Impact of Housing Policy Uncertainty on Herding Behavior: Evidence from UK's Regional Housing Markets

Geoffrey M. Ngene* and Rangan Gupta**

Abstract

This study investigates the impact of housing policy uncertainty on the herding behavior in the UK's regional housing markets. Using a sample of thirteen regional housing markets and quarterly data from 1973Q4 to 2019Q2, we find that the probability of herding behavior is increasing in policy uncertainty in nine of the thirteen regions and the national housing market. However, London and the Outer Metro regions, which have a high presence of institutional investors and high population, exhibit decreasing probability of herding as policy uncertainty increases. We attribute this to the presence of informed investors and low asset value uncertainty. Therefore, since herding amplify market volatility, instability, fragility and asset mispricing, policy makers need to minimize policy uncertainties and implement regulatory mechanisms such as circuit breakers to circumvent the policy information risk from inducing non-information and irrational herding behavior among the investors.

JEL Codes: C32, G11, G14

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* Corresponding author. Stetson-Hatcher School of Business (SHSB), Mercer University, 1501 Mercer University Drive, Macon, GA 32107, USA. Email: ngene_gm @mercer.edu.

** Department of Economics, University of Pretoria, Pretoria, 0002, South Africa. Email: rangan.gupta@up.ac.za.

1. Introduction

In the presence of uncertainty regarding assets' future values, investors tend to suppress their own beliefs and private information when making investment decisions. They are likely to observe and imitate other investors' actions, resulting in herding behavior characterized by exuberance and irrational synchronization of investment decisions. This causes an increase in asset prices beyond values justified by fundamentals and in the formation of price bubbles. (Friedman, 1984; Dreman, 1979). As Lobao and Serra (2007) note, increased uncertainty, especially during extreme up and down markets, reduces informational quality and precision, initiating strong herding behavior among investors. Herding behavior causes mispricing of assets, distorted price discovery, and reduction in portfolio diversification benefits as asset prices (and returns) become increasingly correlated (Ngene et al. 2017, Shiller, 2003). Babalos et al. (2015) also argue that the development of complex financial innovation, unsuitable risk management, inadequate transparency, moral hazard, and an upsurge in leverage provides a conducive environment asset price booms (bubble) and bust cycles. For example, the expansionary monetary policy and lax borrowing and credit standards in the US (and in most developed countries) financial system in the late 1990s and early 2000s was the harbinger of the exponential housing price boom between 2003 and 2006 and subsequent bust in 2007 which engendered the global financial crisis (GFC).

With notable exceptions of Ngene et al. (2017) and Cakan et al. (2019), studies in herding behavior in the housing market are based on Real Estate Investment Trusts (REITs) (See, for example, Akinsomi, 2016, 2017, 2018; Zhou and Anderson, 2013; Philippas et al., 2013, among others.). As these authors aptly argue, REITs are leveraged and tradable securities hence subject to market-wide sentiments. The overall herding behavior among equities can distort and contaminate REITs investors' herding behavior, especially during extreme up and down markets when investors engage in correlated trading decisions and actions. Therefore, unlike REITs, direct real estate prices remain the purest representation of real estate. While an argument can be put forth that real estate is illiquid, it is noteworthy that investors demand an illiquidity premium in real estate pricing. Indeed, Rapaport (1997) contends that economic agents concurrently pick the price and quantity of housing units they want to consume as they have to choose the housing unit's location and the different housing prices across regions.

Past studies have shown that market uncertainty (proxied by volatility) exacerbates herding behavior. The impact of Economic Policy Uncertainty (EPU) on economic performance and financial assets such as stocks and REITs have been extensively studied in the literature. (See, for example, Baker et al. (2016), Li et al. (2016), Brogaard (2015), Antonakakis et al. (2013), Philippas et al. (2013), and Pastor and Veronesi (2012), *inter alia*).

Policy uncertainties are generated by the political process, government actions, and motives. Pastor and Veronesi (2012) show that the economic and political shocks generated by policy changes are sources of uncertainty for corporate and household sectors in making investment decisions. If herding behavior is amplified during periods of uncertainty, we expect housing policy uncertainty (HPU) to exacerbate the herding behavior phenomenon since HPU is a policy information risk. Herding behavior triggers asset mispricing and plays a vital role in market volatility (Blasco et al., 2012). HPU is one of the prominent proxies of market stress which can originate irrational investor behavior. Therefore, understanding the impact of HPU on herding behavior and the resulting market volatility and asset mispricing can help policymakers develop and implement regulatory policies such as circuit breakers to mitigate the destabilizing effects of herding-induced risk.

An issue that has not been investigated in past studies is how housing market-specific policy uncertainty affects the probability of herding behavior. However, the impact of overall policy uncertainty on increased regional housing market herding has been depicted by Ngene et al. (2017) and Cakan et al. (2019) for the United States (US) and South Africa, respectively. This paper addresses two major gaps in extant literature by investigating the effect of housing market-specific policy uncertainty on the UK housing market during 1973-2019 across thirteen different geographical regions. First, this is the first paper to empirically investigate the effect of varying levels of housing market-specific policy uncertainty on herding behavior at different regional housing markets. Second, Cameron et al. (2006) underscore the necessity for research to draw inferences on the more disaggregated and informative regional housing market data. The extra information gleaned from regional data provides more accurate estimates of the effect of housing market policy uncertainty on the regional-level herding behavior relative to the overall UK housing market index. Any differences across the idiosyncratic regions in documented evidence buttresses the findings by Ashworth and Parker (1997) that the national UK housing price index is likely to mask valuable insights gained from variations in regional housing markets.
e fill this gap in the literature by focusing on the UK regional housing and national housing markets.

