-8113

Notes

1. The countries as of c. 1914 are: Australia, Austro-Hungarian Empire, Belgium, Brazil, Bulgaria, Canada, Denmark, Finland, France, German Empire, Greece, Iceland, Ireland, Italy, Mexico, Netherlands, New Zealand, Norway, Portugal, Romania, Russia, Spain, Sweden, Switzerland, UK, USA, Yugoslavia.
2. See Appendix 2 for sources.
3. European cities only, Italy and Hungary excluded because of data irregularities.
4. Using Eurostat data averages 2005–2015. The results are similar for the slightly different country coverage of the OECD social expenditure variable averaged over 2005–2016.

References

Allinne J-P (1984) *Banquiers et bâtisseurs. Un siècle de Crédit Foncier, 1852–1940*. Paris: Ed. du CNRS.

Andersen S (2011) *The Evolution of Nordic Finance*. Basingstoke: Palgrave Macmillan.

Ball M (1990) *Under One Roof. Retail Banking and the International Mortgage Finance Revolution*. New York: Harvester Wheatsheaf, pp. 10–16.

Bengtsson B and Ruonavaara H (2010) Introduction to the Special Issue: Path dependence in housing. *Housing, Theory & Society* 27(3): 193–203.

Blackwell T and Kohl S (2018) The origins of national housing finance systems: A comparative investigation into historical variations in mortgage finance regimes. *Review of International Political Economy* 25(1): 49–74.

Blanchflower DG and Oswald AJ (2013) *Does High Home-Ownership Impair the Labor Market?* Cambridge, MA: National Bureau of Economic Research.

Board of Trade (1908) *Cost of Living of the Working Classes. Report of an Enquiry by the Board of Trade Into Working Class Rents, Housing and Retail Prices, Together with the Rates of Wages in Certain Occupations in the Principal Industrial Towns of the United Kingdom*. London: Darling & Son.

Bostadsräkning (1920) *1912–1914 Allmänna bostadsräkningar, del 1*. Stockholm: Sveriges Officiella Statistik.

Bragard P (2012) Fortification et dé-fortification sur le territoire belge. *Les cahiers nouveaux* 81: 10–16.

Caruana Galizia P and Wolf N (2016) *Phoenix from the ashes: Bombs, homes, and unemployment in Germany, 1945–2011*. CEPR Discussion Paper No. DP11649.

Chandler T and Fox G (1974) *3000 Years of Urban Growth*. New York and London: Academic Press.

Choko M and Harris R (1990) The local culture of property: A comparative history of housing tenure in Montreal and Toronto. *Annals of the Association of American Geographers* 80(1): 73–95.

Clark P (2001) Book review: *City walls: The urban enceinte in global perspective*. Edited James D. Tracy. *The English Historical Review* 116(469): 1214–1216.

Daunton MJ (1990) Introduction. In: Daunton MJ (ed.) *Housing the Workers, 1850–1914. A Comparative Perspective*. London: Leicester University Press, pp. 1–32.

Dincecco M and Gaetano Onorato M (2016) Military conflict and the rise of urban Europe. *Journal of Economic Growth* 21(3): 259–282.

Donnison D and Ungerson C (1982) *Housing Policy*. Harmondsworth: Penguin.

Eberstadt R (1914) *Städtebau und Wohnungswesen in Holland*. Jena: Fischer.

Eberstadt R (1920) *Handbuch des Wohnungswesens und der Wohnungsfrage*. Jena: Fischer. Original edition, 1909.

Goetzmann WN and Newman F (2010) *Securitization in the 1920's*. NBER Working Paper 15650.

Harris R (1996) *Unplanned Suburbs. Toronto's American Tragedy, 1900 to 1950*. Baltimore, MD: Johns Hopkins University Press.

Hecht F (1900) *Les crédits fonciers en Europe*. Paris: Dupont.

Hill MR (1959) *Housing Finance in Australia, 1945–1956*. Melbourne: University Press.

