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## The first real estate bubble? Land prices and rents in medieval England c. 1300–1500<sup>☆</sup>

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### ABSTRACT

This paper tests for speculative bubbles in the medieval English property market based on a unique hand-collected dataset from the feet of fines spanning the fourteenth and fifteenth centuries. We focus on asset types where there are sufficiently large numbers of transactions each year to make a long and reliable run of information, and we transform this into annual time-series of prices. We employ a regime switching model that allows for boom and crash episodes to characterise and test for bubble dynamics. The results are consistent with the presence of periodic, partially collapsing speculative bubbles in the market for agricultural land, but there is no such evidence in the context of messuages. Our findings demonstrate that the medieval English property market shares important features with its contemporary counterpart, for instance with the recent so-called ‘barn bubble’.

### 1. Introduction

The housing market in the UK today is often considered to be somewhat dysfunctional – disproportionately driving economic activity, consuming overwhelming proportions of household budgets, encouraging excessive debt accumulation, and prone to periods of substantial price rises and collapses. There is also considerable regional variation in house price growth, which impedes labour mobility, with a broad North-South divide and substantial disparities within this. More specifically, London has pulled away from the rest of the South, taking the already challenging objective of home ownership further and further out of the reach of most people. In the modern era, price rises are said to originate from a failure of housing supply to adjust to rising demand. Land supply in London, the South of England and most major cities is almost fixed while demand continues to increase as a result of net migration and the formation of larger numbers of small households. At the same time, the buy-to-let market developed rapidly in the UK, where properties are purchased by private landlords in order to provide both a stream of rental income and longer term capital appreciation (for analysis see [Marsden, 2015](#)).

Further afield, deregulation and securitisation of the mortgage market in the US is widely believed to have engendered a housing bubble which triggered the recent financial crisis (see [Ashton, 2009](#)). Securitisation resulted in mortgage debts being combined and

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then sold as stand-alone investment products. Investor appetite for such 'low risk' securities may have contributed to the relaxation of underwriting standards, fuelling house price appreciation. The housing market was inseparably linked with financial asset markets via this process of securitisation (Ashton, 2009), and thus a crash in the former could cause a systemic crisis in the latter. A further unintended consequence was that local shocks could be propagated to the national and international levels, thus increasing the interconnectedness between local housing markets and between housing markets and other asset classes, resulting in heightened systemic risk.

While securitisation is a fairly new phenomenon, excessive price rises and subsequent collapses are certainly not, and seem to have occurred episodically during the past century, linking with the concept of periodically collapsing speculative bubbles. Speculative bubbles are often considered to have numerous undesirable consequences, including pushing home ownership out of the reach of large sections of society on the way up, and with 'negative equity' and repossessions on the way down. Housing bubbles have been argued to be particularly dangerous in the modern era due to their ability to distort activity in other sectors and to contribute to a wider economic crisis when they deflate, leading to a collapse in consumer and business confidence, and resulting in reduced economic activity and increased unemployment (see, for example, Claessens et al., 2009; Hott and Monnin, 2008; Shiller, 2008). Nneji et al. (2013a) find that bubbles can spill over from the residential real estate market in the US to the stock market as a result of the impact of housing wealth engendering a 'feel-good factor' among consumers, who then spend more. Moreover, according to Case et al. (2001), a 10 % rise in housing wealth leads on average to a 1.1 % rise in consumption.

The longer lasting and greater the magnitude of a boom in property prices, the greater the likely economic costs of the subsequent collapse (Agnello and Schuknecht, 2009). Speculative bubbles in housing can have potentially very serious economic and social consequences including a reduction in affordability, poverty and a deadweight loss of economic output compared to the situation where the bubble had not been allowed to form in the first place (Agnello and Schuknecht, 2009). Perhaps even worse than a spectacular bubble collapse is that prices tend to be sticky in the declining phase of the market cycle so that the bubble deflates slowly and the market effectively freezes, with sellers unwilling or unable to reduce their prices sufficiently to clear the supply (see Merlo et al., 2013).

Turning now to some formal terminology and definitions, according to orthodox financial theory, the price of an asset should be equal to the present value of all future cashflows that would accrue to the purchaser. While temporary random variations of the actual price around this present value are consistent with the theory, longer term and persistent differences are not. A speculative bubble is said to exist if the price of an asset deviates from its 'fundamental value' in a persistent, systematic and increasing fashion (Brooks and Katsaris, 2005a; 2005b). A fundamental value is the underlying or intrinsic worth of an asset based on the (appropriately discounted) sum of future cashflows that would accrue to the holder.

From a theoretical perspective, bubbles in asset prices can arise when investors include expectations about rising future prices in their current information set, and this logic is discussed in the real estate context by Case and Shiller (2004). This is linked with the 'greater fool theory' where investors are rational in continuing to pay increasingly excessive prices for assets despite being aware that they are over-valued since they believe that the price will continue to rise and therefore they can sell the asset on at an even greater price subsequently.

Testing for speculative bubbles in real estate is more challenging than for purely financial assets (such as stocks and bonds) due to the dual purpose nature of residential property as providing both a flow of consumption benefits and the potential for speculative gains when prices appreciate. In other words, property, and housing in particular, can be considered as both an asset (purchased with the expectation of selling it later at a higher price) and a consumption good (where owners receive a flow of services from being able to live in the house), which complicates the issue of measuring fundamental values. This has been achieved using two different approaches. First, models are estimated based on rents (which are akin to dividends for stocks in representing the direct reward to investors of holding the asset) – see, for example, Roche (2001) or Himmelberg et al. (2005). A second method is to run a regression of actual property prices on the fundamental factors thought to drive those prices, such as the supply of land, general inflation, interest rates, and employment (Brunnermeier and Huliard, 2008; Black et al., 2006).