The choice of the UK regional housing market is motivated by several factors. Over the past two decades, UK has experienced an increasingly limited supply of housing units coupled with high demand for owned and rental single-family and multi-family housing units. Further, the continued urban gentrification, especially in Southern England, has triggered structural imperfections in the UK property markets (Hamnett, 2009). Granted the existing structural flaws in the UK housing markets and the effect of housing market policy uncertainty on herding behavior, this study affords a timely empirical investigation of how HPU affects the herding behavior in the UK's regional housing markets. Lastly, the choice of the UK's housing market is understandably driven by the availability of the HPU,[1] besides providing an additional case study to those that exist for the US and South Africa.

The present investigates the impact of housing market-specific policy uncertainty, i.e., HPU, on herding behavior in the UK housing market. We identify periods of herding behavior in different UK regions and investigate how the UK's HPU impacts herding behavior. Briefly, we find that the probability of herding behavior increases in HPU in nine of the thirteen regions and the national housing market. The remainder of the study is organized as follows: Section 2 outlines the data, and Section 3 details the methodology. Section 4 discusses the empirical results, while Section 5 offers the conclusion.

2. Data

We collect quarterly, regional-level house price indexes from the Nationwide Building Society website[2]. The data covers 13 UK regions, namely East Anglia, East Midlands, London, Northern Ireland, North, Northwest, Outer Metro, Outer SE, Scotland, South West, Wales, West Midlands, and Yorkshire and Humberside, as well as the UK's general housing market index. We also gather the quarterly housing economic policy uncertainty (HPU) series from the United Kingdom Housing Observatory.[3] The HPU index is constructed by Yusupova et al. (2020) using the methodology suggested by Baker et al. (2016). The HPU is an index of search results from five large newspapers in the UK: The Guardian, The Independent, The Times, Financial Times, and Daily Mail. In particular, the authors use LexisNexis digital archives of these newspapers to obtain a quarterly count of articles that contain the following three terms: 'uncertainty' or 'uncertain';

[1] Nguyen Thanh et al., (2020) has also developed a real estate uncertainty index for the US, but the data availability is till 2017, and provides an opportunity to analyse its role in US regional housing markets as part of future research.
[2] https://www.nationwide.co.uk/about/house-price-index/download-data#xtab:regional-quarterly-series-all-properties-data-available-from-1973-onwards.
[3] https://uk.housing-observatory.com/dashboard.html.

'housing' or 'house prices' or 'real estate'; and one of the following: 'policy', 'regulation', 'Bank of England, 'mortgage', 'interest rate', 'stamp-duty', 'tax', 'bubble' or 'buy-to-let' (including variants like 'uncertainties', 'housing market' or 'regulatory'). To meet the search criteria, an article must contain terms in all three categories. The resulting series of search counts is then scaled by the total number of articles in the given newspaper and in the given quarter. Finally, to obtain the HPU index, Yusupova et al. (2020) average across the five newspapers by quarter and normalize the index to a mean of 100. The housing market index (HPU) series runs from 1973Q4 (1982Q1) to 2019Q2. The availability of data dictates the sample period. For each index, the continuously compounded returns, $R_{i,t}$ are derived as the natural log difference multiplied by 100.

3. Econometric modeling

The cross-sectional absolute deviation (CSAD), proposed by Chang et al. (2000), is the most widely used measure of the dispersion of returns in herding behavior literature. In the present study, we use absolute deviation (AD) of return of region i at period t ($R_{i,t}$) from the market return at the same period ($R_{m,t}$). Formally,

$$AD_t = \left| R_{i,t} - R_{m,t} \right| \quad (1)$$

Following Chang et al. (2000), we investigate the herding behavior using the following nonlinear regression model.

$$AD_t = \gamma_0 + \gamma_2 \left| R_{i,t} \right| + \gamma_3 R_{i,t}^2 + \varepsilon_t \quad (2)$$

Herding behavior is extant if the coefficient γ_3 is negative and statistically significant. Herding behavior is time-varying (See, for example, Babalos et al., 2015, Philippas et al., 2013) and will be distorted by structural changes in the relationship between dependent and explanatory variables. To confirm this possibility, we employ the Bai and Perron (1999, 2003) structural break test of the herding model in Eq. (2).[4]. To this end, we run a 10-year (40 quarters) rolling regression to circumvent distorted empirical results occasioned by structural breaks.

