Developing a House Price at Risk framework for the UK

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The views expressed in this paper are those of the author, and not necessarily those of the Bank of England or its committees.

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1. Introduction

- Why?
  - FS aspect – macroprupolicy tracks tail risks
  - Size of market in UK
  - Lack of sub-national analysis
- What?
  - Develop a model that can: track HP dynamics at different parts of the distribution for UK
  - Decompose factors that contribute to dynamics at different parts of the distribution
  - Develop certain indicators that have not yet have been used in this modelling framework
  - Analyse the differences between 12 UK regions



1. Introduction

- Why?
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  - Size of market in UK
  - Lack of sub-national analysis
- What?
  - Develop a model that can: track HP dynamics at different parts of the distribution for UK
  - Decompose factors that contribute to dynamics at different parts of the distribution
  - Develop certain indicators that have not yet have been used in this modelling framework
  - Analyse the differences between 12 UK regions



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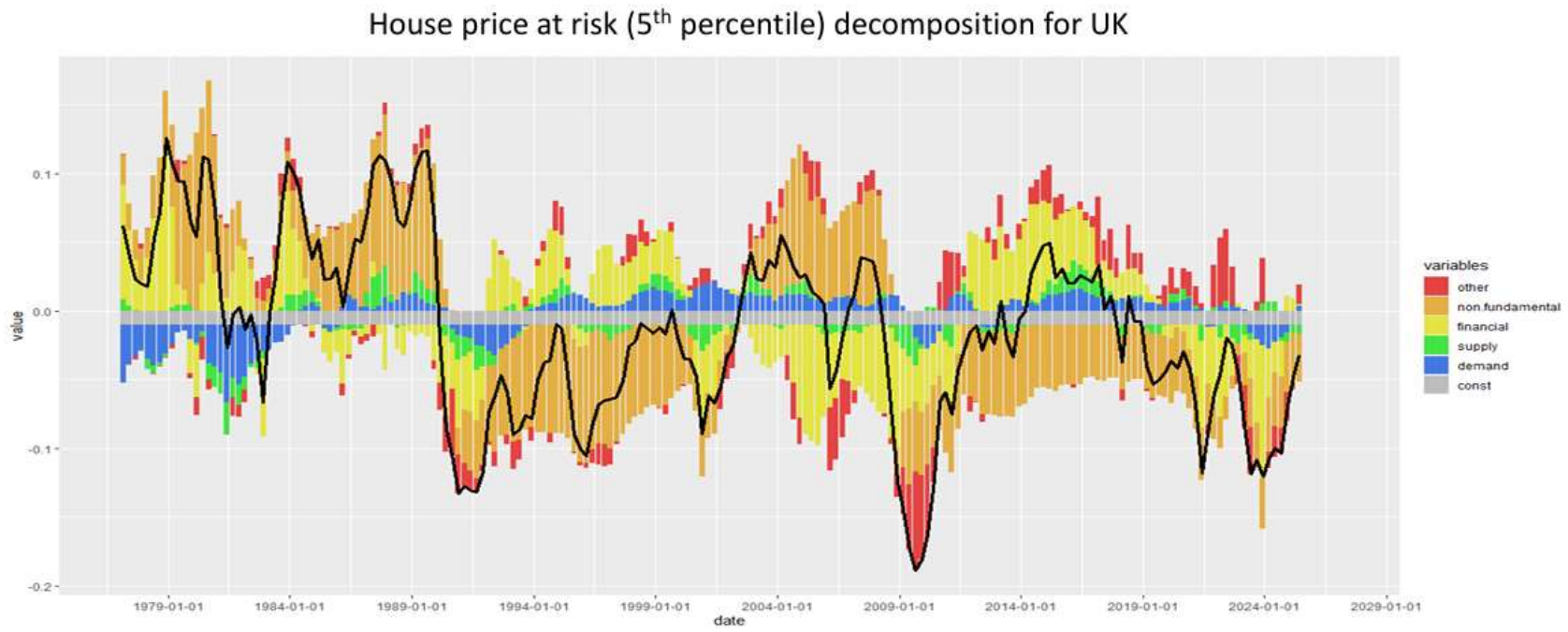


2. Contributions

1. What are supply, demand, and other factors that contribute to the house price dynamics in UK?
2. What are the diffs between median and the at-risk growth?
3. What is the probability of a price contraction in the next *h* forecasting horizons?