In the scholarly literature, the existence of bubbles in residential real estate is still contested, with Himmelberg et al. (2005), for example, arguing strongly against the bubble explanation for the rapid price rises in the early 2000 s. Testing for bubbles in real estate prices presents particular difficulties due to the uniqueness and individual nature of different properties, and the irregularity with which specific properties may be sold. The findings of such studies have been very mixed also in part due to the difficulty in measuring fundamentals, which can easily become contaminated with the very bubble that they are trying to detect, particularly when 'imputed' rents (from prices) are employed rather than actual rents.

So while undeniably subject to strong price cycles, whether modern property prices can formally be characterised as containing speculative bubbles is still highly controversial, both in the academic literature as documented above and in the popular press. For example, although they do not formally test for speculative bubbles, Ambrose et al. (2013) examine the price-rent ratio for a very long run of data on houses in Amsterdam (1650–2005), finding that the price and rent series have a fixed long-run relationship. Therefore, prices and rents will eventually wander back together, albeit this may take a very long time, which is evidence against the notion that there were bubbles present. They find that adjustment back to the long-run value of the price-rent ratio arises primarily through changes in prices rather than rents, a result echoed in a more recent study of US house prices in the late twentieth century by Kim (2007). Nneji et al. (2015) showed that bubbles were not endemic across all regions in the US during the pre-sub-prime crisis period, and in fact they were not present in four of the nine regions they investigated.

The run-up in house prices that began in the late 1990 s and continued until the global financial crisis in 2007 was felt in the US and widely over Europe (Engsted et al., 2015). The conditions for real estate bubbles to develop in the 1990 s arose from financial market liberalisation combined with an environment of low interest rates and easy borrowing in the US based on self-certify mortgages where

weak checks of affordability were made by lenders, allowing borrowers to leverage heavily (Nneji et al., 2013b). While these real estate market conditions were historically unique, the suggestion that asset prices might be subject to the periodic growth and then spectacular collapse of speculative bubbles has not been confined to modern markets in the post-big bang era. Indeed, some of the most famous and fascinating of alleged bubble episodes occurred several centuries ago. Most notably, 'Tulipmania' in seventeenth century Holland, the South Sea bubble in the eighteenth century English company of that name and the Mississippi bubble in eighteenth century France are widely cited and entertaining examples of historical bubbles (Mackay, 1841; Garber, 2001; Dale et al., 2005). The 'Tulipmania' and 'South Sea' episodes are frequently quoted as the earliest examples of financial bubbles (Mackay, 1841; Garber, 2001; Dale et al., 2005), but our analysis will examine evidence for such behaviour several hundred years earlier in medieval England. We search for periods of booms and busts where there were persistent and protracted deviations from fundamentals and will analyse the factors that contributed to these swings (Muelbauer and Murphy, 1997 offer a modern comparator). Even more relevant to our study, Blöndal (2015) tests for speculative bubbles in the Stockholm housing market in the late nineteenth century, finding no evidence for the existence of bubbles during that time period.

In the historical literature, there is as yet virtually no quantitative analysis of the property market within the context of testing for speculative bubbles in Europe or America before 1900 and the research that exists is primarily focused on summarising the information and exploratory analysis rather than formal econometric modelling (see Drelichman and Agudo, 2012; for England, see Lindert and Williamson, 1983 and Devaney, 2010). There are no long run historical data series for property going back to the Middle Ages; the earliest is the 'City and Region' project which has a limited dataset of rents (but not prices) for London and its environs back to 1400 (Ormrod et al., 2012) and there is localised evidence for Amsterdam and Beijing from the seventeenth century (Ambrose et al., 2013; Raff et al., 2013). Ambrose et al. do look at the long-run relationship between house prices and rents in Amsterdam but their focus is on only one city and a single statistical technique.

This gap in our knowledge reflects the inaccessibility to economists of the relevant sources, which are scattered across disparate archives in unpublished manuscripts and are in the main written in highly technical Latin. Existing work on the medieval English property market has primarily been focussed on the transfer of customary land rather than freehold, as this process was more reliably recorded (Harvey, 1977; Howell, 1983; Smith ed, 1984; McIntosh, 1986; Mullan and Britnell, 2010; Larson, 2011). The most extensive study of the transfer of freehold land has focussed on inquisitions *post mortem* (IPMs), which are assessments of the landholdings of Crown tenants made after their death for taxation purposes (Campbell, 1994; Campbell et al., 1992; Campbell and Bartley, 2006; Holford, 2012; Yates, 2012). To date, the transfer of freehold land market on the open market in the middle ages therefore remains a relatively uncharted topic.

Real estate was probably the most significant asset class in medieval England. Although much property was transferred by inheritance and dominated by the feudal aristocracy, there was still an active property market. There is evidence to suggest that successful merchants and professionals (soldiers, lawyers and royal officials) purchased estates to establish themselves and their heirs as members of the landed elites as well as to diversify their financial portfolios and as a store of value (Oldland, 2010; Bell et al., 2019a). The emergence of London as a governmental, political and financial centre by 1300 may have spurred the development of an early commuter belt in the Home Counties (Bell et al., 2019a). The same may have been true for the rural hinterlands of other major towns, such as York, Bristol and Norwich.