In general, our econometric modeling proceeds as follows. First, for each of the UK's fourteen regional housing markets and the general UK housing market, we run the rolling regression based on equation 2. Second, for each series, we extract the rolling herding coefficient estimate, γ_3 and generate the following binary values,

$$Herding = \begin{cases} 1 \; if \;\; \gamma_3 \; is \; negative \; and \; significant \\ 0 \; otherwise \; (herding \; does \; not \; exists) \end{cases} \tag{3}$$

We then run a probit model where the dependent variable is the herding binary variable specified in Eq. (3), while the explanatory variable is the UK's housing policy uncertainty (HPU) index. Precisely, the probit model is set as follows:

$$\mathrm{P}(y_i = 1|x_i) = \Phi(\beta x_i) \text{ and } \mathrm{P}(y_i = 0|x_i) = 1 - \Phi(\beta x_i) \tag{4}$$

Where P is the probability, y_i represents a binary variable, 1 or 0, ($i = 1, 2, \dots\dots, T$ iid observations) indicating presence of herding behavior or otherwise, in the region, Φ is the Cumulative Distribution Function (CDF) premised on the standard normal distribution, x_i is a $1\times K$ vector of predictor variables, while β is a $K \times 1$ vector of coefficients estimated by maximum likelihood estimation.

4. Empirical Evidence

According to the descriptive and distributional statistics presented in Table 1, London had the highest average quarterly returns. In contrast, West Midlands (Northern Ireland) had the highest (lowest) percent price increase (decline) during the sample period. Northern Ireland (Scotland)

[4] See Ngene, Jordin and Mungai (2018) for the discussion and application of Bai and Perron (1999, 2003) structural break model.

housing market experienced the highest (lowest) average volatility of housing returns. Apart from London, Northern Ireland, Outer Metro, Outer SE, and Scotland, the rest of the regions exhibit positive skew of housing returns, suggesting more positive than negative returns. This is consistent with the notion of sustained house price rallies with occasional price declines. Further, the low negative skew coupled with low excess kurtosis (Kurtosis-3) for London and Outer SE generated normally distributed returns since the Jacque-Bera statistic is not different from zero. The rest of the regions' returns are characterized by excess kurtosis and fat-tail distribution, which seem to be the key driver of the non-normal return distribution.

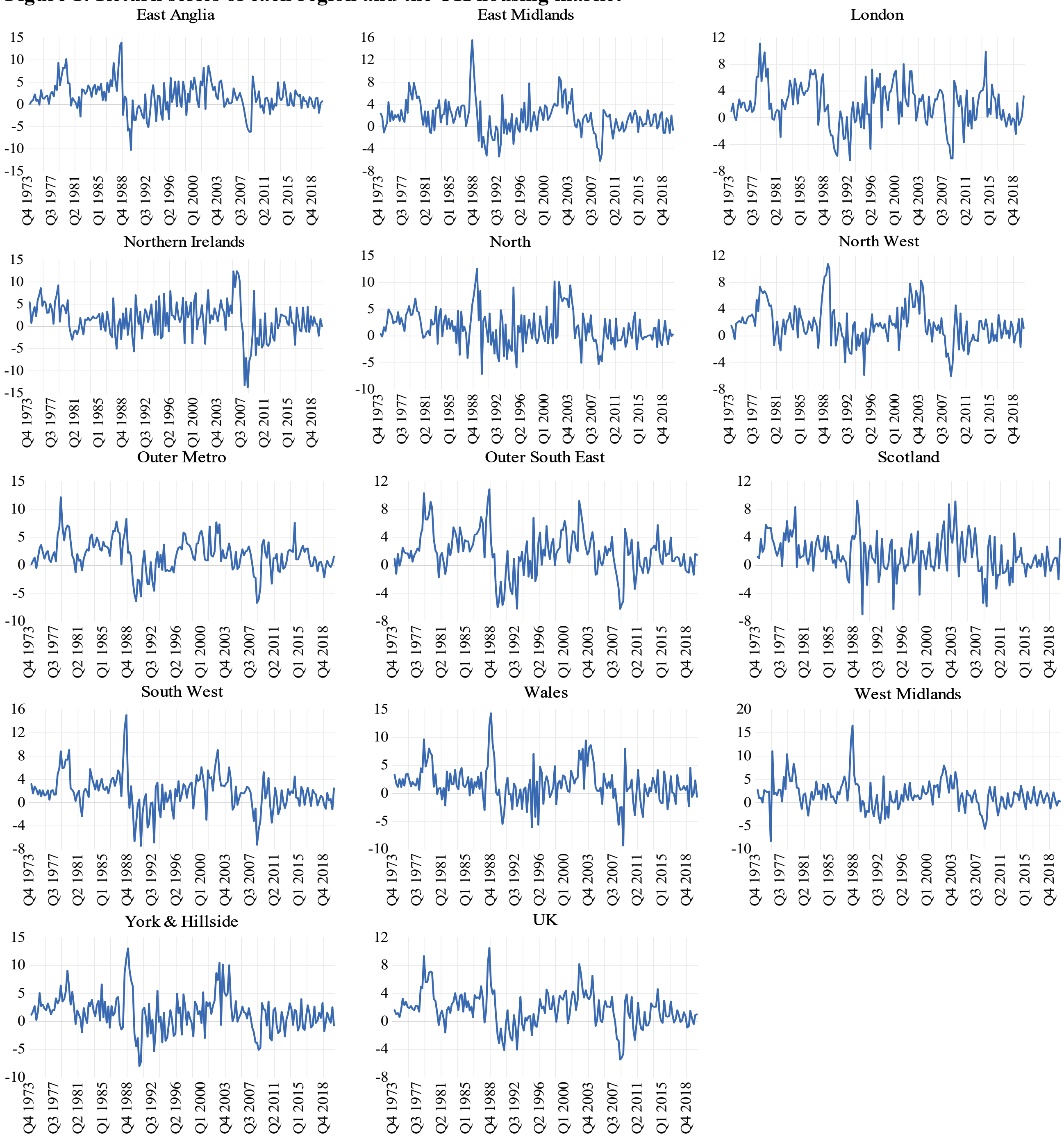
Table 1: Descriptive and distributional features of housing returns

