AUM2020
'Modelling the New Urban World'
Session 13

UK2070 Futures Modelling: Results from pre- and post-Lockdown scenarios

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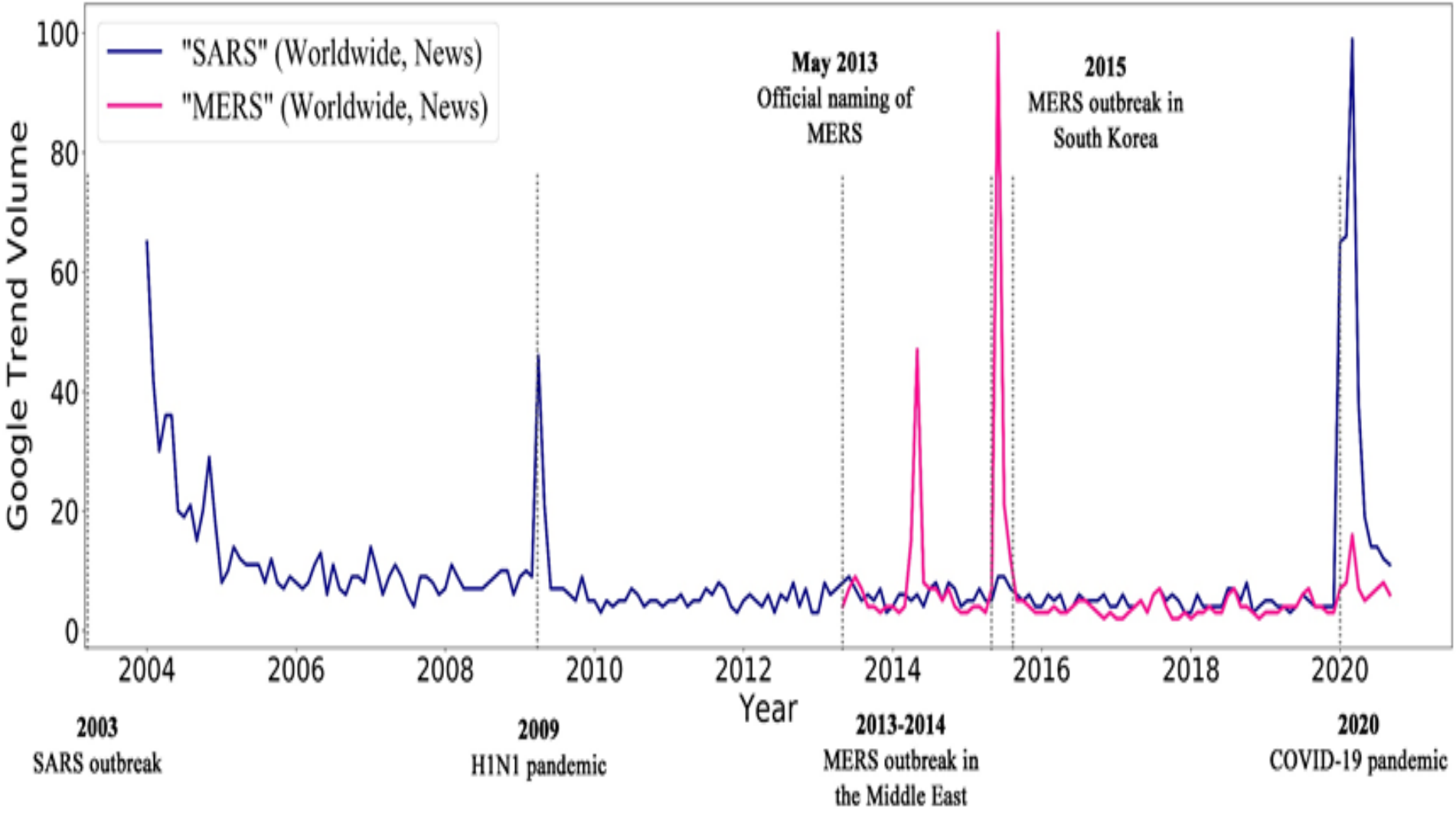
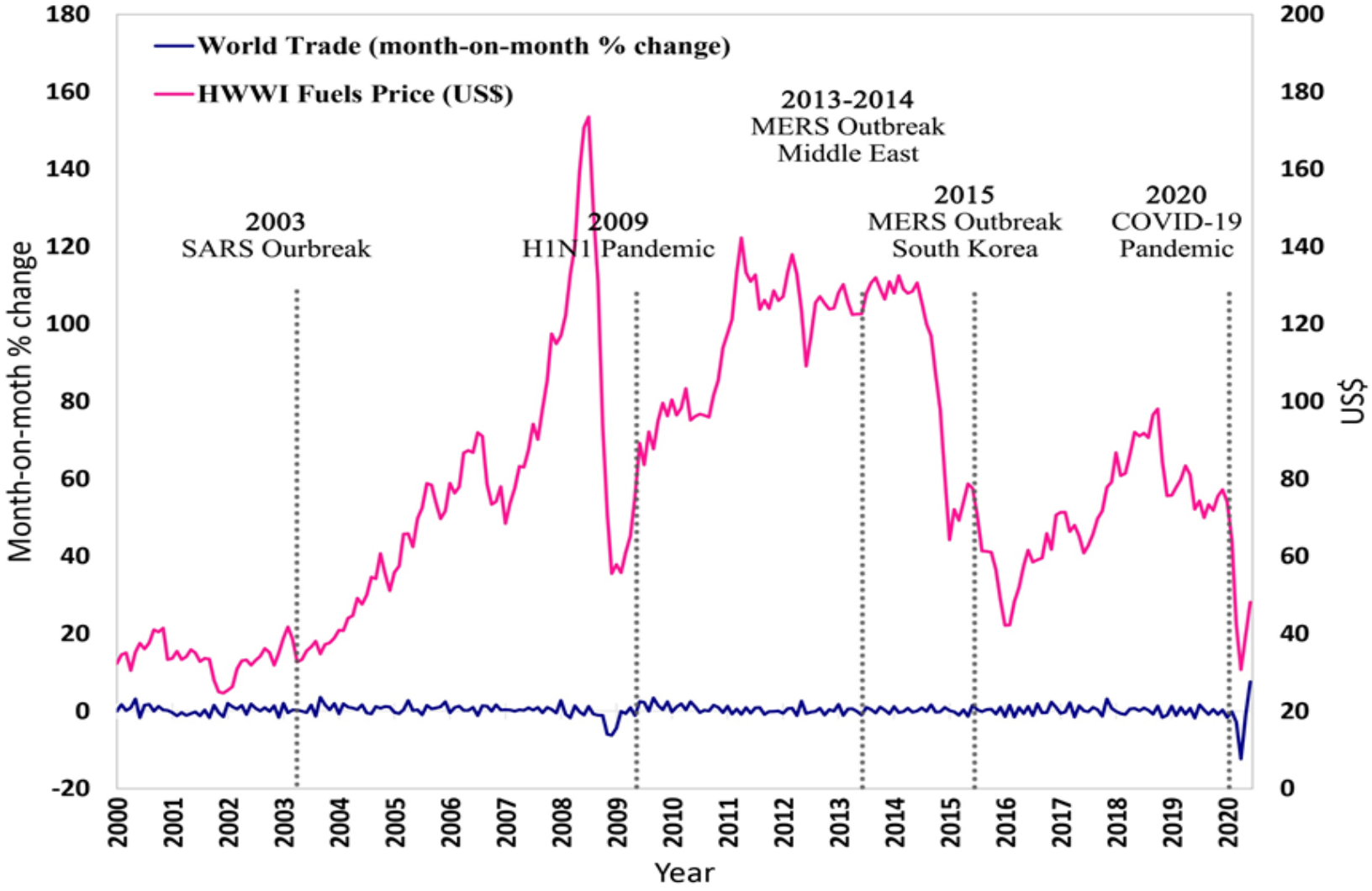
Preamble

- What has the COVID-19 Pandemic already changed?
  - Answer: the **starting point** and **trajectory** of economic growth – the paths to recovery and growth are now laden with post-WW2 level of debts, many new difficulties to local businesses, and new deprivation in local communities

People can be very forgetful about epidemics…



… but in terms of global fuel prices and trade volumes, Covid-19 was the very first one to make a clear mark at the global scale



Some of the pre-existing challenges are accelerated/worsened

- Very low interest rates for savings
- Asset illiquidity
- Political populism
- A possible resurgence of greenhouse gas emissions (e.g. road transport; electricity generation)
- The government/cities will be even more **short of money** to improve urban living, and decision-making will be even more fraught
  - Whilst the urban challenges are getting harder

So what would the paths to recovery and growth look like?

- This presentation: uses the **UK as a case study**
- At a stretch, the UK could be considered as a 'mega city-region' (or perhaps a series of connected city-regions), with
  - a total population of **67 million** and
  - the maximum distance between main cities (London-Aberdeen) under **640 km**

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Go Big – Go Local: The UK2070 Report on a New Deal for Levelling Up the United Kingdom

The UK2070 Commission has today (October 1st 2020) found that COVID-19 has increased the urgency for a comprehensive, large scale plan to level the UK economy. In a follow up report to *Make No Little Plans – Acting At Scale For A Fairer And Stronger Future* – which found that the UK is the most unequal large country in the developed world – the UK2070 Commission has now found that the pandemic has exposed the UK's economic dependency on London and the Wider South East. Only a balanced growth plan is likely to deliver greater prosperity without damaging environmental and social consequences.

The UK2070 Commission has prepared a post-COVID Action Plan setting out the priorities for action over the next ten years. Learning the lessons from the COVID-19 response, it proposes a major programme of investment in transport, skills and the advanced economy; coupled with a radical devolution of powers; and funding from Whitehall.