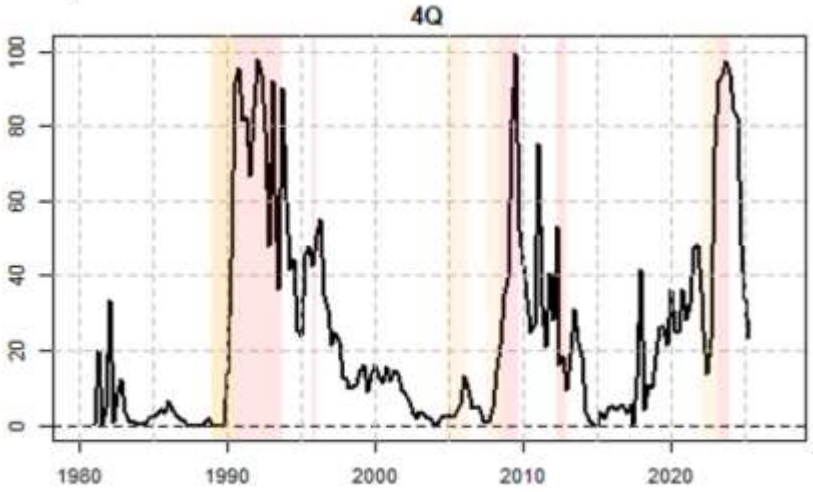
2. Contributions – preview of the results



Note: Estimates shown such that values in 2024 Q3 reflect forecasts based on 2023 Q3 data.

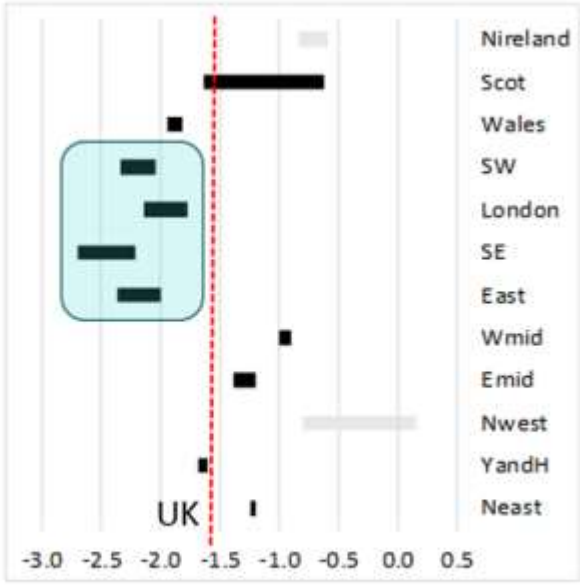
2. Contributions – preview of the results

Probability of negative house price growth for 4 quarters ahead



Note: orange shaded areas denote great drop of house price growth, whereas red shaded areas denote periods when the house price growth became negative

Range of estimates for mortgage rate change, median



Grey bars indicate non-significance.
Red dashed line is the UK estimate

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3. Lit review (> 250 papers)

- **At-risk literature**: return distribution modelling (Ghysels, 2014; Allen et al., 2009), and general stock market behaviour modelling (Škrinjarić and Slišković, 2020; Škrinjarić, 2018, 2019), inflation (López -Salido and Loria, 2021), growth (Adrian et al., 2019), macroprudential policy stance (Škrinjarić 2023b, 2024), capital flows (Gelos et al. 2022), bank capital (Lang and Forletta, 2019, 2020)
  - First time of national and regional analysis of UK HP in this way.

- **UK housing market analysis:** simple regressions, VAR, VEC on house price determinants, ripple effects, hedonic price models, specific questions (e.g. covid change of preferences), etc.
  - Capturing tail risks for first time, with most comprehensive indicator/variable list

- **Supply and demand misalignment indicators**: indicators that capture differences among regions
  - New indicators not used so far in such setting, especially on sub-national level