Region	Mean	Max	Min	Std. Dev.	Skew	Kurtosis	Jarque-Bera	N
East Anglia	1.687	13.918	-10.231	3.416	0.205	4.642	22.201***	186
East Midlands	1.656	15.541	-6.169	2.984	0.787	5.904	84.527***	186
London	1.941	11.146	-6.402	3.190	-0.072	3.219	0.533	186
Northern Ireland	1.555	12.438	-13.710	3.998	-0.361	4.577	23.309***	186
North	1.517	12.587	-7.126	3.295	0.393	3.564	7.253**	186
North West	1.643	10.766	-6.005	2.776	0.484	4.033	15.540***	186
Outer metro	1.798	12.151	-6.776	2.922	-0.080	3.986	7.729**	186
Outer SE	1.750	10.850	-6.259	3.099	-0.010	3.713	3.938	186
Scotland	1.531	9.217	-7.063	2.690	-0.039	3.844	5.574*	186
South West	1.755	15.031	-7.469	3.054	0.305	5.932	69.504***	186
Wales	1.557	14.323	-9.373	3.281	0.429	4.817	31.289***	186
West Midlands	1.630	16.556	-8.318	3.038	0.913	7.106	156.528***	186
Y&H	1.527	13.060	-8.038	3.304	0.421	4.253	17.650***	186
UK	1.675	10.504	-5.492	2.530	0.198	4.200	12.379***	186

Note: N is the number of quarterly observations. ***, ** and * means significance at 1%, 5% and 10% level, respectively. Y&H is Yorkshire and Humberside.

Figure 1 graphically illustrates the evolution of the housing price returns for each of the thirteen housing market regions and the UK. The graphs confirm that Northern Ireland, followed by East Anglia, experienced the steepest decline in house prices, consistent with the minimum returns reported in Table 1. Conversely, West Midlands, East Midlands, and South West, in that order, recorded the highest increase percent increase in house prices in a quarter. The use of the UK's overall return is likely to mask the distinctive descriptive and distributional features of the regional housing market returns.

Figure 1: Return series of each region and the UK housing market



It is possible that the herding regression model in Eq. (2) is characterized by structural breaks given the boom-bust cycles associated with the housing market. Figure 1 reveals marked differences in variations in regional housing market returns. The sharp upsurges and plummets in housing returns for each region over the sample period point to potential structural breaks occasioned by housing policies, domestic and global economic cycles, monetary policies, and changes in demand for housing due to population growth and labor mobility. We, therefore, test for fundamental shifts in herding behavior. We conduct a full model structural break test using the Bai and Perron (1998, 2003a) sequential *L+1* breaks vs. *L* testing methodology.

Table 2: Structural Breaks test for the herding model, Equation 2.

	Ho versus Ha and F-statistics						
Region	0v1	1v2	2v3	Structural break dates			N_B
East Anglia	17.397**	37.109**	21.743**	1987Q3	1995Q4	2002Q3	3
East Midlands	15.840**	25.613**		1989Q1	1998Q2		2
London	30.607**			1985Q2			1
Northern Ireland	9.196						0
North	14.818**	46.574**		1986Q4	1998Q2		2
North West	20.379**	31.145**		1990Q2	2000Q3		2
Outer metro	18.953**	18.728**		1983Q2	2005Q1		2
Outer SE	16.911**	39.458**		1989Q1	1997Q1		2
Scotland	15.764**	58.407**		1986Q4	1995Q4		2
South West	15.332**	46.766**		1987Q4	1997Q2		2
Wales	56.856**	17.153**		1989Q1	1999Q2		2
West Midlands	20.564**			1981Q4			1
Y&H	22.540**	30.198**	18.048**	1982Q2	1989Q1	2001Q2	3
UK	39.812**	113.518**	20.837**	1986Q3	1996Q2	2010Q3	3

Notes: N_B is the number of structural breaks. The critical F-statistics at 5% significance level is 13.98, 15.72, 16.83 and 17.61 for 0v1, 1v2, 2v3 and 3v4 sequential tests, respectively. Y&H refers to Yorkshire and Humberside.