The Right Honourable The Lord Kerslake, Chair of the UK2070 Commission and former Head of the Civil Service, said:

"Our new post-COVID Action Plan sets out a proposed programme of action which unlocks capacity and delivers action at scale through local democratic leadership. We are

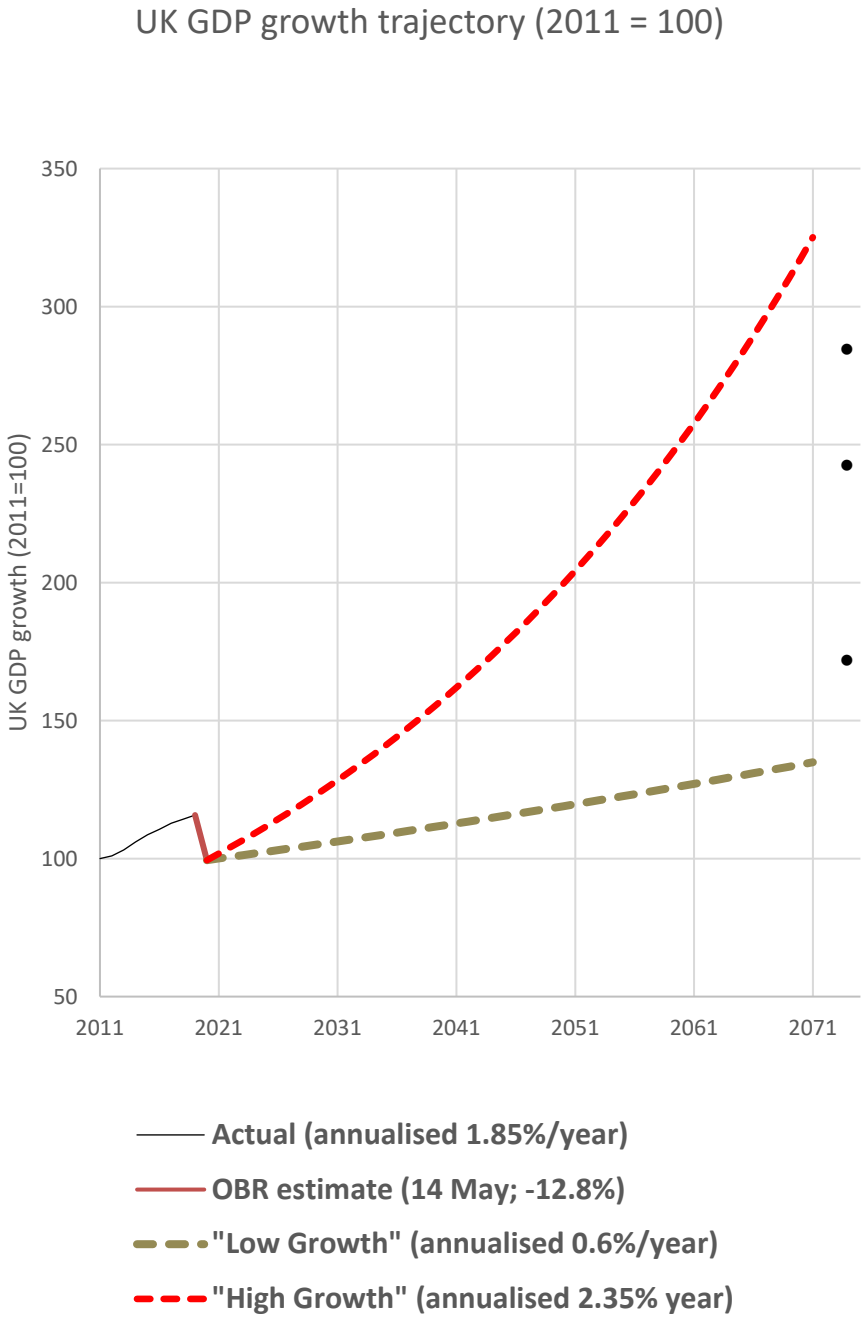
Purpose of UK2070 Futures model tests: to help the UK2070 Commission to consider how to substantiate UK government's ambition to rebalance the economic and social geography ('Levelling-up')…

… through a large series of scenario tests

'Go long term'

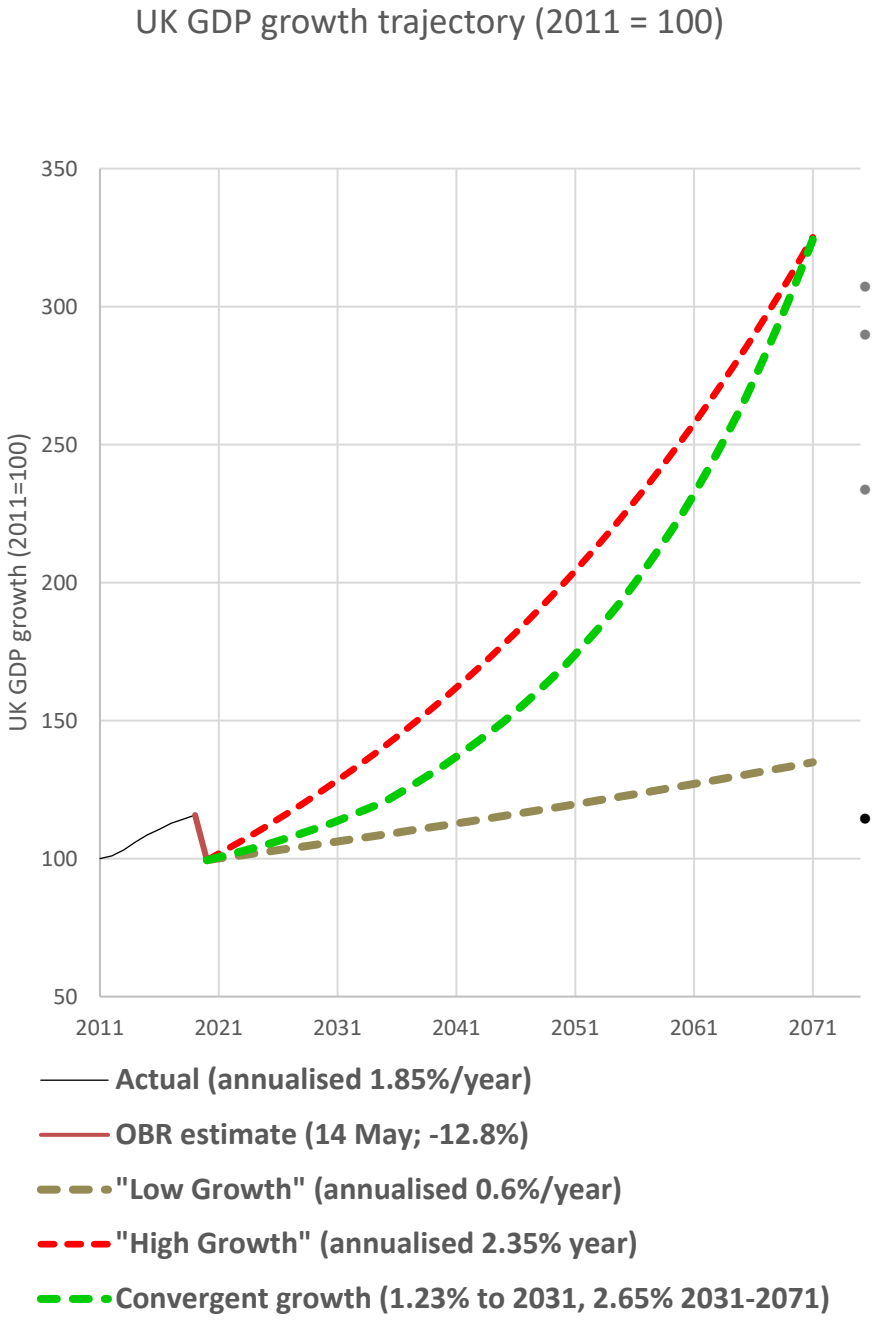
Assumption A:
GDP growth trajectories

Pre-COVID: ‘high’ & ‘low’ trajectories



- UK GDP 2020 looks to be 12-13% down from 2019
- ‘Low Growth’ scenario: **like Japan** since 2000
  - Although a real possibility
    - is this acceptable?
- ‘High Growth’ scenario: **like the US** since 2000
  - Given the persistent lack of productivity growth over more than a decade, the prospect of low population growth in the coming years, and the time needed for AI and automation to turn into real productivity
    - Is a rate of 2.35% a year realistic?

Post-COVID: ‘high’, ‘low’ and ‘Recovery’ trajectories



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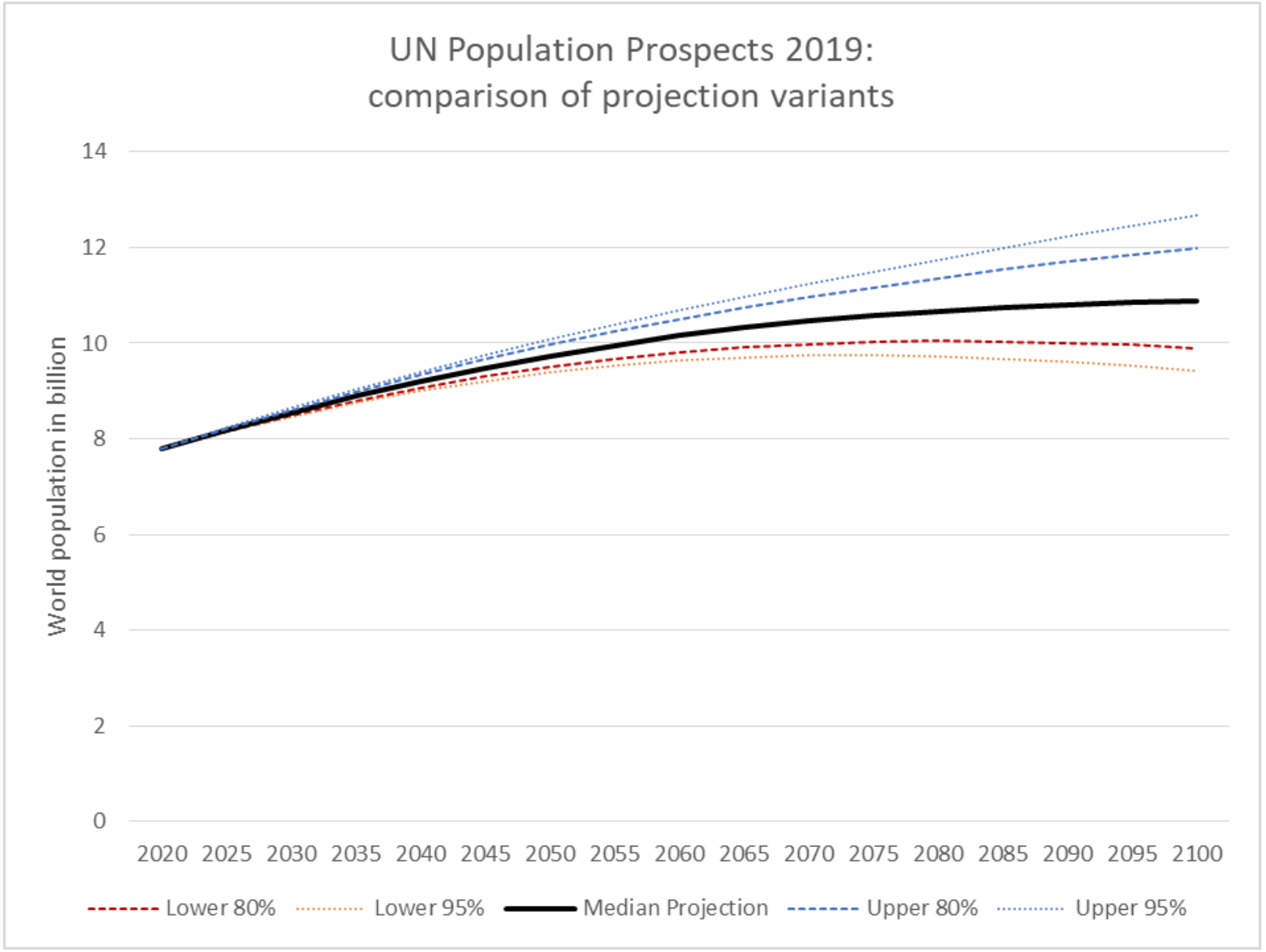
  - Given the persistent lack of productivity growth over more than a decade, the prospect of low population growth in coming years, and the time needed for AI and automation to turn into real productivity
    - Is a rate of 2.35% a year realistic **in the short term**?
- ‘**Gradual Recovery**’ scenario: without any precedents
  - Variable rate converging to high growth: 2021-25: 1.1%; 2026-2031: 1.3%; … 2066-2071: 3.5%
  - Context: IT, automation, AI, healthier and happier workers, vastly better transport connections to promote productivity, low productivity areas pick up, London and South East (LWSE) to retain global lead