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4. Variables

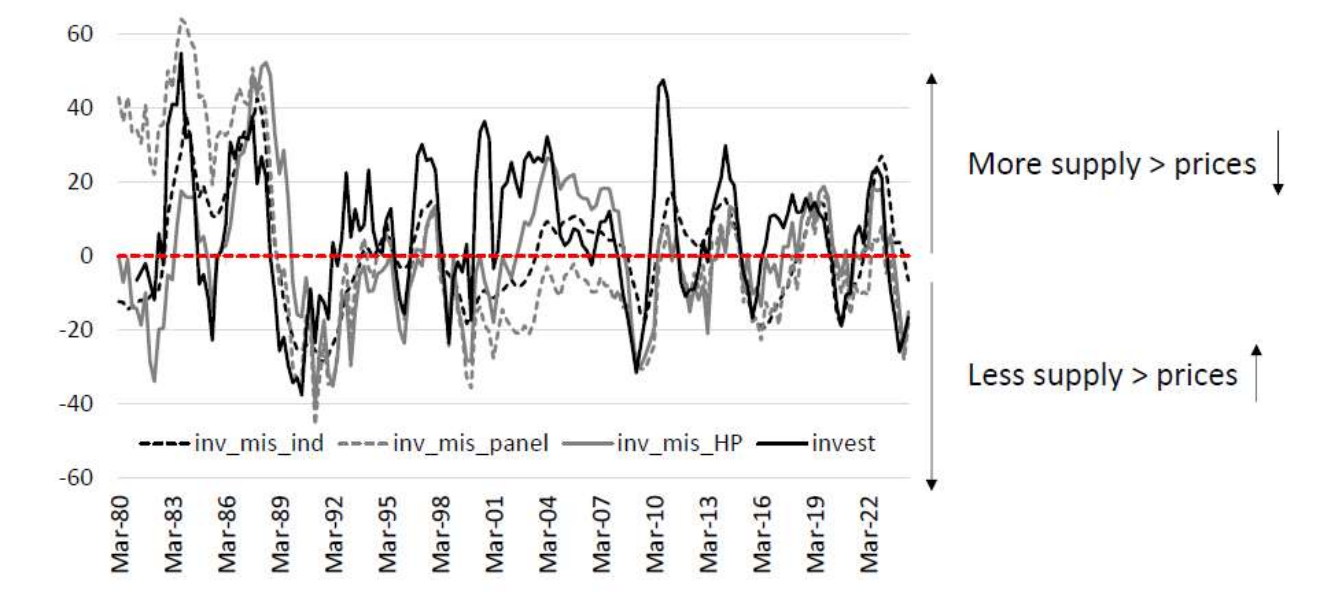
Category	Variable	Note/transformations
Dependent	Uk house price index	
	Regional HP indices	
	Final consumption expenditure deflator	For dep variable in real terms
Demand	GDI UK (pc)	
	GDI regional (pc)	
	Population UK	growth rates
	Population regional	
	GDP UK (pc)	
	Affordability	ratios gaps from stat filters
Supply	Output of construction, new housing, UK and regional	growth
	PPI	inflation
	Oil price	growth rates
	Stock of dwellings, UK and regional	
	Investment misalignment	from a model, stat filters
Financial	Mortgage interest rate	change
	BoE rate	change
	Spreads	
	stock market growth	
	Mortgage debt stock and flow	growth, compared to GDP (stat filters)
	M4	growth
	Inflatiton	
	price to rent ratio	growth
Non fundamental	Price misalignment UK and regional	from a model, stat filters
	Price exuberance/bubbles	
Other	Housing transactions UK	growth
	CCI	
	CBI	
	CLI	
	CISS	
	CLIFS	
	EPU	

- UK: Since 1950s
- Regional: mid 1970s
- Quarterly data

- Around 50 different indicators/variable
- Developed indicators that have not yet been used in this setting [esp. for regional setting]
  - Supply misalignment
  - Non fundamental/exuberance



4. Variables / Supply



- mis_ind: individual model
- mis_panel: panel estimate
- mis_HP: gap from HP filter
- invest: YoY growth

- Econ model:

$$i_t = \beta_0 + \beta_1 p_t + \beta_2 pop_t + \beta_3 ppi_t + e_t \quad \text{... (S)}$$
$$p_t = a_0 + a_1 s/pop_t + a_2 y_t + a_3 pop_t + a_3 irate_t + u_t \quad \text{... (D)}$$

- HP filter

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5. Methodology

- Quantile regression

$$Q_{y|X}(\tau) = \alpha^{\tau} + \sum_{i \in I} \beta_i^{\tau} X_i + \varepsilon^{\tau}$$

- where τ is the observed quantile, *i* is the i-th explanatory variable, and ε is the error term, i.e. equation describes the τ-th quantile of the conditional probability distribution of y given X. Model is estimated at different parts of the distribution of variable y
- Criteria to derive best models
  - Dynamic Quantile test, AIC, pseudo-Rsquared at h = 4
  - Cover all categories of variables
  - Both significance and correct sign
- Started with ~9.5 mil models > best > refined to have economic interpretation
- Panel quantile regression & individual models
  - Cameron et al. (2006) criteria for a regional house price model
  - Ripple effects
- Fit skewed t-dist: track its moments, calculate probability metrics



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6. UK results

- Best model at $h = 4$

One year ahead forecast, nominal UK HP growth

Category	Variable	5th	Median	95th
	Const	-0.892	**6.960**	**14.421**
Demand	YoY real GDP growth	1.266	**4.035**	**4.459**
Supply	YoY investment growth	1.189	-1.087	-0.495
Supply	YoY oil price growth	-0.811	-0.725	**-1.386**
Financial	YoY mortgage rate change	**-2.317**	**-1.616**	-0.796
Financial	C2GDP gap	**-2.398**	**-1.811**	-0.714
Financial	YoY stock market growth	**-1.997**	**-2.650**	**-2.748**
Financial	CISS	**-2.076**	0.910	0.56
Financial	YoY price to rent growth	-0.914	0.404	1.482
Financial	YoY Inflation	3.544	3.200	1.356
Other	YoY transaction growth	**2.336**	**1.262**	**1.89**
Other	EPU	**1.132**	-0.568	**-1.869**
Other	CCI	0.044	**1.877**	1.033
Non fundamental	Exuberance	**6.064**	**4.312**	**4.376**
	AIC	-461.08	-516.99	-471.01
	Pseudo R2	0.665	0.614	0.792

5th	Median	95th
Exuberance	Exuberance	YoY real GDP growth
C2GDP gap	YoY real GDP growth	Exuberance
YoY transaction growth	YoY stock market growth	YoY stock market growth
YoY mortgage rate change	CCI	YoY transaction growth
CISS	C2GDP gap	EPU
YoY stock market growth	YoY mortgage rate change	YoY oil price growth
EPU	YoY transaction growth	

In line with papers that show non-linear relationships (Shimzu et al., 2014; Dieckelmann, 2023).