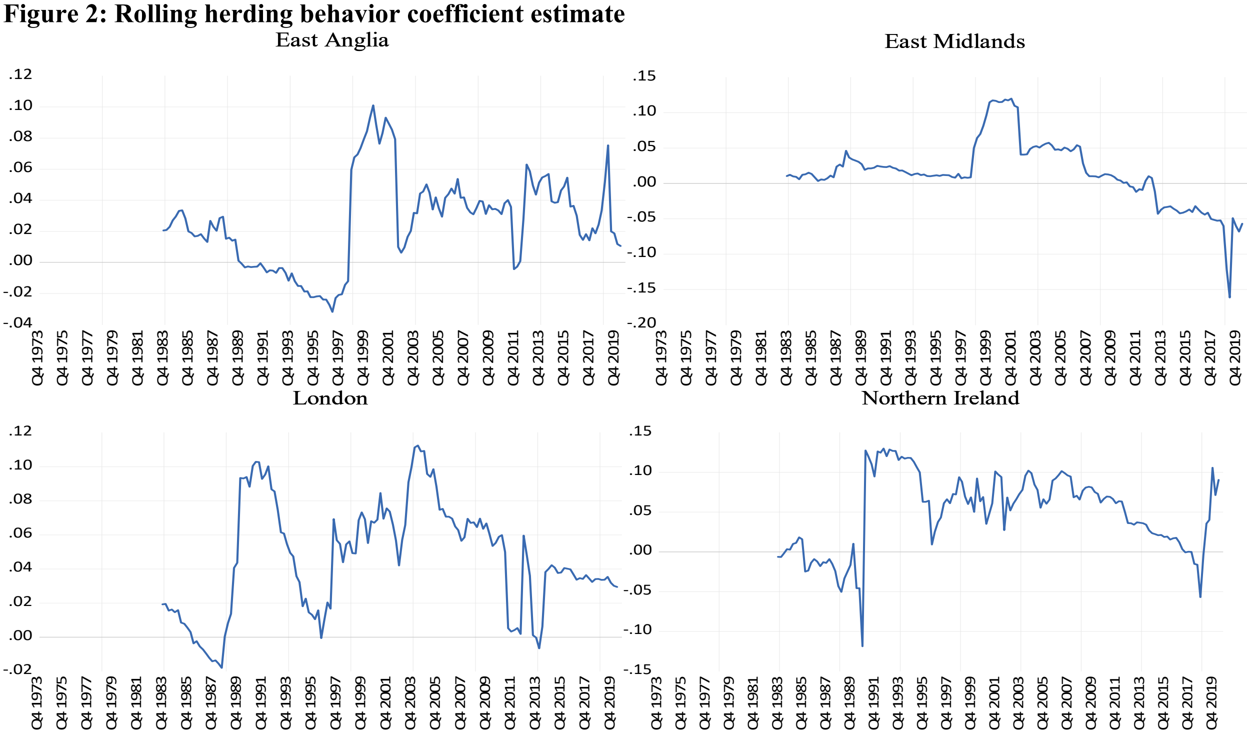
For example, 0v1 (1v2) sequential test has the null that there are zero (one) breaks. The alternative hypothesis is that there are one (two) structural breaks. Rejection of the null confirms the presence of *1, 2, 3, ….., N_B*. We set a maximum number of breaks, N_B to 5 and a 15% trimming at the tails. Table 2 gathers the results of the structural changes.

Expectedly, the linear relationship among the variables in Eq. (2) for all regionals bar Northern Ireland housing market was disrupted by between one and three breaks at different times during the sample periods. London and West Midlands (East Anglia, Yorkshire and Humberside, and the overall UK housing market) regions registered one (three) breaks. The rest of the regions had two breaks each.

Notably, all regions except Outer Metro, West Midlands, and Yorkshire and Humberside had the first structural break between 1985 and 1990. There is a wide variation in the timing of the second break and third breaks for regions with more than one break, suggesting that herding may be a regional-specific feature.

To sidestep contamination of empirical evidence by structural breaks, we run a rolling regression of eq. (2) using a ten-year (forty quarters) rolling window. The time-varying coefficient estimate for herding behavior (γ_3 in Eq. (2)) is graphically presented below for each region.

Figure 2: Rolling herding behavior coefficient estimate




North
North West
Outer Metro
Outer South East
Scotland
South West
Wales
West Midlands
York & Hillside
UK

It is evident from Figure 2 that the herding behavior is episodic. The herding behavior coefficient estimates switch signs and magnitude over time and across regions. Therefore, it is not a universal feature for all housing regions, neither can it be modeled using a static model that does not account for possible structural breaks.[5]

Using Eq. (3), we create a binary variable equal to unity when γ_3 is non-positive and zero otherwise. The binary variable becomes the independent variable in implementing the probit model detailed in Eq. (4). The explanatory variable is the housing market policy uncertainty (HPU) index.