Assumption A has in fact two parts

Assumption A1: population and number of workers

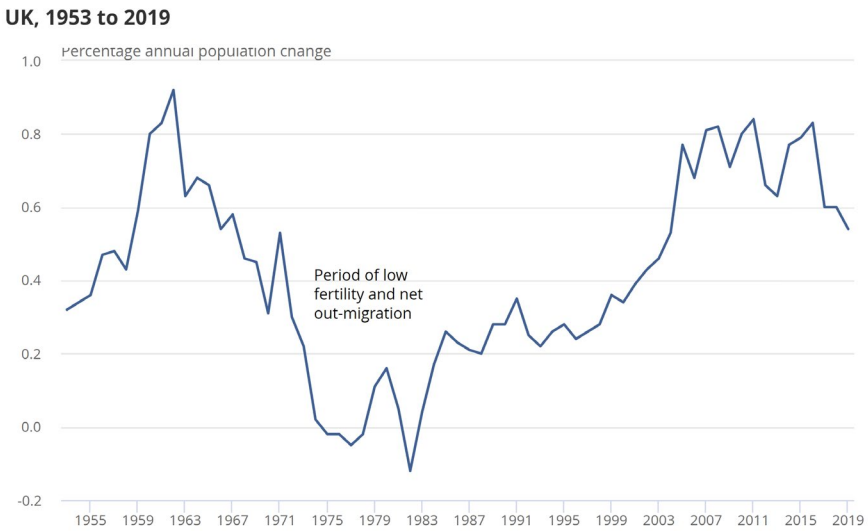
Assumption A2: Per-worker productivity trends

Upcoming global population stabilization



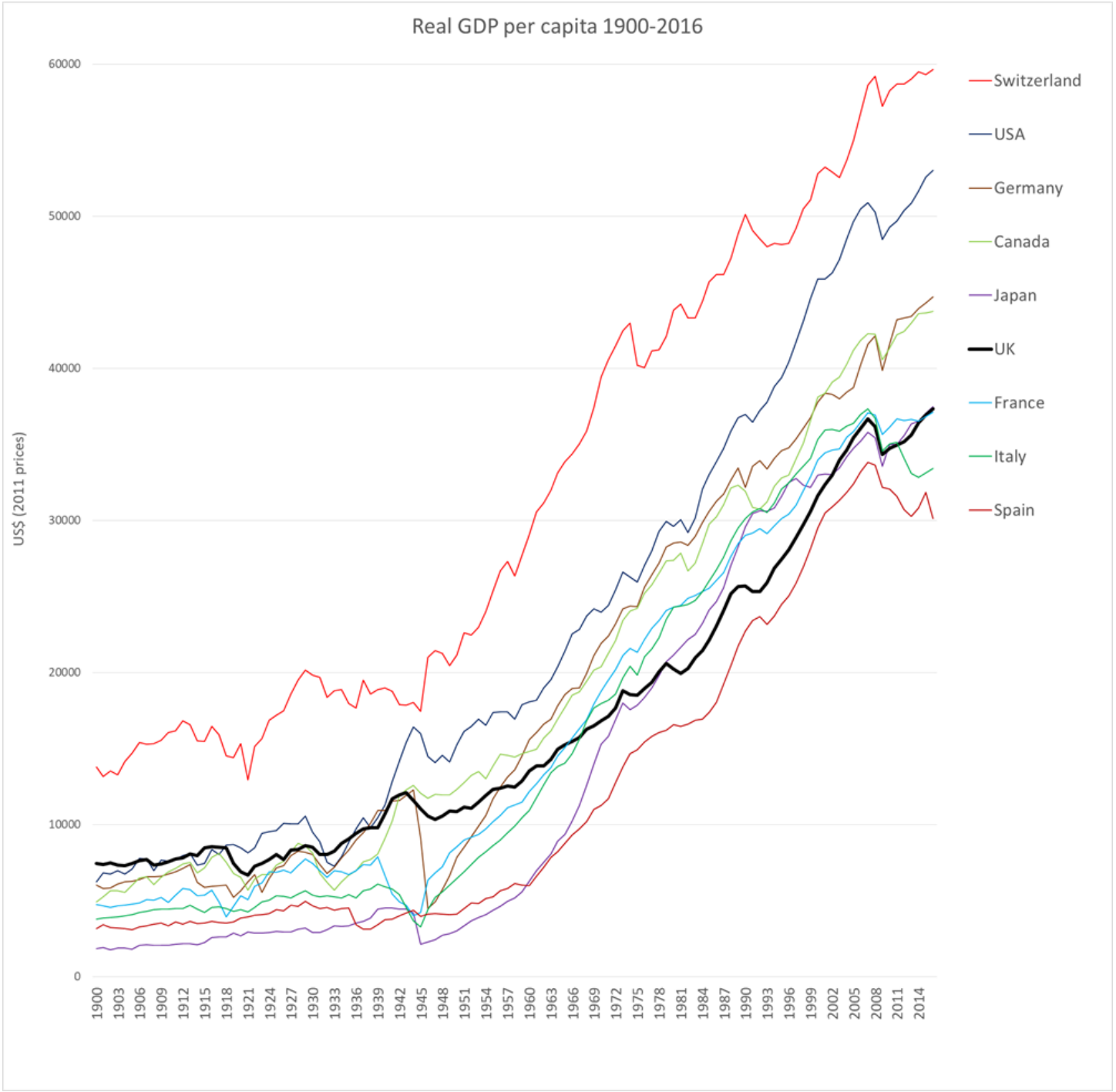
Assumption A1: population and number of workers

- % growth in workers =
  % growth in population



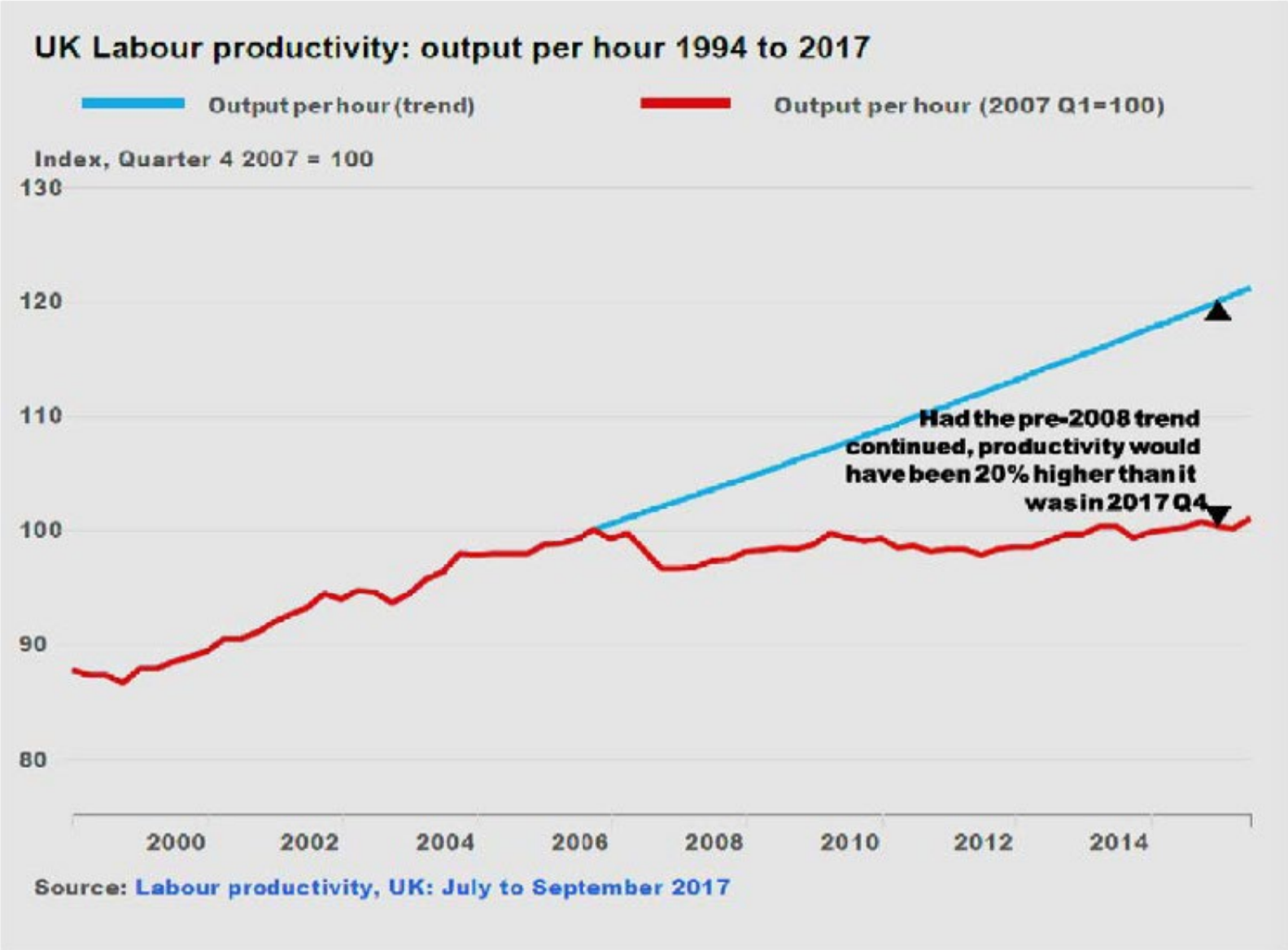
- Low Growth: 0.1% per year
- High Growth: 0.55% per year
- ‘Gradual Recovery’ Scenario: 0.55% per year

Assumption A2:
Per-worker productivity trends



The UK has been growing more slowly in terms of per person productivity among the big OECD economies