6. UK results

- Best model at $h = 4$

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Booming credit dynamics – lowers all price growth

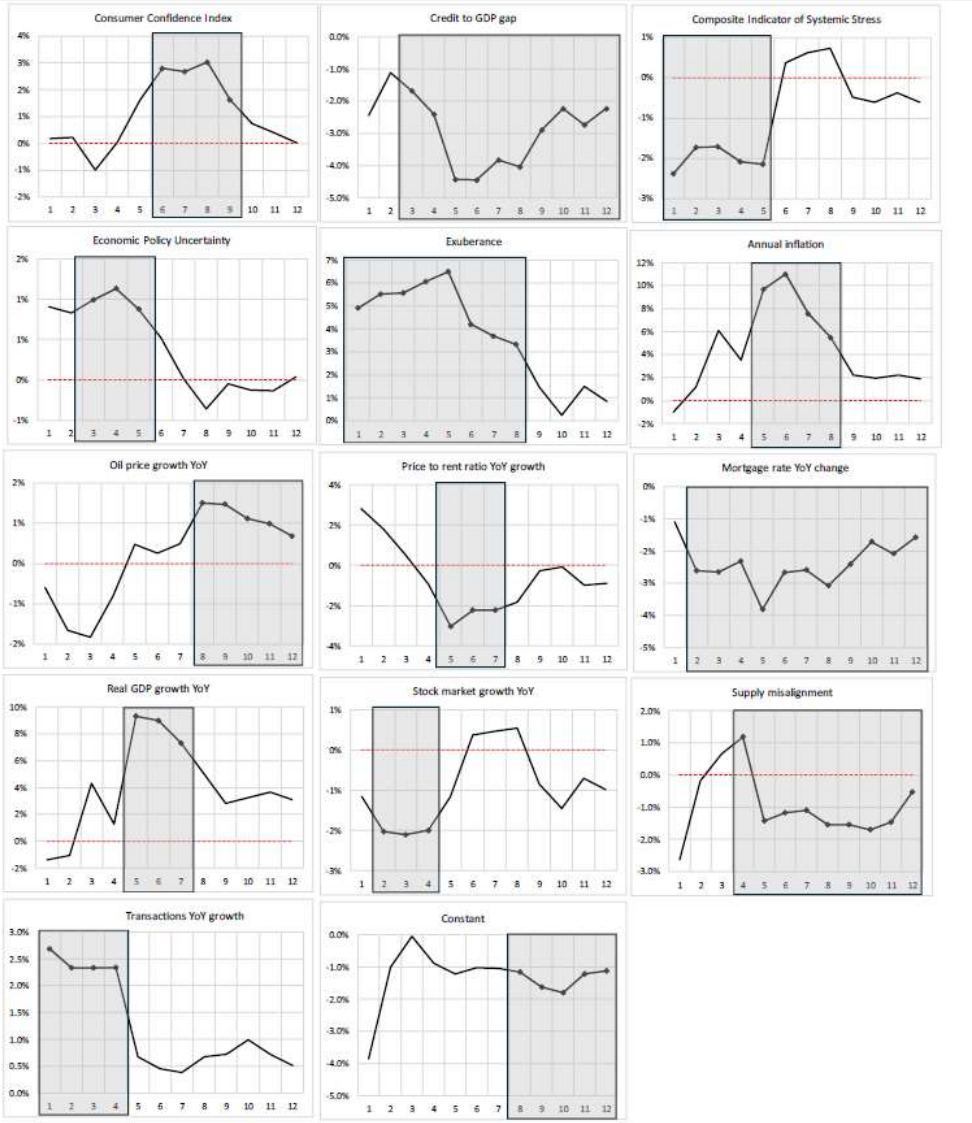
Credit dynamics, and in particular mortgages can be a reflection of increasing optimism about economic agents' availability to service the debt in the future (Plašil et al., 2015). Jimenéz and Saurina (2006) find that loans granted during boom periods have a higher probability of default than those granted during periods of slow credit growth.

Household debt has been proven to have negative impact on future GDP (Mian et al., 2017). Excessive build-up of mortgage debt may signal loosening of mortgage underwriting standards (Valderrama, 2023)

> Macropru policy can act to tame excessive credit growth.