To glean rich insights on the impact of HPU on herding behavior, we derive the marginal effects and the corresponding conditional probability of herding, P(herding), at different quantiles of HPU. For example, what is the probability of herding at the 5^{th} and 95^{th} percentiles values of HPU? The results are presented in Table 3. We make the following inferences from Table 3. First, the probability of herding behavior and the impact of HPU on herding noticeably varies across the regions and different quantiles of HPU. For example, the probability of herding when HPU is very low (high) at 5^{th} is zero in the South West region but 0.51 in the Outer South East region. Conversely, herding probability when HPU is very high at 95^{th} is zero in Wales but 0.51 in the Outer South East region. This poses a significant challenge in developing housing policies that meet each regional housing market's unique needs to avert or minimize the negative impact of the herding behavior on the housing markets. Second, the probability of herding is increasing in quantiles of HPU in nine out of thirteen regions and in the overall UK housing market. The

[5] Based on the Nomenclature of Territorial Units for Statistics (NUTS) codes, the UK housing observatory has created new disaggregated regional house prices at three levels comprising of 10, 35 and 144 regions (see: https://uk.housing-observatory.com/dashboard.html for further details). As a robustness check, we computed CSAD for these three levels of dataset covering the quarterly period of 1995Q2 to 2020Q3, and then analyzed herding for the overall UK. The rolling herding coefficients, based on a 10-year window, for levels 1, 2 and 3 have been presented in Figure A1 in the Appendix, and we find that in this case the herding coefficients are found to be negative over a less prolonged period, compared to the results reported in Figure 2, and generally covers 2008 to 2012, which is of course associated with heightened uncertainty in the housing market.

exceptions are London, Outer Metro, South West and Wales regions. Therefore, herding behavior in the housing market is most likely to arise when housing policy uncertainty rises. Such uncertainty presents information risk about the future values of the housing prices. According to Devenow and Welch (1996), herding behavior can be broadly classified into rational herding and irrational herding. Irrational (noise) investors, usually individuals, will engage in non-information-based herding since they are endowed with insufficient and inferior information as well as inadequate risk appraisal expertise. Information disadvantage forces the irrational herders to discard their prior beliefs and imitate other investors' trading behavior and actions.

Table 3: Impact of HPU on the probability of herding behavior at different levels (quantiles) of HPU

		HPU Quantiles										
Region		0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
E. Anglia	P(herding)	0.276***	0.274***	0.270***	0.268***	0.265***	0.261***	0.257***	0.251***	0.247***	0.231***	0.224***
	z-score	5.180	5.410	5.910	6.230	6.570	6.900	7.030	6.720	6.100	3.920	3.270
E. Mids.	P(herding)	0.186***	0.195***	0.214***	0.227***	0.243***	0.264***	0.288***	0.324***	0.356***	0.471***	0.523***
	z-score	3.980	4.280	4.970	5.470	6.070	6.840	7.490	7.770	7.460	5.780	5.330
London	P(herding)	0.221***	0.197***	0.155***	0.131***	0.106***	0.079***	0.056***	0.034*	0.020	0.003	0.001
	z-score	3.360	3.490	3.710	3.780	3.700	3.300	2.670	1.900	1.420	0.650	0.500
N. Ireland	P(herding)	0.200***	0.209***	0.227***	0.239***	0.254***	0.273***	0.296***	0.328***	0.358***	0.462***	0.508***
	z-score	4.370	4.700	5.410	5.930	6.510	7.220	7.730	7.800	7.380	5.650	5.180
North	P(herding)	0.415***	0.418***	0.425***	0.430***	0.435***	0.443***	0.450***	0.461***	0.470***	0.502***	0.516***
	z-score	6.750	7.180	8.100	8.760	9.480	10.310	10.810	10.560	9.650	6.450	5.540
NW	P(herding)	0.099***	0.107***	0.125***	0.137***	0.153***	0.175***	0.202***	0.242***	0.281***	0.429***	0.498***
	z-score	2.910	3.140	3.670	4.060	4.550	5.210	5.840	6.290	6.220	5.120	4.850
Outer Met	P(herding)	0.452***	0.425***	0.371***	0.336***	0.298***	0.252***	0.206***	0.151***	0.112***	0.033	0.018
	z-score	6.470	6.580	6.800	6.900	6.900	6.560	5.760	4.380	3.330	1.500	1.130
Outer SE	P(herding)	0.511***	0.512***	0.516***	0.518***	0.520***	0.524***	0.527***	0.532***	0.537***	0.551***	0.558***
	z-score	8.120	8.610	9.670	10.410	11.230	12.130	12.620	12.190	11.030	7.120	6.030
Scotland	P(herding)	0.168***	0.176***	0.192***	0.203***	0.216***	0.234***	0.254***	0.284***	0.312***	0.411***	0.456***
	z-score	3.850	4.120	4.730	5.170	5.690	6.350	6.890	7.130	6.860	5.260	4.790
SW	P(herding)	0.009	0.010	0.013	0.014	0.017*	0.020*	0.025	0.032**	0.041**	0.081**	0.106*
	z-score	1.290	1.350	1.490	1.590	1.700	1.850	2.000	2.150	2.210	2.010	1.880
Wales	P(herding)	0.166**	0.108**	0.038	0.017	0.006	0.001	0.000	0.000	0.000	0.000	0.000
	z-score	1.990	2.070	1.510	1.000	0.650	0.400	0.260	0.160	0.120	0.050	0.040
W. Mids.	P(herding)	0.150***	0.152***	0.157***	0.160***	0.163***	0.167***	0.172***	0.179***	0.185***	0.207***	0.217***
	z-score	3.650	3.840	4.260	4.550	4.870	5.220	5.450	5.390	5.030	3.500	3.010
Y&H	P(herding)	0.177***	0.183***	0.194***	0.202***	0.211***	0.224***	0.238***	0.258***	0.276***	0.342***	0.373***
	z-score	3.720	3.970	4.530	4.940	5.430	6.060	6.590	6.800	6.460	4.600	4.040
UK	P(herding)	0.077***	0.083***	0.095***	0.104***	0.115***	0.131***	0.150***	0.179***	0.207***	0.317***	0.372***
	z-score	2.700	2.880	3.300	3.600	3.970	4.460	4.920	5.270	5.240	4.290	3.970