Recent productivity was flat-lining since 2008



Source: ONS

Assumption A2: Per-worker productivity trends

- Low Growth: 0.5% per year
- High Growth: 1.8% per year
- 'Gradual Recovery' Scenario: starting from 0.55% and continue to rise to 2.95% (with an overall average of 1.8%)
- What if per-worker productivity continues to flat-line, like since 2008?
  - GDP growth will be the same as population growth; 0.10 – 0.55%

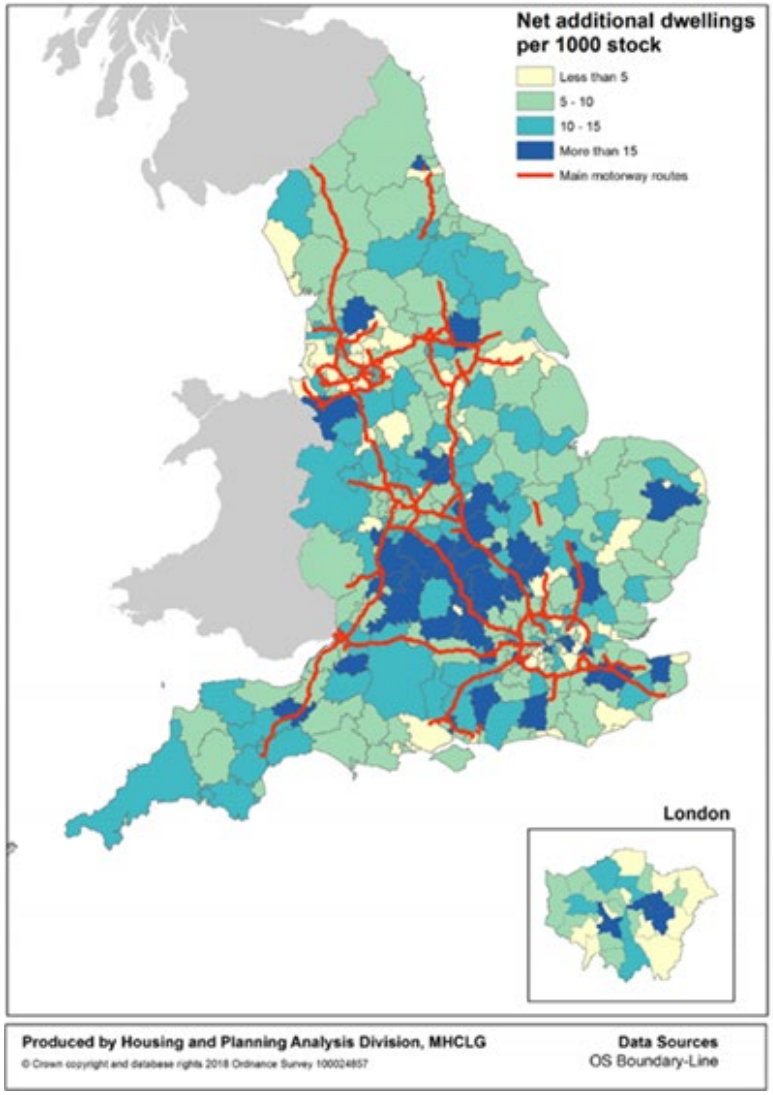
Annualised growth rates 2020-2071	GDP / worker	Population & workers	Implied GDP growth	Growth in earnings per worker
Low Growth (as previously defined and applied for Scenario A and B below)	**0.5%**	**0.10%**	**0.60%**	**0.25%**
High Growth (defined for previous tests and not used in Scenarios A-D below)	**1.8%** (annualized constant rate)	**0.55%**	**2.35%** (annualized constant rate)	**0.9%** (annualized constant rate)
Gradual Recovery (New assumptions; used for Scenario C and D below)	**0.55%-2.95%** (with an overall average of **1.8%**)	**0.55%**	**1.1% - 3.50%** (with an annualised average of **2.35%** per year over 2020-2071)	**0.28%-1.48%** (with an overall average of **0.9%** per year)

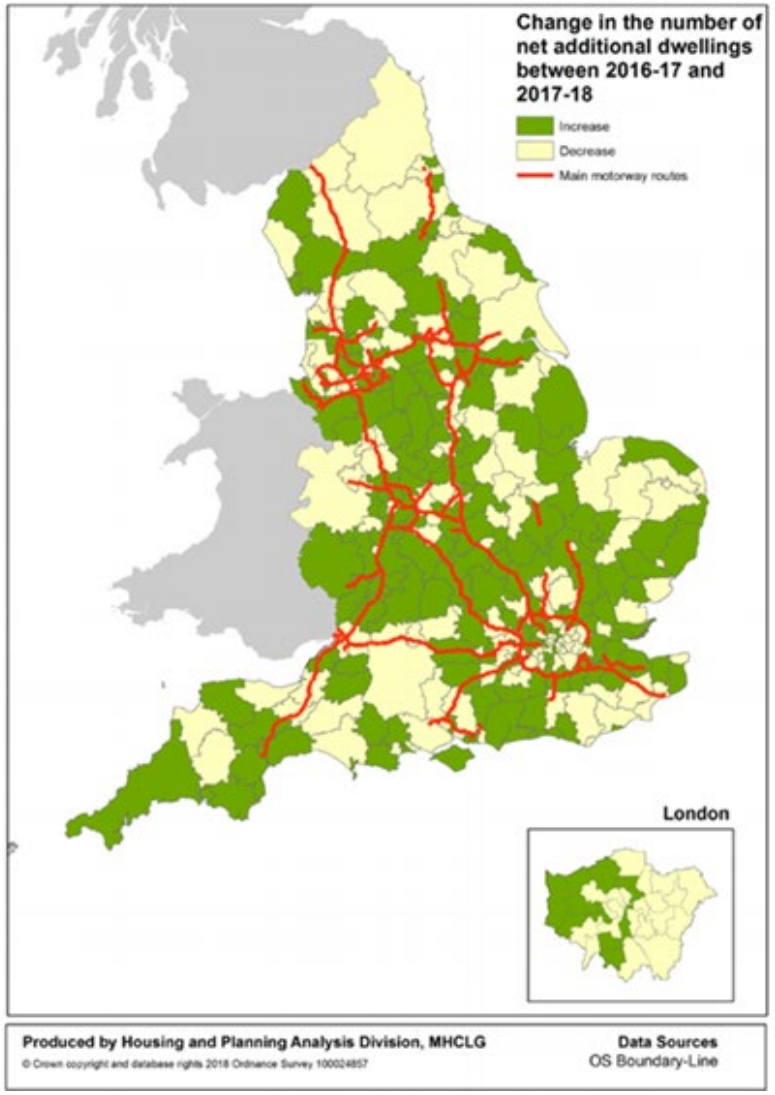
Assumption B
Growth in dwellings

- B1: UK wide growth in dwellings – in line with population growth rates

- B2: geographical distribution of dwellings growth

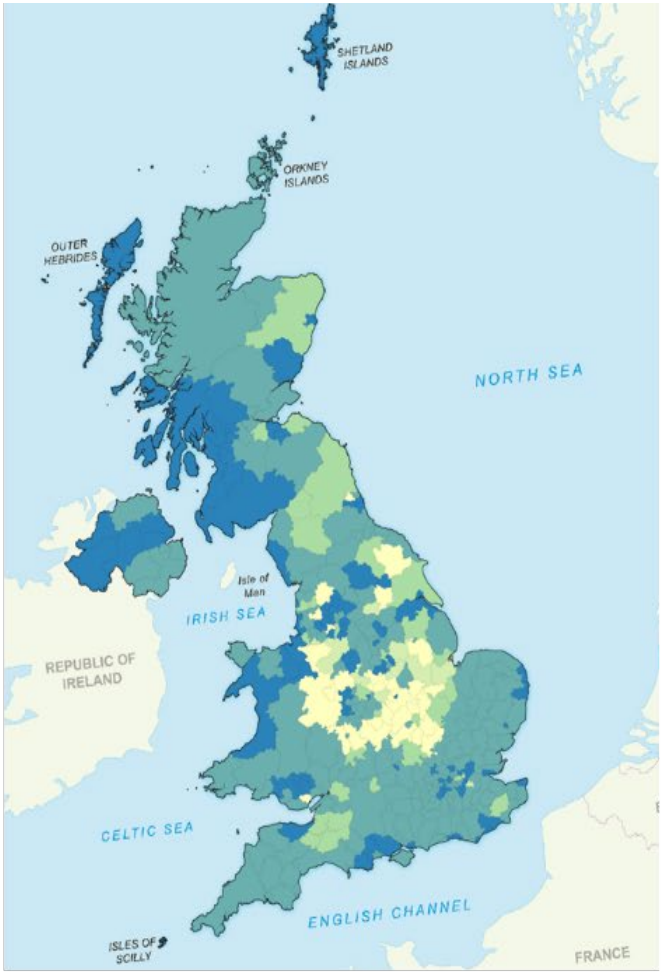
The most prosperous places now find it harder to build more housing



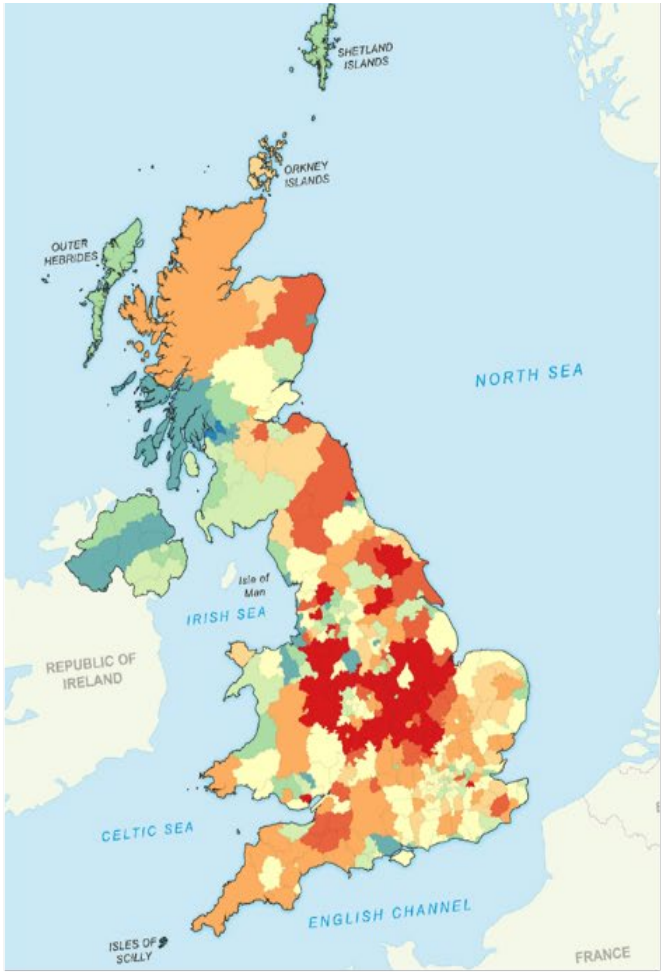


Source of the images: UK MHCLG

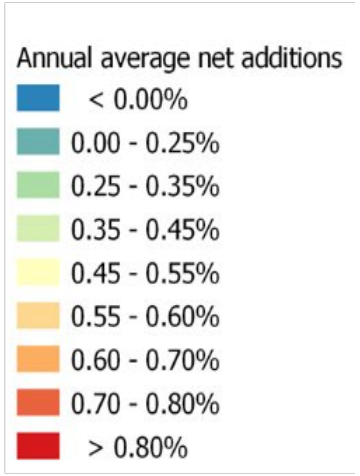
Assumption B2: Dwelling growth in areas where it can still be delivered