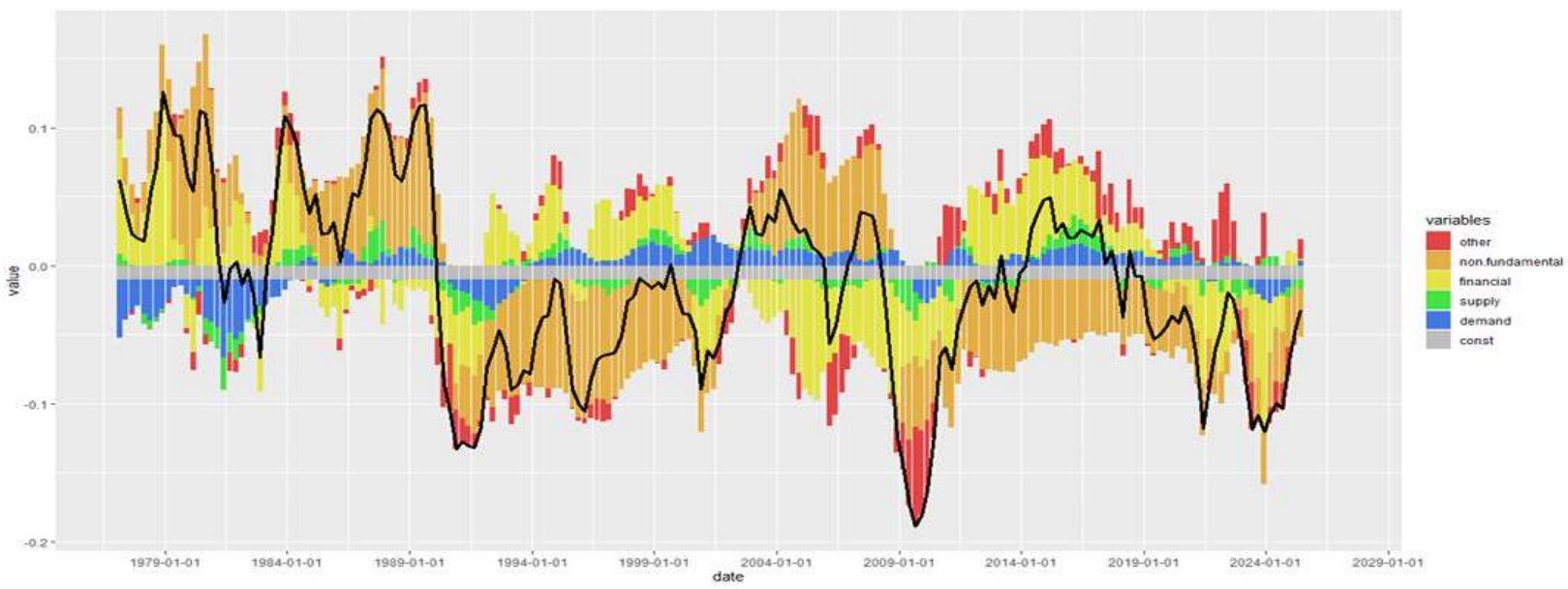
6. UK results – term structure



Note: panels depict the estimated coefficient for a given variable over time (x-axis represents quarters), where the grey shaded area denotes statistical significance. For the description of the variables, see Appendix Table A1.

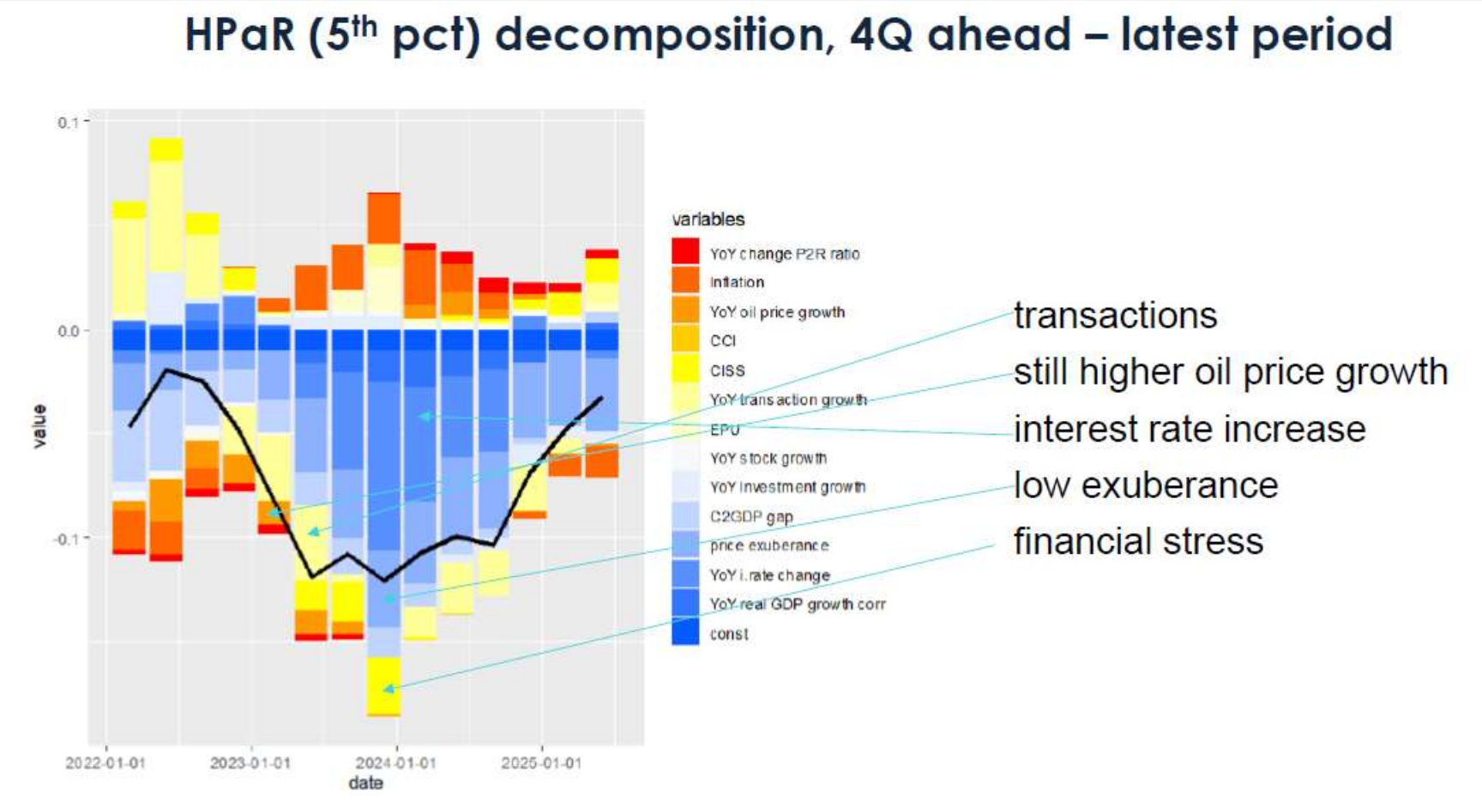
- Short term: transactions, fin stress, EPU
- Medium term: CCI, C2GDP, mortgage rate, real GDP growth
- Long term: supply, oil price, C2GDP