Notes: P(herding) is the probability of herding at different degrees (quantiles) of HPU. E . Mids. and W. Mids are East Midlands and West Midlands, respectively. Y&H is Yorkshire and Humberside. ***, *** and * signify 1%, 5% and 10% significance level, respectively.

Hung et al. (2010), Hwang and Salmon (2004), and Froot et al. (1992) show that non-information-induced herding behavior results in market inefficiencies, a divergence between asset prices and their fundamental values, and asset mispricing. Indeed, Kaniel et al. (2008) note that while rational, information-based herding predicts future returns and diminishes trading noise in subsequent periods, irrational, uninformed traders tend to cluster their trades in the reverse direction of future market activities and intensify trading noise in subsequent periods.

Third, London and Outer Metro regions present results that contradict other regions. The probability of herding is decreasing as HPU increases. Two main features of these regions may help explain the contradicting evidence. Relative to other housing regions, London and Outer Metro are characterized by (i) high population and (ii) presence of more institutional investors since London is one of the major global financial centers attracting global investors. Indeed, Miles (2020) finds that London can be viewed as a "global city" and the destination for housing demand from sources abroad. We propose two potential explanations for the declining herding probability as HPU increases for London. First, the dominance of institutional investors in the two regions. Studies by Busse (1999), Li and Wang (2010), and Lin et al. (2013) show that institutional investors as better informed and more rational because of their advantage and expertise in obtaining and evaluating information. Devenow and Welch (1996) note that rational investors engage in information-based herding by adopting similar responses to similar information about changes in asset (housing market) fundamentals. Rational herding in London and Outer Metro regions in response to new information will drive house prices to their fundamental values. Since HPU may induce low-quality information signals, the dominant rational institutional investors in London and Outer Metro will not engage in rational herding. Second, composition uncertainty. In highly populated regions with many market participants (buyers, sellers, appraisers, regulators, speculators, brokers, etc.), there is a quicker diffusion of information regarding asset prices relative to housing regions with few market participants. Therefore, asset prices are likely to converge to fundamentals. Avery and Zemsky (1998) show that herding and price bubbles arise when different uncertainty levels exist. That is, uncertainty about the fundamental value of an asset (value uncertainty), the possible occurrence and outcome of special events (event uncertainty such as the uncertainty regarding the impact of a new policy), and composition uncertainty (inability to discern the composition of informed and uninformed investors involved in a particular investment position or strategy, especially for the highly decentralized housing market. This creates the "crowded-trade" problem). Granted the speedy information diffusion in the highly populated London and Outer Metro regions, value uncertainty is likely to diminish, and so is the herding behavior even as HPU increases.

Overall, our results suggest that regional-level policies that resolve policy uncertainty are necessary to circumvent and minimize the herding behavior-induced market volatility, asset mispricing, diminished portfolio diversification, and inefficient price discovery mechanism.

5. Conclusion

The study sets out to investigate the impact of housing policy uncertainty of herding behavior in the UK's thirteen regional housing markets and the national housing market. The housing policy uncertainty causes market stress since it presents policy information risk. Investors are known to engage in herding during heightened uncertainty and clear information signals to forecast future asset prices. Since irrational, non-information herding behavior has been documented as an amplifier of market volatility, fragility, instability, and market inefficiencies, it is imperative to investigate whether policy uncertainty may induce herding behavior.

Using sample data spanning forty-six years (1973Q4 to 2019Q2), we employ the conventional herding model and the probit model to assess how the probability of herding changes as the policy uncertainty increases. The probability of herding vastly differs across the regions and different levels of uncertainty, suggesting that the impact of policy uncertainty on herding behavior is a region-specific phenomenon. This poses a significant challenge in developing universal national housing policies that may have a varied effect on the regional housing markets and the herding behavior. We find that in nine of the thirteen regions, the probability of herding is increasing in policy uncertainty. This confirms the existing literature where herding or imitation of other investors' trading behavior is pervasive in the presence of uncertainty. We do not document herding behavior in Wales. We report contradictory results in London and Outer Metro housing markets. The potential explanation for these results is related to high populations and demand for housing and the presence of institutional investors and multiple market players, and the low level of value uncertainty.