Hoekstra J (2005) Is there a connection between welfare state regime and dwelling type? An exploratory statistical analysis. *Housing Studies* 20(3): 475–495.

Jordà Ò, Schularick M and Taylor AM (2017) Macrofinancial history and the new business cycle facts. In: Eichenbaum M and Parker JA (eds) *NBER Macroeconomics Annual 2016, Vol. 31*. Chicago, IL: Chicago University Press, pp. 213–263.

Kemeny J (1981) *The Myth of Home Ownership. Private Versus Public Choices in Housing Tenure*. London: Routledge.

Kemeny J (1995) *From Public Renting to Social Housing: Rental Policy Strategies in Comparative Perspective*. London: Routledge.

Kemeny J (2005) 'The really big trade-off' between home ownership and welfare: Castles' evaluation of the 1980 thesis, and a reformulation 25 years on. *Housing, Theory and Society* 22(2): 595–872.

Keyser E (1939–1976) *Deutsches Städtebuch: Handbuch städtischer Geschichte*. Stuttgart: Kohlhammer.

Kohl S (2016) Urban history matters: Explaining the German–American homeownership gap. *Housing Studies* 31(6): 694–713.

Kohl S (2017) *Homeownership, Renting and Society: Historical and Comparative Perspectives*. London: Routledge.

Lacomba JA and Ruiz G (1990) *Una historia del Banco Hipotecario de España (1872–1986)*. Madrid: Alianza Editorial, Banco Hipotecario.

Lauridsen J, Nannerup N and Skak M (2009) Geographic and dynamic heterogeneity of home ownership. *Journal of Housing and the Built Environment* 24(1): 1–17.

Leontidou L (1990) *The Mediterranean City in Transition. Social Change and Urban Development*. Cambridge: Cambridge University Press.

Lerbs O and Oberst C (2012) *Explaining the spatial variation in homeownership rates: Results for German regions*. CESifo working paper. Available at: http://www.cesifo-group.de/ifoHome/publications/docbase/DocBase_Content/WP/WP-CESifo_Working_Papers/wp-cesifo-2011/wp-cesifo-2011-03/12012011003377.html.

Löffler G (2013) Tower building and stock market returns. *Journal of Financial Research* 36(3): 413–434.

Martens M (1988) The revolution in mortgage finance. In: Ball M, Harloe M and Martens M (eds) *Housing and Social Change in Europe and the USA*. London: Routledge, pp. 130–168.

Meen G, Gibb K, Leishman C, et al. (2016) *Housing Economics. A Historical Approach*. London: Palgrave Macmillan.

Mian A and Sufi A (2016) *House of Debt. How They (and You) Caused the Great Recession, and How we can Prevent it From Happening Again*. Chicago, IL: Chicago University Press.

Mintzker Y (2012) *The Defortification of the German City, 1689–1866*. Cambridge: Cambridge University Press.

MRU (1947) *Résultats statistiques d'une enquête sur la propriété bâtie dans 61 agglomérations de plus de 30.000 habitants*. Paris: Ministère de la reconstruction et de l'urbanisme et Ministère de l'économie nationale.

Mumford L (1979) *Die Stadt. Geschichte und Ausblick*. München: Deutscher Taschenbuch-Verlag. Original edition, 1961.

Newman PWG and Kenworthy JR (1989) Gasoline consumption and cities. *Journal of the American Planning Association* 55(1): 24–37.

Niceforo A (1931) *Indagine sulle Abitazioni*. Roma: Istituto Centrale di Statistica del Regno.

Nunn N (2014) Historical development. *Handbook of Economic Growth* 2: 347–402.

Petrowsky W (1993) *Arbeiterhaushalte mit Hauseigentum. Die Bedeutung des Erbes bei der Eigentumsbildung*. Dissertation, Bremen University, Germany.