Assumptions for low population growth scenarios



Assumptions for the higher population growth scenarios

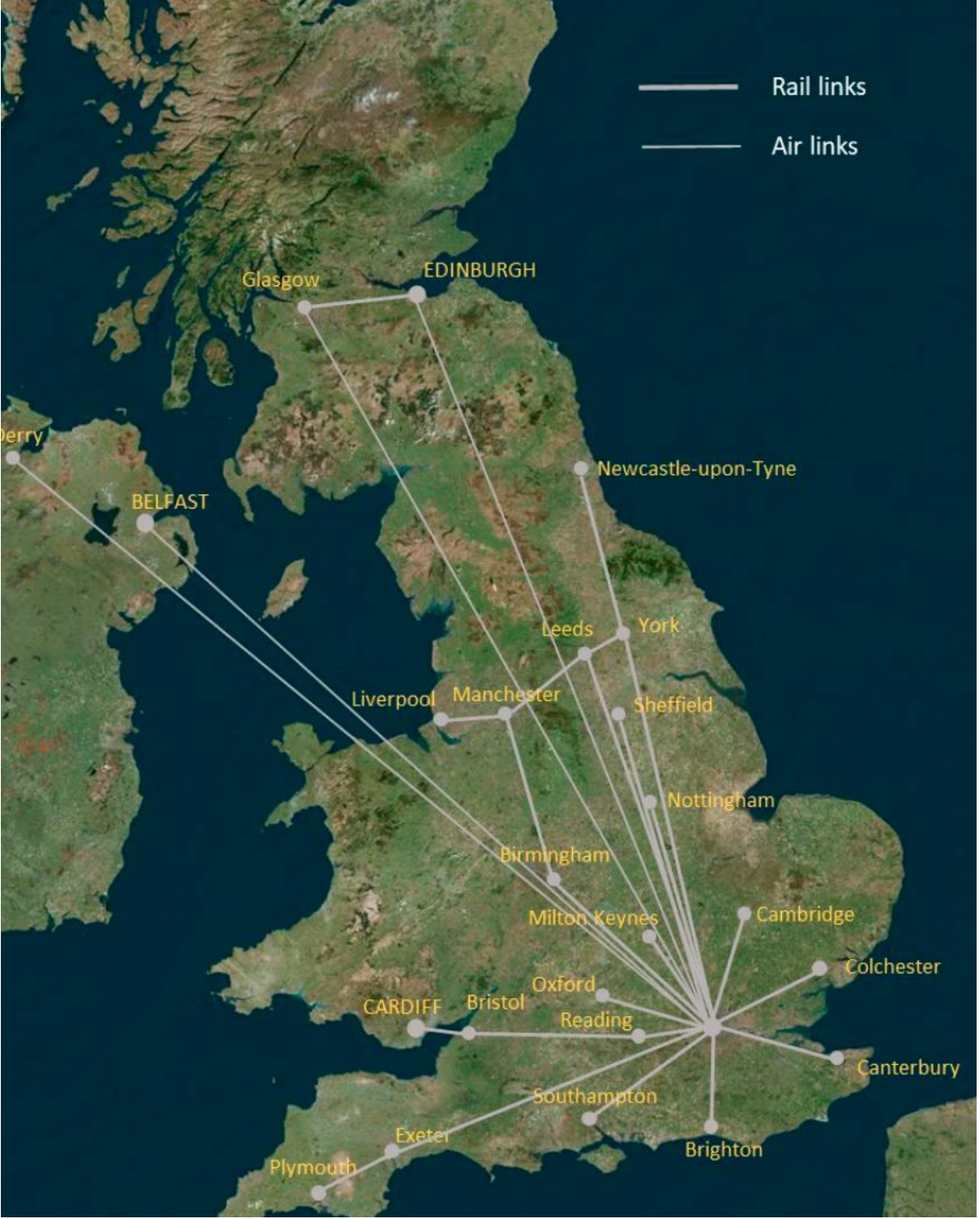


Package up the main assumptions as the main growth scenarios

	Rates of overall economic growth in the UK	
	Low Growth	Gradual Recovery
Geographic spread		
Business as Usual	**Scenario B** Continued Regional Recession	**Scenario A** Persistent Regional Imbalance
Convergent Economy	**Scenario C** Slow Levelling-up	**Scenario D** Dynamic Recovery

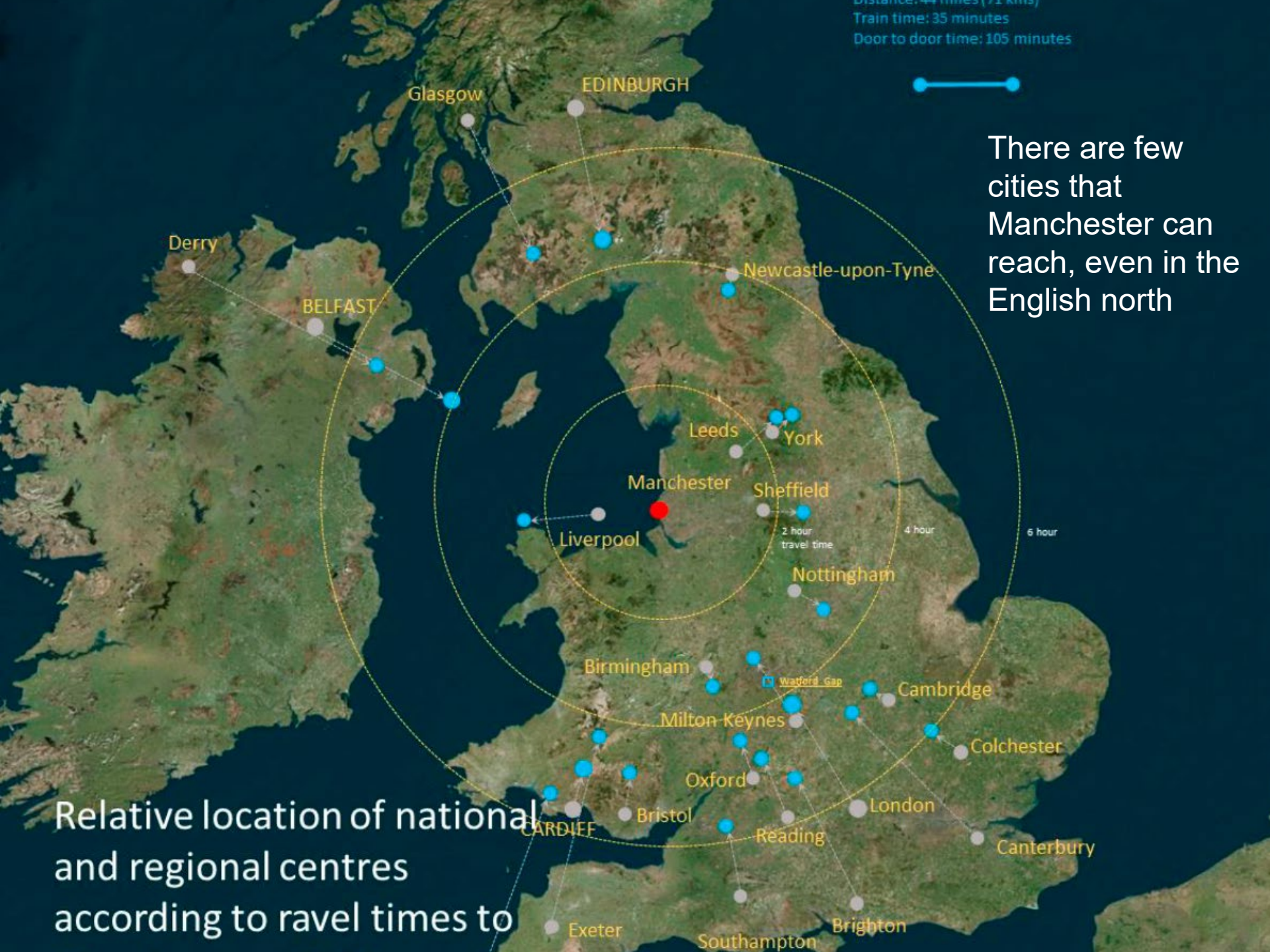
Assumptions C: Transport changes

- For the following three scenarios, we assume that marginal investments will be made to improve transport services but there will be no real change in door to door travel time or convenience between locations
  - Scenario A (Persistent regional imbalance)
  - Scenario B (Continued regional recession)
  - Scenario C (Slow levelling up)
- For Scenario D (Dynamic Recovery), we assume that
  - the critical business travel times between all main UK cities will be reduced to 1 hour 45 mins door to door by 2070 and
  - within each region, the critical business travel times are reduced by 10% in the next 10 years (i.e. 1% a year starting from next year)



The UK's intercity transport network is heavily concentric, focusing on London

'Watford Gap' is indeed a key location that divides the South from the Midlands and the North


Train time: 35 minutes
Door to door time: 105 minutes
Glasgow
EDINBURGH
Derry
BELFAST
Newcastle-upon-Tyne
Leeds
York
Manchester
Sheffield
Liverpool
2 hour travel time
4 hour
6 hour
Nottingham
Birmingham
Watford Gap
Cambridge
Milton Keynes
Colchester
Oxford
London
Bristol
CARDIFF
Reading
Canterbury
Exeter
Southampton
Brighton
There are few cities that Manchester can reach, even in the English north
Relative location of national and regional centres according to ravel times to


Glasgow
Derry
BELFAST
Newcastle-upon-Tyne
Leeds
York
Manchester
Sheffield
Liverpool
2 hour travel time
4 hour
6 hour
Nottingham
Birmingham
Watford Gap
Cambridge
Milton Keynes
Colchester
Oxford
CARDIFF
London
Bristol
Reading
Canterbury
Exeter
Southampton
Brighton
Plymouth
The Scenario D assumptions of 1 hour 45 min door to door time looks like this for Manchester
Relative location of national and regional centres according to ravel times to Manchester - **2071**