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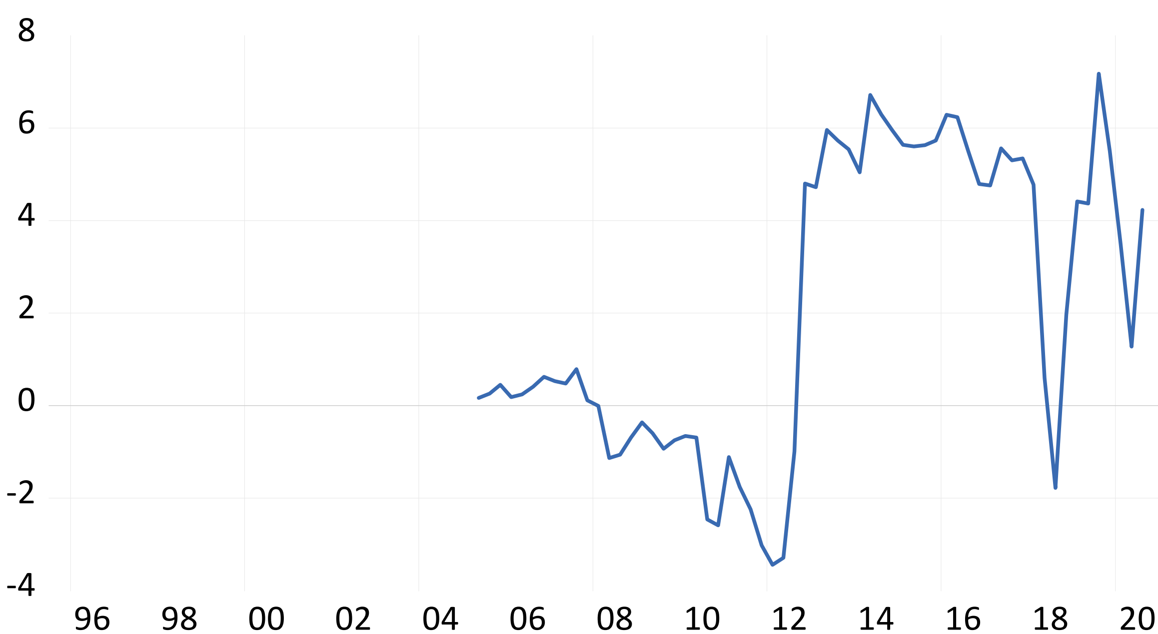
APPENDIX

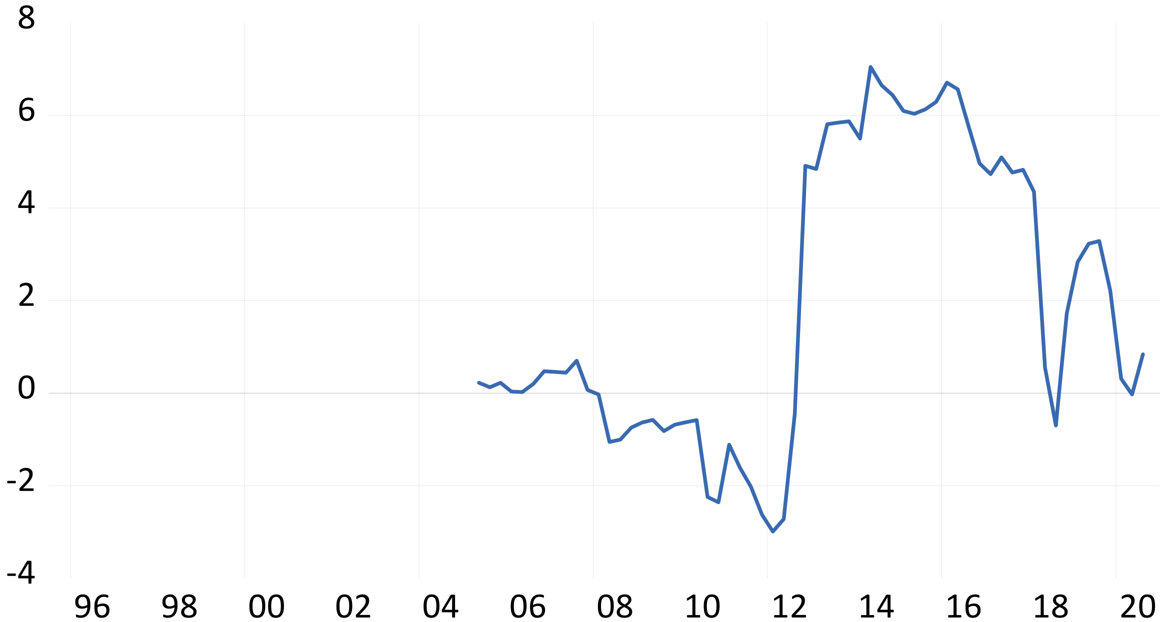
Figure A1. Rolling Herding Coefficients for Level 1, Level 2 and Level 3 Disaggregated Regional House Prices of the UK Sourced from the UK Housing Observatory

A1(a). 10-Year Rolling Herding Coefficient of Level 1 (Comprising of 10 Regions)

A1(b). 10-Year Rolling Herding Coefficient of Level 2 (Comprising of 35 Regions)



A1(c). 10-Year Rolling Herding Coefficient of Level 3 (Comprising of 144 Regions)



Note: See: https://uk.housing-observatory.com/dashboard.html.