Pinol J-L and Walter F (2003) La ville contemporaine jusqu'à la Seconde Guerre mondiale. In: Pinol J-L (ed.) *Histoire de l'Europe Urbaine. II. De l'Ancien Régime à nos jours. Expansion et limite d'un modèle*. Paris: Éd. du Seuil, 9 ff.

Regeringen (1920) *The Housing Question in Sweden*. Inter-Allied Housing and Town Planning Congress Swedish Delegation, Stockholm: P. A. Norstedt & söner.

Rodger RG (2001) *The Transformation of Edinburgh*. Cambridge: Cambridge University Press.

Rutte R and Abrahamse JE (2016) Atlas of the Dutch urban landscape. *International Planning History Society Proceedings* 17(5): 13–26.

Samy L (2008) *The building society promise: Building societies and home hwnership, c. 1880–1913*. Discussion Papers in Economic and Social History. Oxford: Oxford University, pp. 1–47.

Schulte F (1918) *Die Hypothekenbanken*. Berlin: Duncker & Humblot.

Schwartz H and Seabrooke L (2008) Varieties of residential capitalism in the international political economy: Old welfare states and the new politics of housing. *Comparative European Politics* 6: 237–261.

Schwartz P-A (2013) Stadtbefestigungen. In: Sonderegger C (ed.) *Historisches Lexikon der Schweiz*. Bern. Available at: http://www.hls-dhs-dss.ch/textes/d/D8597. php.

Snowden KA (2010) Covered farm mortgage bonds in the United States during the late nineteenth century. *The Journal of Economic History* 70(4): 783–812.

Stephens M (2003) Globalisation and housing finance systems in advanced and transition economies. *Urban Studies* 40(5–6): 1011–1026.

Sveinsson JR (2004) The formation of urban homeownership in Iceland. ENHR Conference, 2–6 July, Cambridge, UK. Available at: http://citeseerx.ist.psu.edu/viewdoc/download ?doi = 10.1.1.595,9595&rep = rep1&type = pdf.

van der Woud J (1937) *De hypotheekbank. Haar wezen en hare waarde*. Amsterdam: H.A. van Bottenburg.

von Oppenried M (1911) *Die Hypothekaranstalten (Bodenkreditanstalten) in Deutschland und Österreich-Ungarn*. Wien: Export-Akademie des K.K. Österr. Handels-Museums.

Weber K-K (1995) Stadt und Befestigung: Zur Frage der räumlichen Wachstumsbeschränkung durch bastionäre Befestigungen im 17. und 18. Jahrhundert. *Die alte Stadt* 4: 301–321.

Weber-Schurter J (1914) *Die Schweizerischen Hypothekenbanken*. Zürich: Institut Orell Füssli.

White P (1984) *The West European City: A Social Geography*. London: Longman Publishing Group.

Willis C (1995) *Form Follows Finance. Skyscrapers and Skylines in New York and Chicago*. New York: Princeton Architectural Press.

Appendix 1: Urban density

When collecting the historical housing and building statistics, we tried to approximate 1910. For some countries, we had to rely on earlier or later dates, which is still justifiable because the measure, and particularly its intra-country rankings, are relatively stable over time. As units, we used the cities (not their broader regions, which sometimes include rural areas). As variables we looked for the total population registered (local or not) and all buildings (not housing units): where possible, we only used inhabited, not vacant buildings. Within countries, we always used consistent sources, so that intra-country comparisons are less distorted by statistical artefacts than inter-country comparisons. We relied on the following country sources with the following country-specific adaptations: Austria, *Volkszählung* 1910; Australia, Census 1911; Belgium, Récensement 1910; Brazil, *Recenseamento Geral* 1920;