The LUISA model for the UK (v3.0): model summary

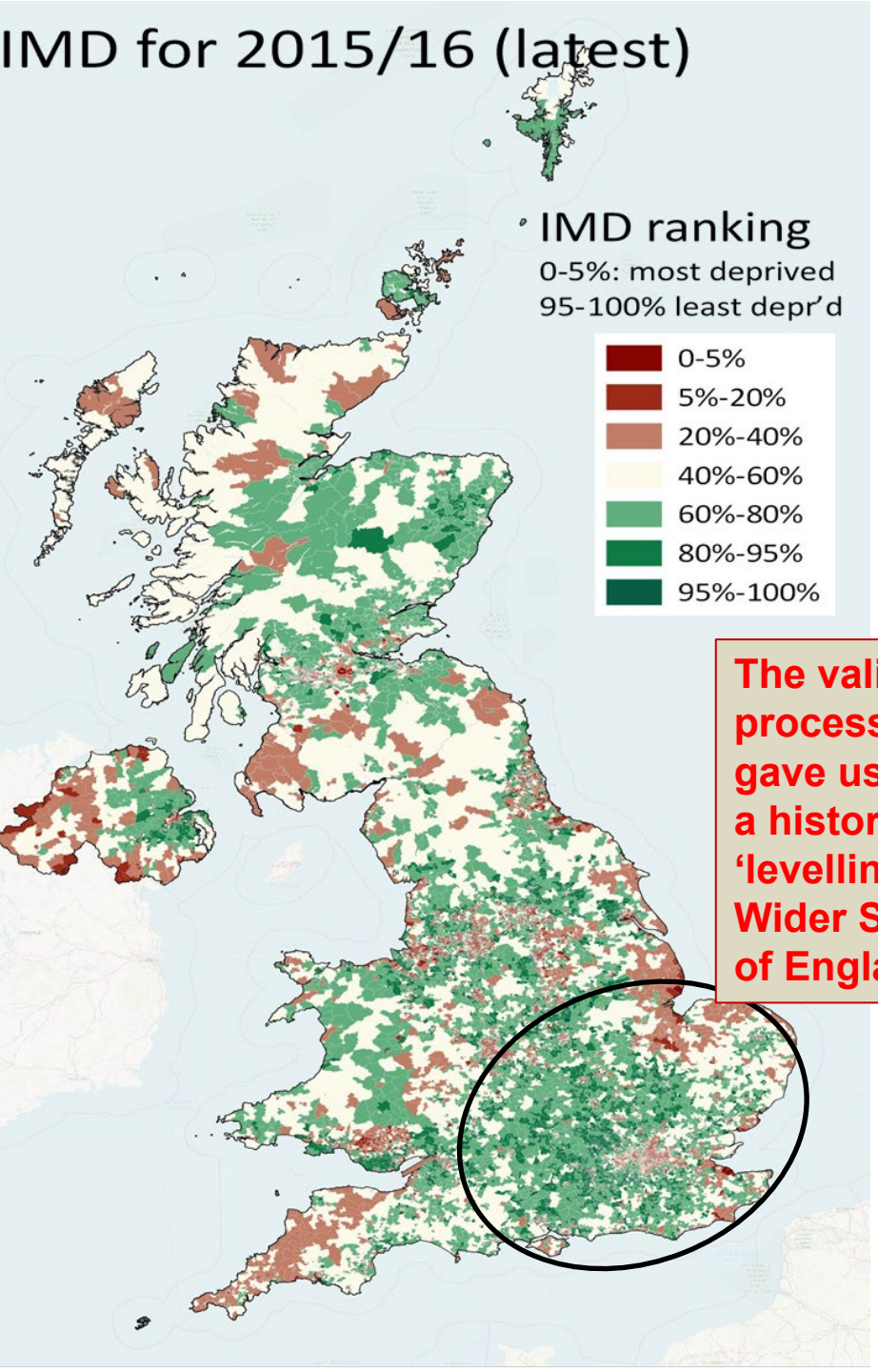
- Our current aim is to develop applied models as ‘silver’ or ‘metallic grey’ boxes
- The model structure follows the recursive spatial equilibrium model paper (Jin, Echenique and Hargreaves, 2013), with some of the dynamics modelling done by focus groups within the UK2070 Commission
- Contribution of a large modelling team to correct biased spatial observations, calibrate spatial equilibrium parameters and incorporate observed rents and congestion times
- Connection of total factor productivity to transport accessibility changes; Hicksian consumer utilities
- Validation of the entire model over time (2001-2011-2018 – see methodology reported in Wan and Jin, 2017 in EPB)

Model report references

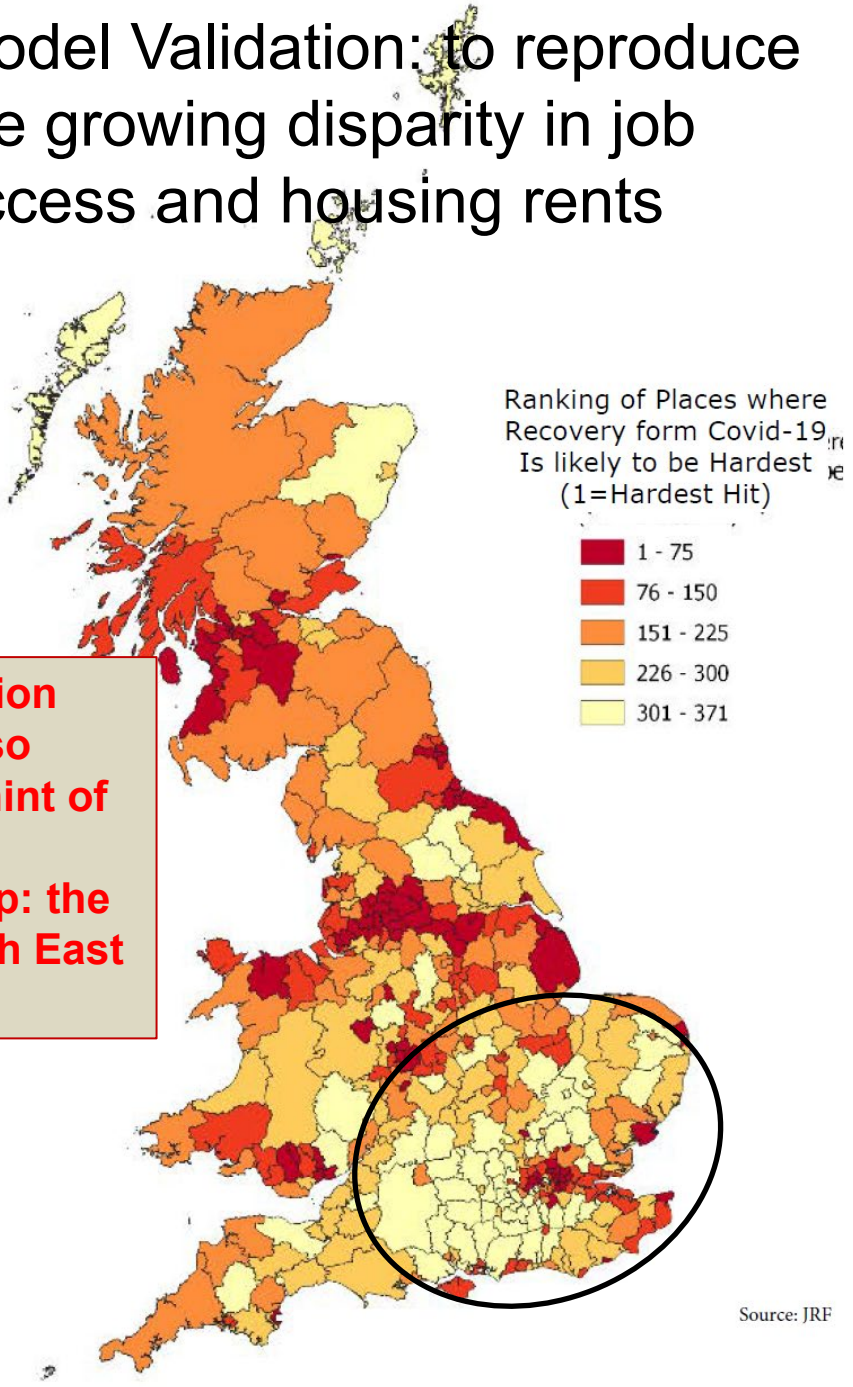
- Post-covid scenarios tests: http://uk2070.org.uk/wp-content/uploads/2020/09/UK2070-Futures-Post-COVID-Scenario-Modelling.pdf

- Pre-covid modelling report that established the maths, model structures and high-low growth scenarios: http://uk2070.org.uk/wp-content/uploads/2019/05/UK2070Commission-MODELLING-TECHNICAL-REPORT.pdf

- The UK2070 Commission's main report is the first listed on this page: http://uk2070.org.uk/publications/



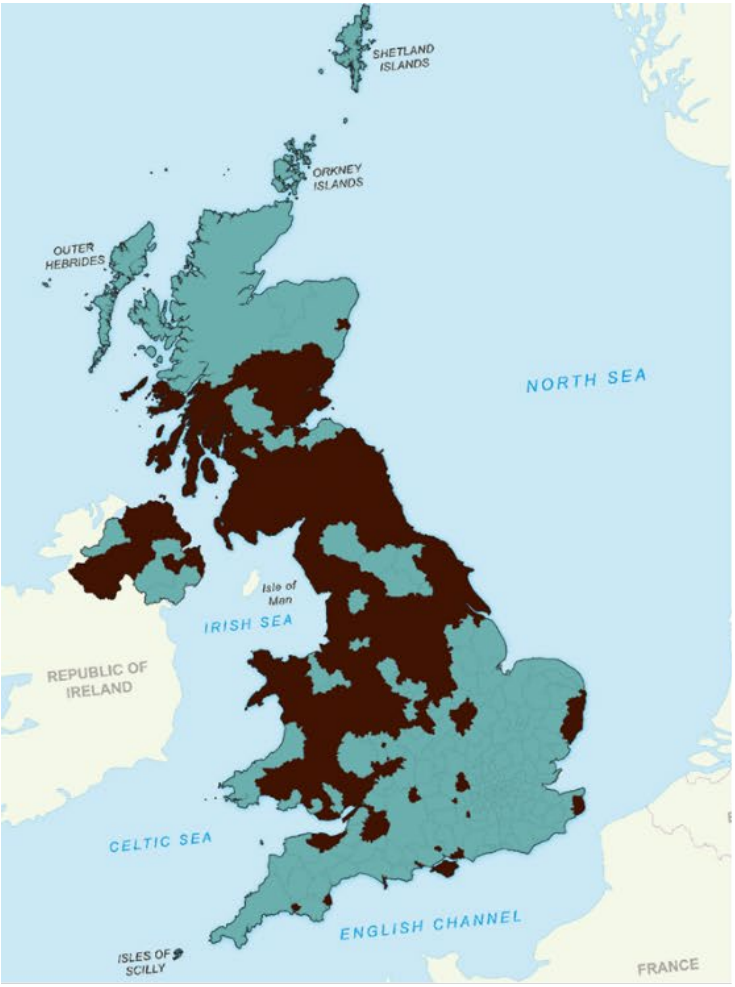
Model Validation: to reproduce the growing disparity in job access and housing rents