6. UK results



Note: Estimates shown such that values in 2024 Q3 reflect forecasts based on 2023 Q3 data.

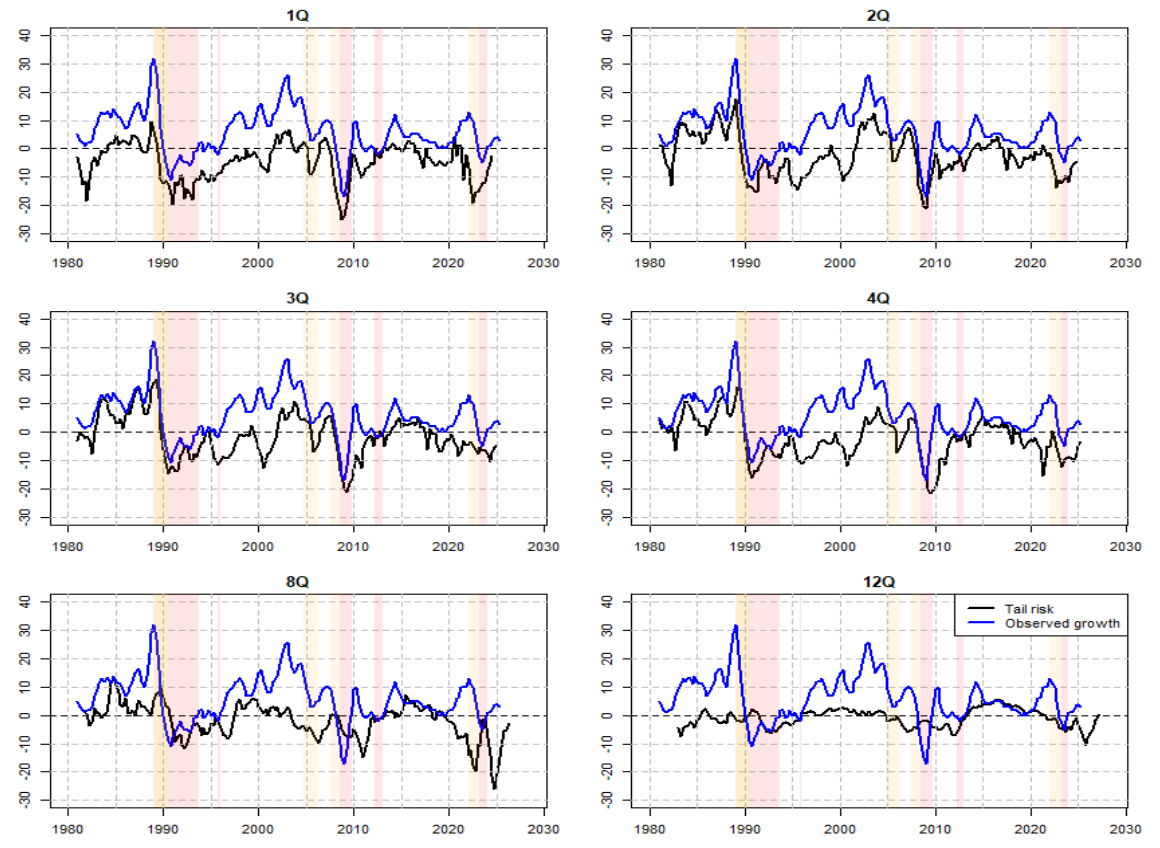
6. UK results



Estimates shown such that values in 2025 Q2 reflect forecasts based on 2024 Q2 data.