Bulgaria, Récensement 1930; Canada, Census 1911; Denmark, Bostadsräkning, 1912–1914; Finland, Census 1910, only heatable units counted; France, MRU (1947); Germany, *Reichswohnungszählung* 1927, 1918 only for French and Polish cities; Greece, Leontidou (1990); Italy, Niceforo (1931), housing units on the ground floor used to approximate buildings; Ireland, Census of 1926; Iceland 1920 Sveinsson (2004: 85); Mexico, *Censo* 1910, building from entire urban 'distritos'; Netherlands, *Volkstelling* 1909, partially 1919; New Zealand, Census 1911, tents not counted as buildings; Norway, Folketellingen i Norge 1926; Portugal, *Censo* 1940; Romania, Census 1930; Russia, Goroda Rossii v 1910 godu; Spain, Census 1910; Sweden, Bostadsräkning., 1912–1914. Switzerland, *Eidgenössische Wohnungszählung* 1910; UK (England, Scotland), 1911 Census of England & Wales, and 1911 Census of Scotland; US, Census 1910. Where population data were lacking, we relied on Chandler's and Fox's data for 1900 city population (Chandler and Fox, 1974).

For some countries, we collected two different dates and as the inter-country years are different, we calculated some inter-temporal correlation between the two available dates for robustness: the correlation of the persons per building metric for 55 large cities in the USA in 1900 and 1910 is 0.97 (US Census). For 44 large Dutch cities, we find a correlation of the respective metric for the years 1909 and 1919 of 0.90; while some cities in 1919 show unusually high values, probably reflecting post-war overcrowding, these circumstances did not change city rankings too much. We avoid the immediate post-war numbers nonetheless. For 18 large German cities in 1901 (Eberstadt, 1920) and 1918, the correlation amounts to 0.94. For the 175 largest German cities, the correlation of persons per building of 1918 and 1927 is 0.86. The persons per building averages of the 63 largest Italian cities in 1931 correlate by 0.81 with those of 1911.

As external robustness, we find that the alternative density measure of population divided by built-up area – itself distorted by the inclusion of buildings that are not residential – shows a correlation of 0.92 for 29 international cities from 1890 (US Census). For the largest 96 German cities in 1918 (RWZ), its correlation with the single-family house share is −0.69.

Appendix 2: Defortification

Data on cities' defortification dates are very disperse and most often city-unique sources have to be consulted. Moreover, the defortification is a longer-term process that can stretch over more than a century and can mean anything from opening one part of a surrounding wall for a planned city extension to the complete destruction of a wall, city portals and possibly bastions at the demand of an external power. For our purposes, the starting date of the defortification of the city wall – and not just military bastions – is most important, as at that point planned city extension – and not just illegal settlements – became legally (and physically) feasible. We relied on the following sources for the respective countries: Germany, Keyser (1939–1976), Mintzker (2012); Switzerland, Schwartz (2013); Belgium, Bragard (2012); the Netherlands, Rutte and Abrahamse (2016). For cities (and countries) not covered in these publications, we had to rely on the eclectic sources available through online searches, ranging from local historians to municipal history pages.

Appendix 3: Mortgage banks and city development

We do not know of any systematic investigation of the hypothesised link between mortgage bank presence and higher urban density. In all bond-based countries, however, we found specialised urban and

mortgage history sources which support the idea that mortgage banks had a lending preference for income-generating rental multi-storey buildings and that the majority (or even entirety) of mortgages was on these types of buildings, as reported for Spain (Lacomba and Ruiz, 1990: 130), for France (Allinne, 1984: 144), for the Netherlands (Eberstadt, 1914: 326; Martens, 1988; van der Woud, 1937: 54), for Germany (Schulte, 1918: 401–405), for Austria (von Oppenried, 1911: 111), for Switzerland (Weber-Schurter, 1914: 49), for Sweden (Regeringen, 1920), and for Denmark (Andersen, 2011). On the contrary, we found similar claims made for the link between deposit-based mortgage institutions and smaller mortgages on single-family houses, as reported for the USA (Kohl, 2017: chapter 2), Canada (Harris, 1996), Australia (Hill, 1959) and Great Britain (Daunton, 1990: 26; Rodger, 2001; Samy, 2008).