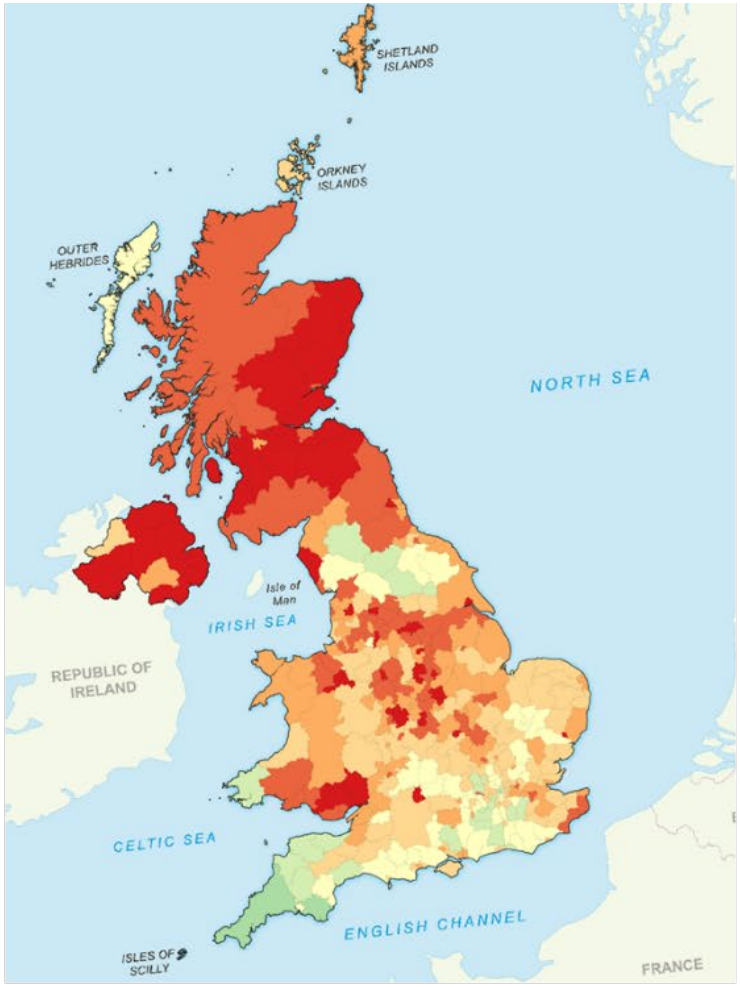
The validation process also gave us a hint of a historic 'levelling-up: the Wider South East of England

Relevant model results

Test the scenarios using the LUISA model (v3.0) for the UK



'Continued Regional Recession'



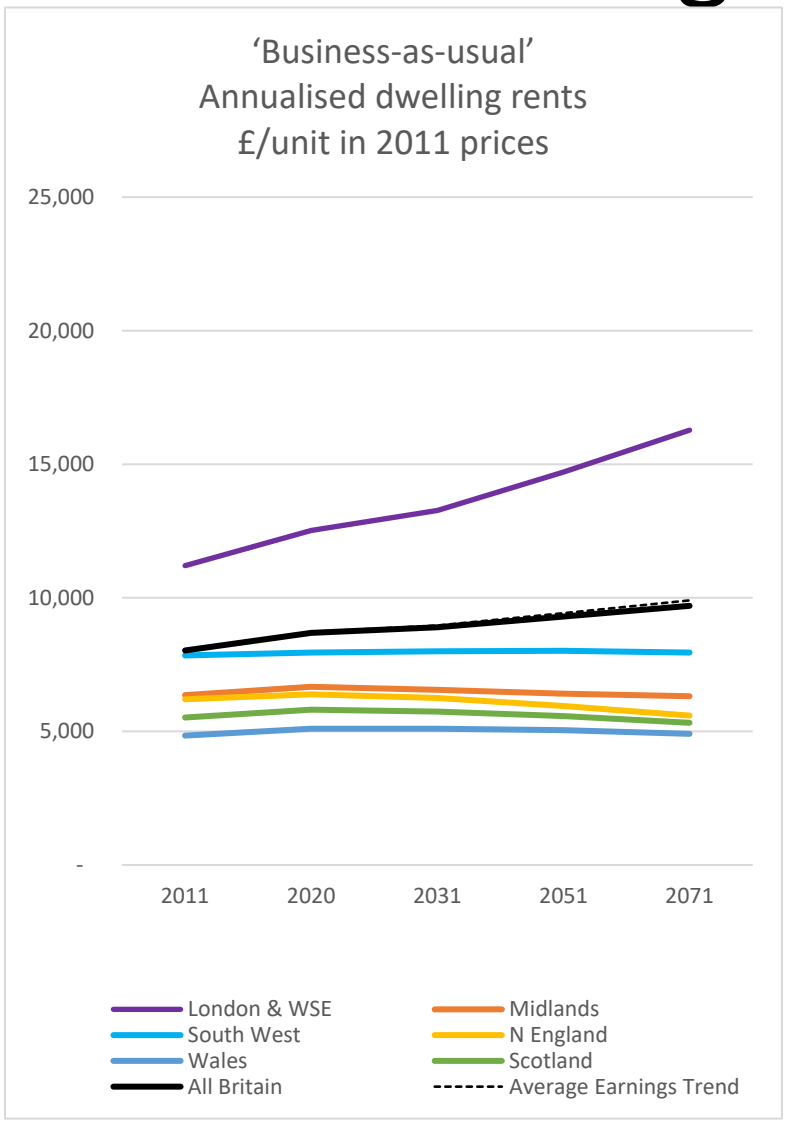
'Dynamic Recovery'

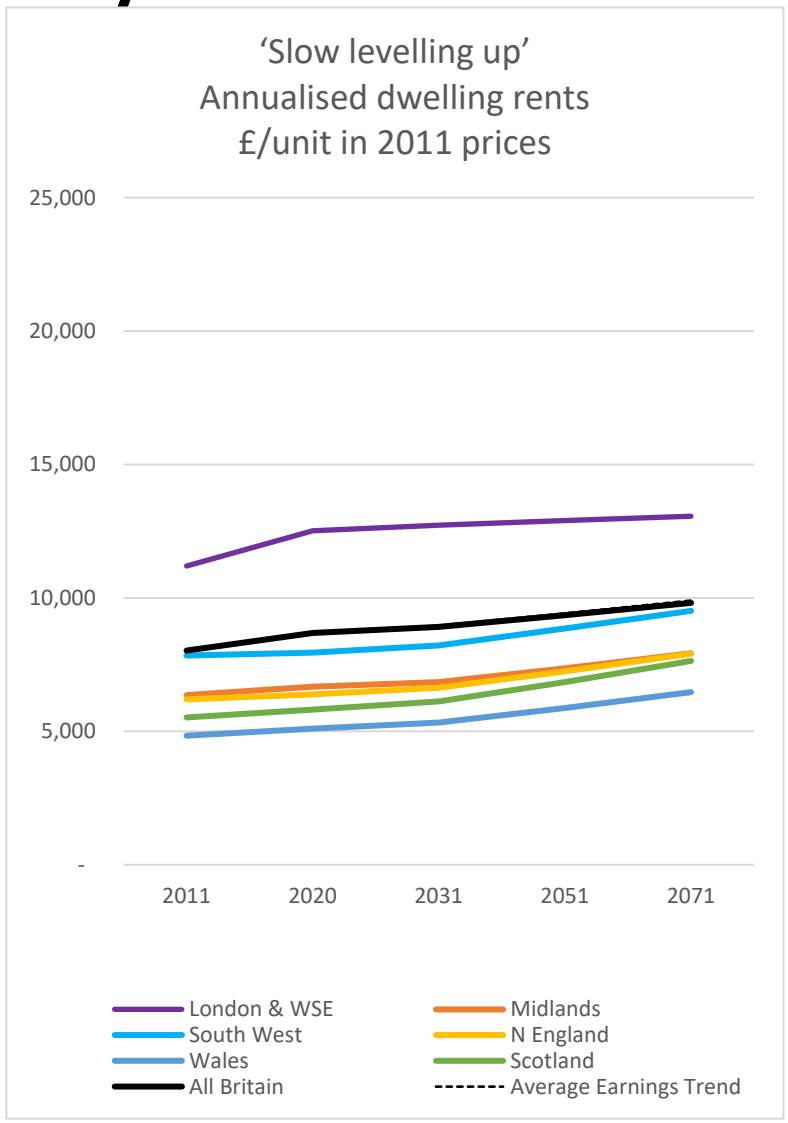
Changes in house prices

Average annual % change

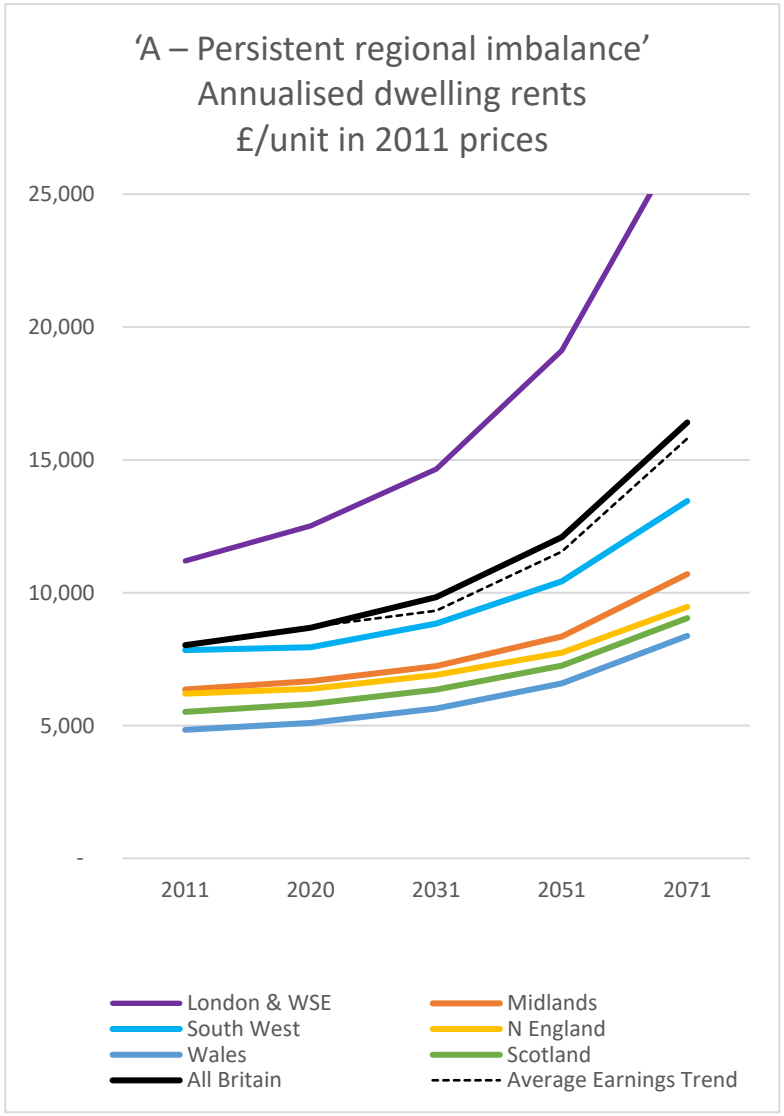
- < 0.00%
- 0.00 - 1.50%
- 1.50 - 2.00%
- 2.00 - 2.50%
- 2.50 - 2.75%
- 2.75 - 3.00%
- 3.00 - 3.25%
- 3.25 - 3.50%
- > 3.50%