The period 1300–1500 also allows us to examine a historically interesting time when the fundamental demographic and macro-economic drivers of property prices were subject to great change. During the early part of this timespan, the English population and GDP were growing steadily (Broadberry et al., 2011a; 2011b). Although there was a limited degree of *assarting* (bringing new land into use), in practice land resources were fixed and certainly did not keep pace with population or economic growth. As demand outstripped supply, rents increased and property holdings were subdivided. This may serve as a useful comparison to the modern situation, where the construction of new housing falls far short of the demand from new households. The arrival of the Black Death in 1348 and recurrent outbreaks of plague thereafter reduced the English population by between one-third and one-half, and it did not recover by the end of our period (see Fenoaltea, 1975 and Campbell, 2000, p. 403, Table 8.06, for a summary of population estimates). The expectation is that this demographic crisis would cause a reversal in the relationship between supply and demand, and a corresponding fall in property prices and rents. However, this process was complicated by a number of social and economic factors; restrictions on wages and buoyant agricultural prices mean that land values remained relatively high for a generation after the Black Death, with the profitability of land only seriously beginning to decline in the 1370s (Campbell, 2000, p. 234). Demand for land in this period was high; plots made vacant by mortality were soon filled, and many tenants took advantage of an increasingly fluid market in order to accumulate large estates (Bolton, 1980, pp. 209–11; 238–9; Campbell, 1984, pp. 103–5). Local studies demonstrate how the effects of plague on the land market varied regionally (Bailey, 2015, pp. 152–3). In some areas, commutation of feudal tenures held by labour services into leaseholds (held in return for cash rents) actually increased the commercial value of land per acre (Bailey, 1989, pp. 226–31).

Of course, there are important differences between the medieval and modern property markets. For instance, Austrian economists (e.g. Thornton, 2009) would attribute speculative bubbles to overly loose monetary policies by central banks or to government intervention to encourage home ownership. In the UK today, property prices are heavily-influenced by the terms on which mortgage credit is available from banks (Offer, 2013). By contrast, although there is some evidence of a relationship between mercantile credit and property investment (Nightingale, 1990, pp. 569–70; Holt, 1990, p. 152; Goddard, 2016, pp. 35–6; 75–6), there was no developed system of mortgage finance in England during the Middle Ages. Study of the English medieval property market thus provides a natural experiment to test whether the mortgage credit, loose monetary policy or government regulation that exist in the modern era are fundamental causes of asset price bubbles.

The property market is of vital economic and financial, not to mention political, significance today. Its historical evolution is

therefore an important question. However, although recent research on economic development in its long-run and comparative perspective has led to the compilation of extensive data series about prices and wages, there remains little empirical data on property prices before the twentieth century. This paper combines hand-collected data from archives with extant secondary sources to enable a thorough historical analysis of the medieval property market over the period c. 1300–1500. Although our data are not of high quality compared to modern price indices, where potentially many thousands of transactions are combined thereby smoothing out a great deal of noise, our sample period is longer than almost anything available in the modern era. The longer run period for this study allows a more nuanced response than would be possible from a short-run analysis as conducted in the majority of existing studies. The 200 years under investigation cover a number of external shocks such as plague and famine, along with political change and warfare. To understand how society and the economy reacts to these events, a longer time frame allows patterns to emerge and explanations to become clear.

We will subject the newly formed dataset to a sophisticated econometric analysis that will examine and quantify the deviations of actual prices from their fundamentally justifiable values. We will thus consider the extent to which the medieval English property market was subject to speculative forces. As such, it represents the first broad-based and systematic study of its kind. We will attempt to draw out the similarities between the occurrences of speculative episodes within the medieval and modern real estate markets in order to identify potential lessons for contemporary policymakers.

We analyse the Feet of Fines held at the National Archives, an incredibly extensive but underutilised resource covering most of the country from c. 1194–1832. Fines nominally record the settlement of legal disputes over property but are usually considered as fictitious lawsuits intended to convey property. They often include a ‘consideration’ or price paid for the property, which can be decomposed to provide property valuations (see Yates, 2013).

To develop our findings, we construct long-run indices of land and property prices, akin to the US ‘Case-Shiller housing index’, to put UK house prices into their historical context. The Case-Shiller (1987, 2004) index is a ‘repeated sales’-based measure of average house prices in various cities beginning in the 1980s, and which was extended back to 1890 by Shiller (2005). However, repeated sales of the same properties are not a characteristic of our medieval data and thus we employ a creative variation on their approach. Existing historical research has focused on rents and their contribution to the cost of living, rather than property prices, whereas we will investigate, amongst other things, the relationship between rents and prices.

## 2. Data

Our analysis is based on data extracted from a collection of documents known as the Feet of Fines. As outlined above, fines (also known as final concords) are copies of agreements to legal disputes over freehold property conducted in the Court of Common Pleas, one of the central English law courts. These documents originated in the late twelfth century, but by the end of the thirteenth, the lawsuits they describe are thought to be largely fictitious; both parties agreed as to the outcome of the case, and the procedure became in effect a form of property conveyance. They typically contain the following information: the date of the transaction; the type of legal action; the names of the buyers and sellers; a brief description of the property, its location and assets; and the consideration, a sum of money given in exchange for title to the property. This last element is not present in every fine; the current study has omitted those containing no mention of a monetary consideration on the assumption that these transactions are not representative of commercial market activity.

The attraction of fines lies in the fact that they exist in largely unbroken series for the period between 1195 and 1509, and have a wide geographical coverage. Despite this, fines have only recently been utilised as a source for analysis of the medieval property market, as the information they contain has been viewed as problematic due to their provenance as ‘fictitious’ lawsuits; thus several commentators have cast doubt on the accuracy of the property descriptions, and in particular, the consideration. This sum is often a round figure, leading some to argue that it was not the actual purchase price, but instead had a symbolic value (Meekings, 1946, xxii; Yates, 2013, p. 588). Nevertheless, recent research has gone a considerable way towards rehabilitating the fines as a key source for economic history; through comparison with other sources, Yates (2013) demonstrates a relationship between the considerations recorded in the fines and the perceived value of the property according to its annual return, and Yates et al. (2013) use econometric techniques in order to demonstrate how the consideration can be broken down in order to estimate the value of the constituent assets of the property in question.

Our dataset contains information extracted from 24,395 fines dating from the period 1308–1508. This includes fines from the counties of Essex and Warwickshire obtained from Yates, Campbell and Casson, and new data hand-collected from fines for the counties of Bedfordshire, Buckinghamshire, Devon, Hampshire, Hertfordshire, Herefordshire, Kent, Leicestershire, Lincolnshire,

**Table 1**  
Correlation in annual percentage changes between average consideration in pence and annual change in land traded in acres.