6. UK results

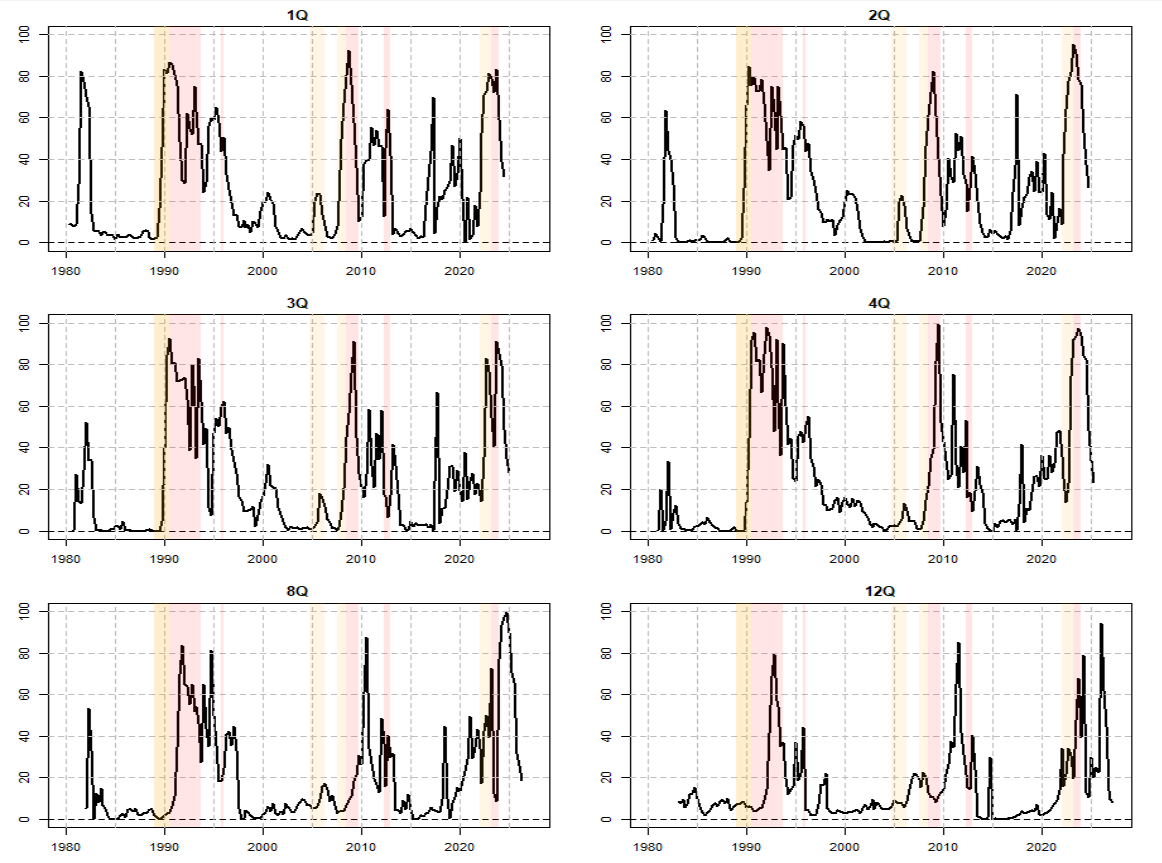
Tail risk of house price growth at different prediction horizons



Note: orange shaded areas denote great drop of house price growth, whereas red shaded areas denote periods when the house price growth became negative. 1Q, 2Q, 3Q, 4Q, 8Q, and 12Q denote one, two, three, four, eight, and twelve quarters ahead. Tail risk denotes the forecasted 10th percentile of future house price growth, observed growth is the actual consumption growth.

6. UK results

Probability of negative house price growth for h quarters ahead



Note: orange shaded areas denote great drop of house price growth, whereas red shaded areas denote periods when the house price growth became negative. 1Q, 2Q, 3Q, 4Q, 8Q, and 12Q denote one, two, three, four, eight, and twelve quarters ahead.