<i>All years</i>	0.230
<i>1308–1349</i>	0.154
<i>1350–1399</i>	0.121
<i>1400–1449</i>	-0.051
<i>1450–1509</i>	0.346

London and Middlesex, Northamptonshire, Northumberland, Nottinghamshire, Oxfordshire, Rutland, Shropshire, Worcestershire and Yorkshire. This data has been arranged within a relational database that, in addition to information taken directly from the original documents, contains several standardised fields in which this information is categorised according to type. The individual assets of each property have been categorised into seven broad groups: Land, Buildings, Manors, Goods, Livestock, Services (feudal revenues) and Tenants. These are further divided into sub-categories, of which there are 87 in total (see Bell et al., 2019b, Table 1 for summary of dataset and Figure 4 for evidence of transactions in Manors). In addition to data on the property, the database contains 92,652 records relating to the buyers and sellers. The level of detail given varies from person to person; in most cases, it is limited to their first and second name, their role in the transaction, and where applicable their relationship to the other parties (for example 'wife/son of ...'). However in a significant proportion of cases, information is also included regarding the regional origins and/or occupation of the individual. Elsewhere, this information has been used to conduct analysis on the social background and economic motivations of the buyers and sellers involved in the transactions (Bell et al., 2019a).

For additional background to this current paper - specifically on our testing for a bubble in the land market in medieval England - we are also able to provide context from two other papers utilising the same underlying dataset and that underpin the findings described here. Bell et al. (2019b) describes an extensive dataset on late medieval English freehold property transactions. They present analysis of this data and examine market activity and the nature of the properties across England between 1300 and 1500. They also investigate other factors such as war, plague and political crises, and the effects of growing commercialisation. A further study, Bell et al. (2019a), interrogates the dataset to investigate the nature of and personnel involved in property transactions. They argue that the property market provided profit opportunity via group purchases, multiple transactions and investors buying in multiple locations.

Analysis of this data reveals a number of trends. The level of market activity (as denoted by the number of monetary fines per year) is considerably higher during the fourteenth century (Fig. 1). Peaks in the number of fines occurred after the Great Famine of 1315–17 and the onset of plague in the mid-fourteenth century, suggesting a link between demographic crisis and market activity. In the case of the first of these crises, we find a positive correlation between market activity and the price of grain, supporting previous studies arguing that during the Famine smaller landholders were forced to sell land in order to buy food (Campbell, 1984; Davies and Kiscock, 2004). During the second half of the fourteenth century this correlation is less apparent, suggesting that the recovery of the land market after the Black Death is not attributable to a subsistence crisis, but to other socio-economic factors; namely, a weakening of the system of feudal landholding that allowed new buyers onto the market (Bailey, 2015, p. 150).

There is some evidence that valuations were assigned according to the perceived annual return of the property – in other words, the expected annual profits due to the holder – which gives some credence to the notion that property was considered an asset class and that a fair price to pay would be on the basis of the (discounted sum of the) cashflows that would accrue to the owner. Previous studies have examined the relationship between the property price and the corresponding annual value during the medieval period. Bean (1991, p. 567) finds that prices tended to equate to roughly 10 years' annual value in the mid-thirteenth century, rising to 20 years' annual value by the mid-fifteenth century; he emphasises, however, that these were standards, and that actual prices exhibited considerable variation. Yates (2013, p. 588) compared the considerations recorded in a sample of fines from Berkshire to the annual valuations of the same properties in IPMs, finding that 'in the 1320 s and 1330 s considerations clustered around two modal multipliers of 15 or 30 times the sworn annual value, and around 10 times the sworn annual value in the second half of the fourteenth century.' Similar to Bean, she finds wide variation, but prices ultimately settling at 20 times annual value by the end of the fifteenth century. We have conducted a similar analysis using a larger sample.<sup>2</sup> The results demonstrate wide variation – prices could be as low as 1–5 times annual value throughout the period, but by the end of the fifteenth century prices as high as 100 times annual value are recorded. In common with Bean and Yates, we therefore find that the ratio of annual value to price rises over the period, indicating an increase in the value of property.

Further data on this topic may be obtained from examination of the 'writs of covenant'. These documents were the legal writs necessary to initiate a fine, and from the mid-fifteenth century they record the 'sworn annual value' of the property in question, which determined the legal fee payable by the litigant.<sup>3</sup> Meekings (1946, pp. xxii-xxiii) found that considerations recorded in fines for Surrey during the first half of the sixteenth century were twenty times the sworn annual value stated in the corresponding writ. We have examined a sample of writs of covenant dating from between 1455 and 1478.<sup>4</sup> The ratio of annual value to price exhibits much less variation than those recorded in the IPMs; in all but a few examples the consideration is between 10 and 20 times the annual value recorded in the writ, with 18–20 times representing the modal ratio. This analysis suggests that the sworn annual values recorded in the writs, like the considerations in the fines, tended to conform to a set of standard values. The greater variation recorded in the ratios between annual value and price obtained through comparison of fines and IPMs suggests that these were less standardised, and perhaps more reflective of the true value of the property in question.

<sup>2</sup> We compare considerations for fines featuring single manors (80 observations in total) with annual valuations recorded for the same manor in printed editions of IPMs (Blagg, 1939, 1892; Brown, 1898, 1902, 1906; Fowler, 1920, 1937; Greenstreet, 1859; Standish, 1914; Train, 1951; Wills Bund, 1894a; 1894b). We would like to express our thanks to Andy Ford for his work in collecting this data.

<sup>3</sup> See Meekings (1946), pp. xiv-xvi for an explanation of this process. Writs of covenant dating from 1556 onwards survive in TNA CP 55 (<http://discovery.nationalarchives.gov.uk/details/r/C5432>) and in broken form for earlier periods in TNA CP 50 (<http://discovery.nationalarchives.gov.uk/browse/r/r/C5427>).

<sup>4</sup> TNA CP 50/1 Box 2. We matched 34 fines with their writs; in 16 cases the consideration was 18–20 times the sworn annual value, in 7 cases 15–17 times, in 5 cases 13–14 times, and in 2 cases 7–10 times. We record 3 outliers in which the considerations were 28, 50 and 60 times annual value.

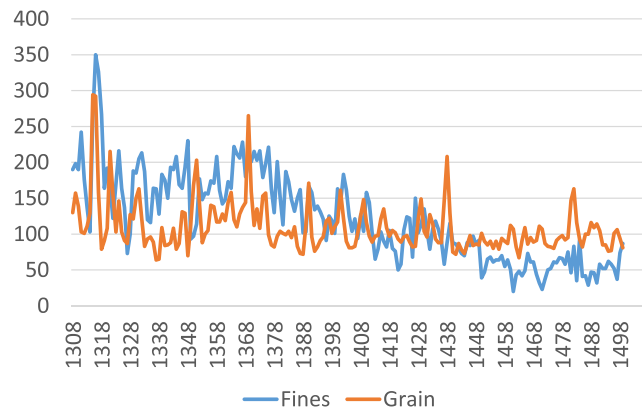


Fig. 1. Monetary fines per year and annual grain price, 1308–1500.<sup>11</sup>

An alternative way to examine the reliability of the prices recorded in the fines is to plot the relationship between average value of consideration and size of property (Fig. 2). A correlation analysis of this data, which examines the relationship between the annual average change in the total consideration for land in pence and the total amount of land traded in acres (Table 1) suggests that plot size and price were mildly positively correlated in the fourteenth century, with this correlation weakening after 1350. No correlation is evident during the first half of the fifteenth century, but there appears to be a strong positive correlation between plot size and price after 1450. This evidence indicates that, in general, prices rose in proportion to the amount of land traded over the period, with the exception of the first half of the fifteenth century, when prices appear to have continued to rise whilst the amount of land traded remained relatively static.

### 3. Methodology

Although the database of property transactions that we have collected is very large, the data required significant pre-processing before they were amenable to formal statistical analysis. Specifically, many of the transactions involved the sale of multiple assets for a single price at any point during the sample period. We therefore developed the following procedure, which is a variant on a hedonic pricing model. We ran a regression where each transaction represents a data point with the dependent variable being the total payment and the independent variables are the numbers of units of each type of asset sold, interacted with year dummy variables. Thus the model estimated for each transaction  $i$  was:

$$Payment_i = \sum_j \sum_k \beta_{jk} Year_j Asset\_type_k + u_i \quad (1)$$

where year dummy variables  $j$  are interacted with the asset-type quantity variables  $k$  so that the parameter estimates,  $\beta_{jk}$ , can be interpreted as the prices per unit of that type of asset  $k$  during year  $j$ . Some transactions involved only one asset, whereas others included several assets, and the approach that we use will separate out the contribution of each individual asset to the overall price. In multiple asset cases, it is clearly important to allow for all asset types in the model to avoid distortions in the estimated prices for the other assets within the transaction. However, for our further analysis below, we focus on two asset types for which there are sufficient numbers of transactions that we can feel reasonable confidence in the reliability of the estimated prices – namely, messuages (a plot with a house on it) and agricultural land (including arable, pasture, meadow, and crofts).

The above process results in a time series of annual prices for messuages and agricultural land spanning the period 1308–1499 (192 data points), which then form the basis of the actual market prices of those assets. This process reduced the number of observations from 24,395 transactions to 16,964. In order to determine whether there were speculative forces at work consistent with a speculative bubble, we need comparable measures of the fundamental values in each case, but how should we do this? Lind (2009) has suggested that it is so hard to measure housing fundamentals that we should revert to what Garber (2001) termed the ‘chartist view of bubbles’ where they are measured simply by reference to the dynamics of the price series alone and evidence for a bubble is taken to be simply a dramatic swing in prices. A more recent generation of tests in this vein focusing on the price series are the explosive root tests developed by Phillips and Yu (2011). In a recent comparison of several approaches to determining whether bubbles existed in various city housing markets, Bourassa et al. (2016) found that the simplest approach – based on a simple price-to-rent ratio, outperformed several other more sophisticated models in enabling a researcher to detect a bubble ‘in process’ rather than merely after the event. Rents are particularly useful as a fundamental measure in the context of housing for two reasons. First, for a pure investor in property as an asset (i.e., a non-resident), they capture the flow of income that would accrue to the purchaser akin to the flow of dividends that a stock investor receives. Second, for a home owner who lives in the house, rents are an approximate measure of the consumption benefit that they receive (Englested et al., 2015). Rents have been widely applied in the literature as a measure of fundamentals for real estate (see, for example, Gallin, 2008; Hamilton and Schwab, 1985; Meese and Wallace, 1994). Nneji et al. (2015) follow Roche (2001) in