6. UK results

Robustness checking

- Recursive / rolling estimates
- Pre / post Covid
- Pre / post GFC
- Simpler models



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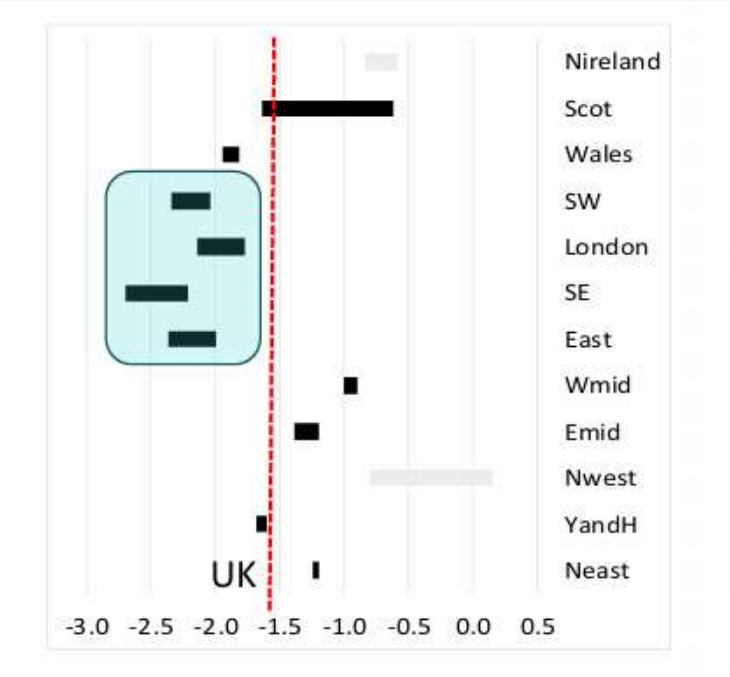
7. Regional results

- Panel results more contained results vs individual (in line with lit)
- Greatest differences for Scotland and Northern Ireland
  - Scotland has some differences in housing regulation and housing policy in general (see Gibb, 2019).
  - NI is more related to the Republic of Ireland's economy (see Brownlow, 2023), with it achieving increased level of independence from UK government since late 1990s regarding social security provisions and housing market taxation (McKee et al., 2017)
- Region specific results suggests divergent regional responses: we find great differences between the estimates for demand; credit-to-GDP gap, mortgage rate change, and supply.



7. Regional results

Range of estimates for mortgage rate change, median

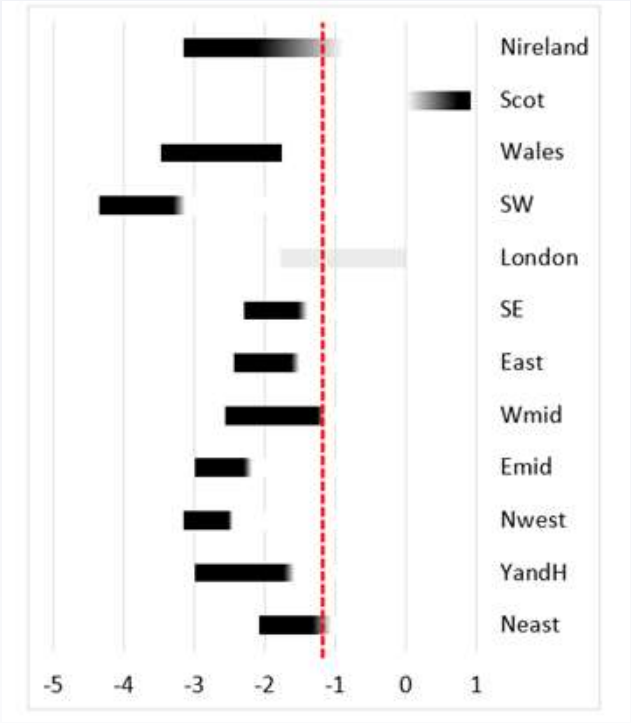


Grey bars indicate non-significance.
Red dashed line is the UK estimate

- Greater effect for more supply constraint regions, in line with Cameron et al. (2006), Aastveit and Anundsen (2022), Vonlanthen (2022), and Walker (2023).
- Policy implications for the monetary policy tightening and easing – in regions that are supply inelastic, policy tightening could be followed by greater price drops, as in the short-term, the supply cannot change, whereas the more expensive cost of borrowing disincentivises demand.
- In line with Meen (1999) who states that debt gearing capacity in southern regions of UK is higher than in the rest of the country, meaning that these regions can face bigger risk of short-term liquidity constraints during periods of interest rate hikes.

7. Regional results

Supply effect, median



Lighter shaded areas indicate non-significance.
Red dashed line is the UK estimate

Increased supply helps to alleviate price pressures.

• Exceptions are London and Scotland.

• London: results could be in line with findings of Zahirovich-Herbert and Gibler (2014), who show that new supply could actually increase house prices, in large built-up metropolitan areas, due to higher land prices and higher constraints, and possible brownfield remediation. According to Farris (2001), the existing infrastructure may require upgrading and thus would lead to increase of house prices.

• Scotland: could be that local amnesties are improved, and the demand increases for second hand housing, thus inflationary pressures (Gleeson, 2023).

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8. Conclusion

- Policy recommendations:
  - Economic policies that stimulate demand can help to lower the tail risk of house price growth
  - Credit activity related to tail risks> room for macroprudential policy to moderate the excessive credit activity to reduce those tail risks.
  - Interest rate effects differ across regions > important for monetary policy
  - Use in stress testing to enrich the results

- Future work: more regional work



Thank you