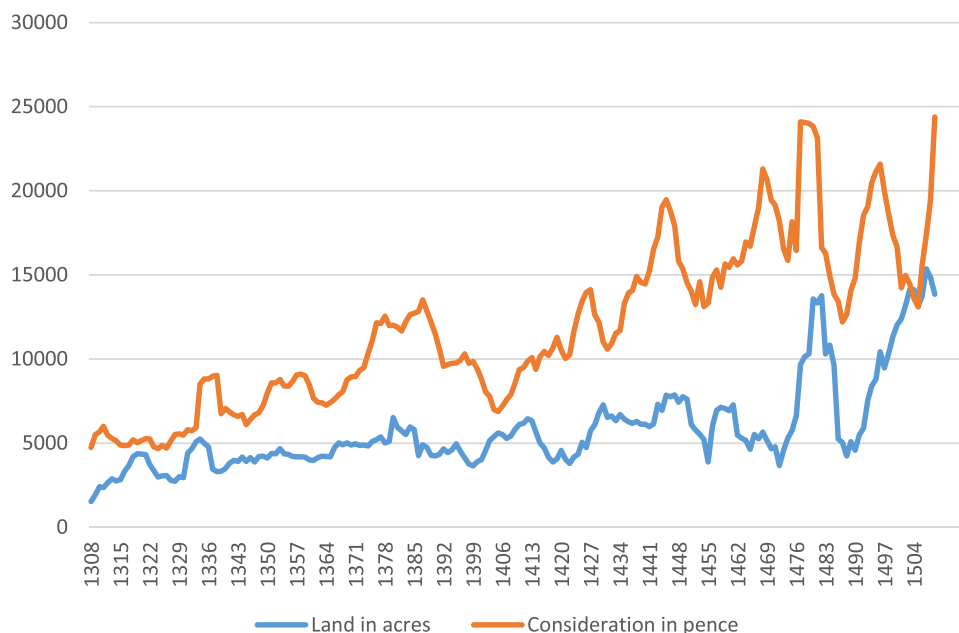


Fig. 2. Consideration and land traded (5 year moving averages).

**Table 2**  
Parameter Estimates for the Speculative Bubble Model and Tests of Restrictions.

Parameters	Messages	Agricultural land
$\beta_{s,0}$	-0.437 (0.030) ***	1.755 (0.006) ***
$\beta_{s,1}$	-1.023 (0.022) ***	0.209 (0.003) ***
$\beta_{c,0}$	1.000 (0.005) ***	1.000 (0.016) ***
$\beta_{c,1}$	-0.00007 (0.00005)	-0.0006 (0.0002) ***
$\beta_{q,0}$	-80.031 (1.640) ***	-26.454 (1.038) ***
$\beta_{q,1}$	-19.820 (0.343) ***	-1.857 (0.021) ***
$\sigma_s$	0.447 (0.007) ***	0.140 (0.0006) ***
$\sigma_c$	0.062 (0.003) ***	0.214 (0.011) ***
Log-likelihood function value	258.307	23.238
	Messages	Agricultural land
Restrictions	Satisfied?	Satisfied?
$\beta_{s,0} \neq \beta_{c,0}$	No	Yes
$\beta_{c,1} < 0$	Yes	Yes
$\beta_{s,1} > \beta_{c,1}$	No	Yes
$\beta_{q,1} < 0$	Yes	Yes

Notes: The model is described in Eqs. (7) and (8) in the text. Standard errors in parentheses; \*\*\* denotes significance at the 1% level. Estimation effectively uses 190 annual observations.

running a regression of the house price index on measures that capture fundamentals, with the residuals from the model then representing the non-fundamental component.

For messages, an appropriate measure would be based on rents, as discussed in the literature review above, while for agricultural

<sup>1</sup> Annual grain prices taken from Farmer (1988), pp. 790–1 and Farmer (1990), pp. 502–5. Prices are in shillings per quarter using a base index (100) derived from the mean of prices 1330–1347 (Wheat 5.09 s, Rye 4.05 s, Barley 3.78 s, Oats 2.25 s, Peas 3.55 s).

land, analogous cashflows would be based on the prices of output that would arise from use of the land. For this purpose, we employ wool and grain (Bell et al., 2019b Table 2).<sup>5</sup> In each case, we run a regression of the actual price on a constant and the fundamental measure, with the residuals then representing the non-fundamental component. Note that by construction, such a non-fundamental measure will have a mean of zero and also note that at this stage we cannot name these residual terms as a ‘bubble’ as this is to be tested subsequently.

Our model for the non-fundamental component of asset price movements is based on that proposed by van Norden and Shaller (1993, 1999, 2002). This has been employed in a number of studies in both the mainstream finance literature pertaining to stock prices (see, for example, Brooks and Katsaris, 2005a, 2005b) and also, more closely related to the present work, in the present-day real estate area (e.g., Roche, 2001; Nneji et al., 2013a, 2015), although as far as we are aware, there exist no extant applications to historical data. Therefore, we provide only a skeleton derivation of the model and readers are directed to these earlier papers for further details.

We employ formal tests for speculative bubbles in property price indices. One approach that can be used involves the adoption of a fixed effects panel regression to test for cointegration between regional property price indices and suitably constructed indices of fundamental values, utilising rental information within a discounted cashflow framework to calculate intrinsic valuations for property viewed from a pure investment perspective. If prices and rents are found not to be cointegrated, this implies that there are no market forces tying them together in the long run and thus they may wander apart, which is taken as evidence in favour of a speculative bubble. However, cointegration tests have difficulty in detecting periodic bubbles which form, collapse and then subsequently reform again. In order to test for the presence of such bubbles, we will instead use the regime switching models of van Norden and Shaller (1993), which have successfully been employed in the modern real estate context by Brooks et al. (2001). These specifications test for rational bubbles where investors are compensated for the increasing risk of bubble collapse by ever higher returns. In these models, the likelihood of collapse of the bubble is estimated probabilistically as a positive function of its size.

Our starting point is the basic decomposition due to Blanchard and Watson (1982) of the actual value of an asset price,  $P_t^a$ , into the fundamental component,  $P_t^f$ , and the bubble component,  $B_t$ :

$$P_t = P_t^f + B_t \tag{2}$$

The bubble component is expected to grow at a given rate  $r$  on average, which is sufficient to compensate the investor for the possibility that the bubble will burst at time  $t + 1$  and the investor would lose money:

$$E_t(B_{t+1}) = B_t(1 + r) \tag{3}$$

Blanchard and Watson propose a two-state model where the bubble can either survive (state  $S$ ) with probability  $q$  and grow by an expected factor of  $(1 + r)/q$ , or the bubble can collapse (state  $C$ ) with probability  $(1-q)$  in which case it falls to zero.

$$E_t(B_{t+1}|S) = B_t \frac{(1+r)}{q} \text{ with probability } q$$

$$E_t(B_{t+1}|C) = 0 \text{ with probability } 1 - q \tag{4}$$

The probability of collapse,  $q$ , is proposed to be a positive function of the size of the bubble relative to the actual price ( $b_t = B_t/P_t^a$ ):

$$q = q(b_t) \tag{5}$$

Given Eqs. (2–5), van Norden and Shaller specify the following bubble process, which is more general than that of Blanchard and Watson as it does not require the bubble to collapse completely to zero, and the bubble process would replace (4) with the following:

$$E_t(B_{t+1}|S) = B_t \frac{(1+r)}{q(b_t)} - \frac{1-q(b_t)}{q(b_t)} u(b_t) P_t \text{ with probability } q(b_t)$$

$$E_t(B_{t+1}|C) = u(b_t) P_t \text{ with probability } 1-q(b_t) \tag{6}$$

where  $u(b_t)$  is a continuous and everywhere differentiable function. When the bubble process is specified in a two-state model in this way, it leads to a similar two-state framework for the returns, which van Norden and Shaller specify as:

$$R_{t+1}^s = \beta_{s,0} + \beta_{s,1} b_t + \varepsilon_{s,t+1}$$

$$R_{t+1}^c = \beta_{c,0} + \beta_{c,1} b_t + \varepsilon_{c,t+1} \tag{7}$$

where the probability of being in the surviving regime,  $q(b_t)$ , is a function of the absolute size of the bubble as a proportion of the actual value:

$$q(b_t) = \Phi(\beta_{q,0} + \beta_{q,1} |b_t|) \tag{8}$$

Further,  $\sigma_s$  and  $\sigma_c$  denote the standard deviations of the error terms  $\varepsilon$  for the return equations in the surviving and collapsing states respectively.  $\Phi$  is a standard normal cumulative distribution function, which by construction will guarantee that the probability of collapse is bounded between zero and one.

<sup>5</sup> Grain and wool prices are taken from Farmer (1988), pp. 790–1; 809–10 and Farmer (1991), pp. 502–5; 512–16. Prices are in shillings per quarter using a base index (100) derived from the mean of prices 1330–1347 (Wheat 5.09 s, Rye 4.05 s, Barley 3.78 s, Oats 2.25 s, Peas 3.55 s).

The test for whether the dynamics in the series under consideration are consistent with periodic, partially collapsing speculative bubbles takes place indirectly via an examination of the parameter values of the model specified by Eqs. (7) and (8). vNS propose four conditions to test the plausibility of the model in this way and thus to test for bubbles:

1. The intercepts in the two return equations,  $\beta_{s,0}$  and  $\beta_{c,0}$ , should differ, with the former expected to be greater than the latter.
2. The parameter attached to the bubble measure should be greater in the surviving regime,  $\beta_{s,1}$ , than the corresponding parameter in the collapsing regime,  $\beta_{c,1}$ .
3.  $\beta_{c,1}$  should be negative so that a bigger bubble implies lower (or more negative) returns in the collapsing regime.
4. The probability of the bubble surviving should be a negative function of the size of the bubble, so  $\beta_{q,1}$  should be negative.

#### 4. Findings

We estimate the model specified by Eqs. (7) and (8) using the maximum likelihood procedure outlined in Brooks and Katsaris (2005a) (2005b), with the results presented in Table 2 in column 2 for messages and column 3 for agricultural land. For both series, almost all of the parameter estimates are significantly different from zero. However, it is also clear that the models represent very different characterisations of the data across the two series. In the case of messages, the second panel of the table suggests that only two of the restrictions on the parameter estimates to identify speculative bubbles as a plausible description of the series are satisfied. Specifically, returns in the collapsing state are a negative function of the bubble size ( $\beta_{c,1} < 0$ ) and the probability of the bubble surviving,  $q$ , is also a negative function of the bubble size ( $\beta_{q,1} < 0$ ). Thus, while these parameters have the theoretically plausible signs and magnitudes, the others do not. The intercept in the surviving regime is smaller than in the collapsing regime, and returns are a less negative function of the bubble size in the surviving regime than in the collapsing regime.

For the agricultural land series, on the other hand, all of the parameter estimates satisfy the four restrictions required for the dynamics to be consistent with a speculative bubble being present in the series. Thus the intercept in the return equation is greater for the surviving than the collapsing state ( $\beta_{s,0} > \beta_{c,0}$ ), and the return is a positive function of the bubble size in the surviving state and a negative function in the collapsing state. Also, the probability of the bubble surviving is lower the larger is the size of the bubble ( $\beta_{q,1} < 0$ ). The latter results are highly intuitive and suggest that, when a bubble has developed and is present in the actual value of the series, provided that it does not collapse, then it propels returns upwards as investors are being compensated for the increasing probability of collapse by ever higher returns. When the bubble does collapse, prices fall by more (negative returns) the greater is the size of the deviation of actual prices over fundamental values: thus, the bigger the bubble, the larger the 'correction' when the market turns and prices do eventually fall.

Three bubbles in agricultural land are observable, all of approximately 10 years' duration: from 1383 to 1394, from 1414 to 1425, and from 1474 to 1484. The economic circumstances contributing to the formation of these bubbles is likely to have varied from case to case, but we are able to suggest several possible hypotheses.

The first two periods do fall in the conflict between England and France known to historians as the Hundred Years' War. 1383 – 1394 was a period of intermittent warfare with France as Richard II established his authority against some challenge from his uncles and nobility. It is also notable for campaigns to Scotland in 1385 and to Ireland in 1394. However, none of this is on a scale that would drive our bubble event (Bell, 2004). 1414 – 1425 is a more involved period taking in Henry V's invasion of Normandy, victory at Agincourt and premature death in 1422. As these events were external to England, and would actually have placed pressure on the land market in terms of funding the expedition, we found other economic drivers to explain the bubble event (Curry, 2003).

In the earlier two cases, the formation of the bubble coincides with a pronounced rise in the value of England's cloth exports, suggesting that the profits of overseas trade were being invested in the land market (Carus-Wilson and Coleman, 1963). In addition, all three bubbles took place at a time when England was experiencing periodic currency shortages, which were off-set to some degree by an increasing reliance on gold coinage (Nightingale, 2010; Day, 1987, p. 35). By the 1420 s, gold predominated over silver, resulting in illiquidity and a concentration of coin in the hands of a wealthy minority who were more easily able to engage in high-value purchases. These individuals were often based in London, as this gave them greater access to credit and mercantile networks where gold could be traded easily (Nightingale, 2010, pp. 1094–5). The earlier two bubble episodes, in particular, may therefore be viewed as a product of rising land prices due to the exclusion of small landowners from the market (Yates, 2013, pp. 592–7; Bell et al., 2019a, p. 10). In this context, the collapse of the early fifteenth-century bubble may have been precipitated by the re-establishment of the Calais mint in 1422 and subsequent increase in volume of silver coinage, which increased liquidity and opened up the market (Nightingale, 2010, pp. 1096–7). This is reflected in the level of activity in the freehold land market; the number of transactions per year falls to a new low between 1412 and 1423, but appears to have recovered almost to its previous level by 1431 (Bell, Brooks and Killick, 2019b). This theory is supported by evidence of London merchants as particularly active in purchasing property during this period (Bell et al., 2019a).

The late fifteenth century bubble (which is the most pronounced of the three) occurred just as England was emerging from a Europe-wide economic recession referred to as the 'Great Slump'. During the 1450 s and 1460 s the UK economy had displayed a pronounced deflationary trend, accompanied by population stagnation and a decline in production and in overseas trade (Hatcher, 1977, pp. 35–54; Hatcher, 2002). Recovery began in the 1470 s, and the volume of overseas trade between 1479 and 1482 was three times as high as it had been between 1456 and 1471 (Hatcher, 2002, pp. 270–2; Britnell, 1995, p. 54). In addition, the decade following the restoration of Edward IV in 1471 is seen as a period of relative peace in the series of civil wars known as the Wars of the Roses, and this comparative political stability is likely to have contributed to a resurgence in investing (Grummitt, 2013, pp. 103–32). In this

context, it is significant that this bubble in land bursts immediately after Edward's death in 1483, which precipitated further political conflict.

## 5. Conclusions

This paper has conducted a detailed analysis of the time-series dynamics of the medieval property market with specific reference to whether the movement of asset prices was consistent with the presence of speculative bubbles. The data are hand-collected from the Feet of Fines, and we construct a database comprising nearly 25,000 individual transactions. Using an approach that is entirely novel in the historical literature, we apply a regime switching model for periodic, partially collapsing bubbles to annual series of the prices of messuages and of agricultural land over a horizon spanning almost 200 years. We find parameter estimates that are consistent with the presence of periodic, partially collapsing speculative bubbles in the market for agricultural land; however, there is no such evidence in the price series of messuages. The reason for this is, as we have argued in this paper, is that the bubbles in agricultural land were driven by wealthy buyers and increased investment in pastoral farming. Messuages are low-status, low-value properties – essentially a dwelling-house with enough land to support a single extended family – and therefore unlikely to appeal to this group, who would have been looking to increase their estate through the purchase primarily of land, not dwellings/outbuildings. In addition, post-Black Death population decline would have decreased the overall demand for dwellings.

An interesting contemporary comparison with our findings above occurs from examining the recent proposed so-called “barn bubble” in agricultural land. A number of American economists have discussed this including Robert J. Shiller, who suggested that “his favourite dark-horse bubble from the next decade or so is farmland” (Shiller, 2011). The fact that the medieval economy was primarily agricultural allows us to consider whether such a property bubble of this specific nature would be more likely to occur in the period under discussion. We need to keep in mind that the drivers for such a phenomenon may be different though – for instance, in contemporary land markets demand would be driven by world-wide commodity prices and speculative purchase of agricultural land in the hope that it may be re-zoned for housing in the near future. In the medieval period we would expect that such a bubble may be connected to local and national commodity price indices, but that speculation linked to potential house building is less likely.

It is notable that none of these bubbles in the land market appear to have occurred during a period of unusually high activity in the freehold property market. Indeed, the overall trend in both the customary and freehold markets from the late fourteenth century onwards was of a decline in rents and in the profitability of agriculture (Hatcher, 2002, pp. 255–62; Britnell, 1995, pp. 51–6). We cannot therefore attribute these bubbles to an increase in competition in the land market overall, but instead we argue that prices for high-status properties were driven up by certain groups of wealthy buyers. These individuals exhibited an increasing tendency to buy up numerous small parcels of land in order to accumulate large estates (Bolton, 1980, pp. 209–11; 238–9; Campbell, 1984, pp. 103–5, Mullan and Britnell, 2010, pp. 77; 136–48; Yates et al., 2013, pp. 132–3; Yates, 2013, pp. 585–7). Whilst grain prices were low, prices for meat and dairy produce remained relatively buoyant, meaning that investment in pastoral farming became an increasingly attractive prospect (Hatcher, 2002, pp. 249–55). The existence of bubbles in the late medieval market for agricultural land therefore may be viewed as a clear sign of the increasing commercialisation of the English agrarian economy.

In terms of implications for current policymakers, what themes have we found from these historical speculative bubbles in agricultural land? It is clear that profits from trade can contribute to bubbles in real assets, especially in uncertain economic times, as investors look for safe havens. Such bubbles can be driven by the behaviour of wealthy minorities and could be counter to the health of the economy at large. An obvious parallel here would be recent house price rises in particular areas of London favoured by non-domiciled overseas investors.

## Author statement

We acknowledge that this work is an original article based on primary research.  
Adrian R Bell.

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