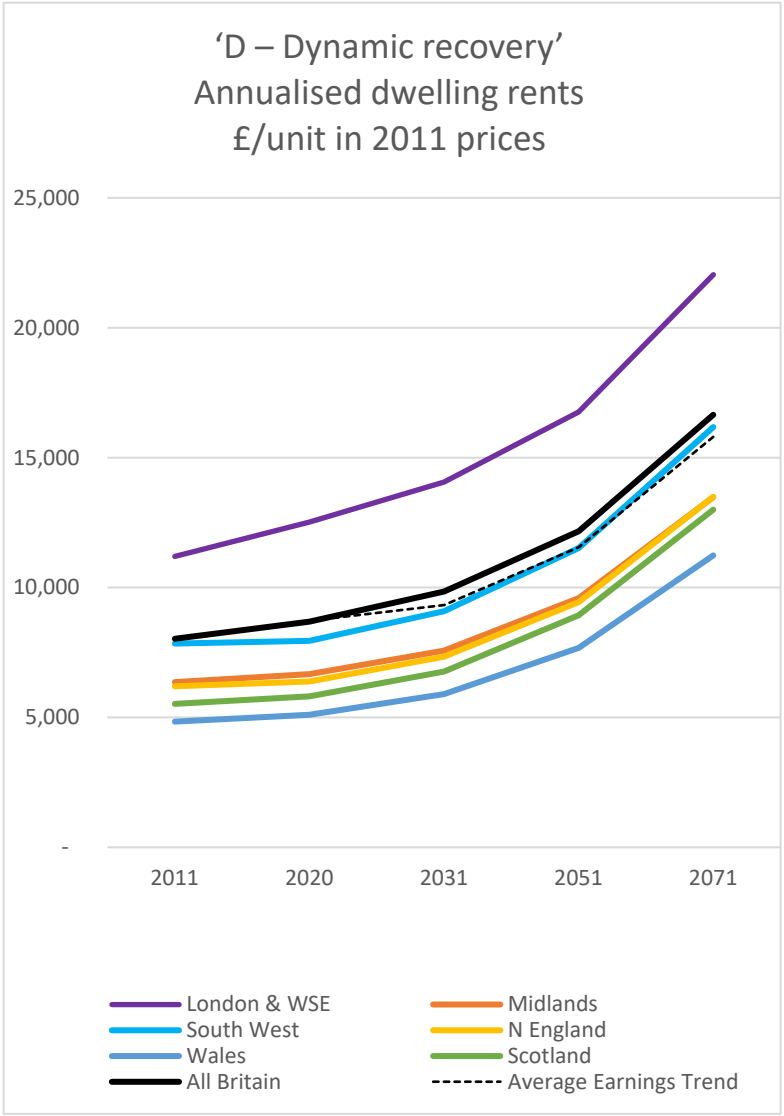
Under low economic growth, there isn't a good way out …



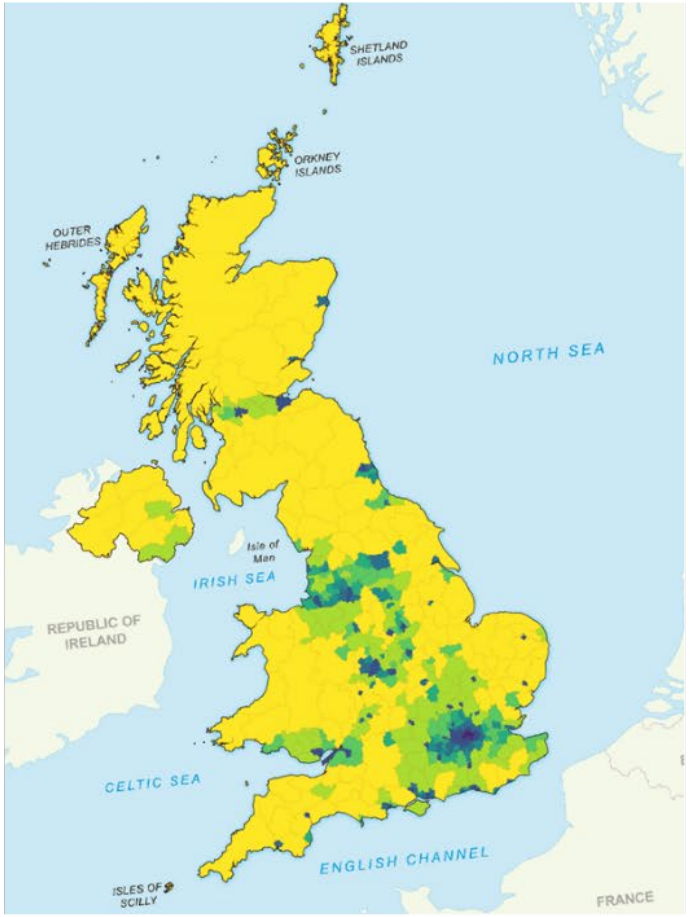


Under gradual recovery, spatial planning and design makes all the difference

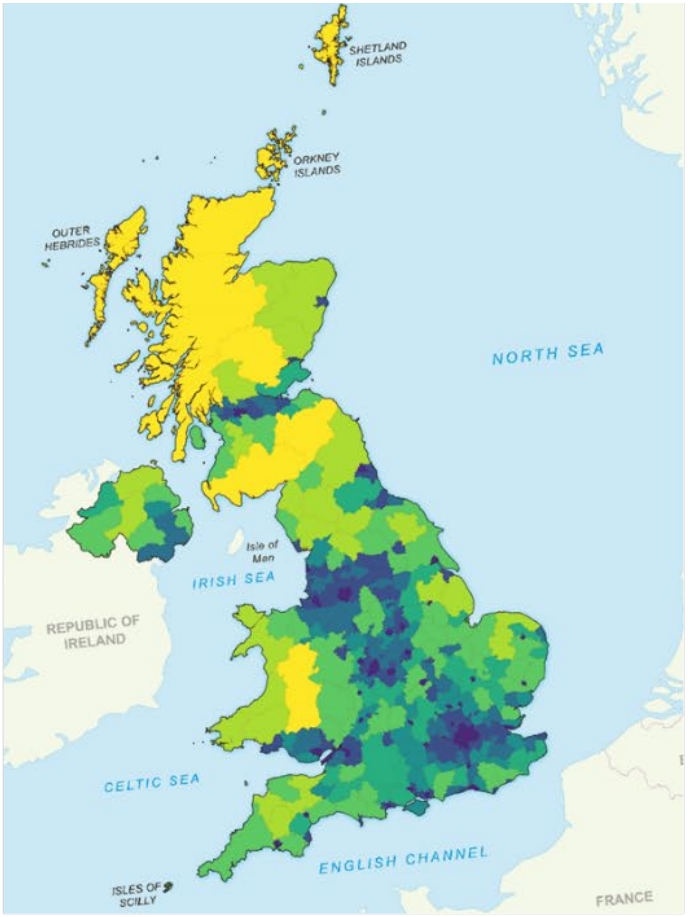




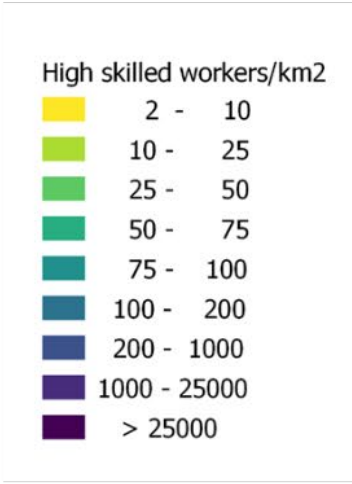
The key ingredient to spatial balance is the distribution of jobs, not of housing



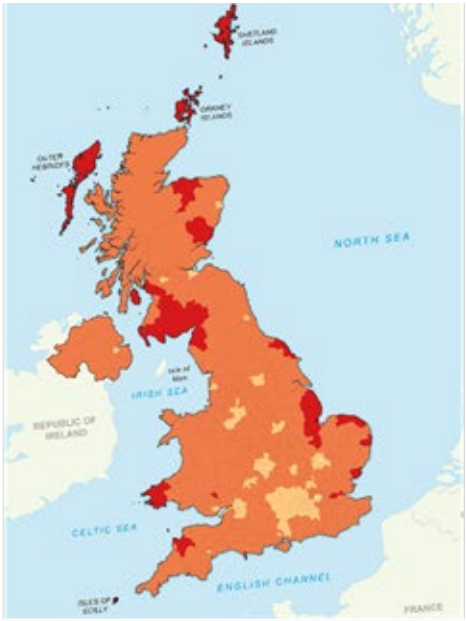
2011 (as recorded by Census)



2071 Dynamic Recovery Scenario



… especially the share of high skilled jobs

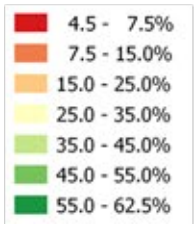


2011 (as recorded in Census)

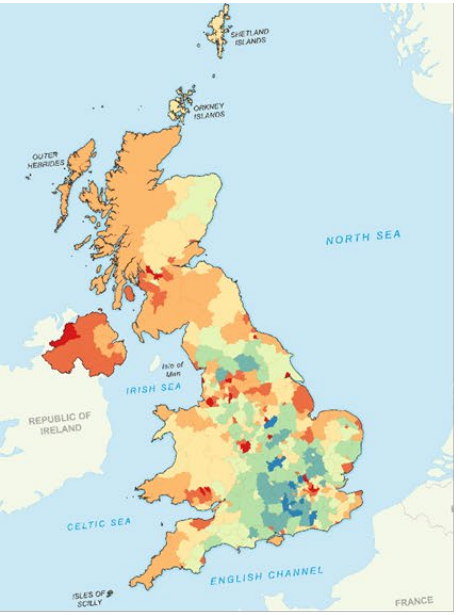
2031 (Dynamic Growth)

2051 (Dynamic Growth)

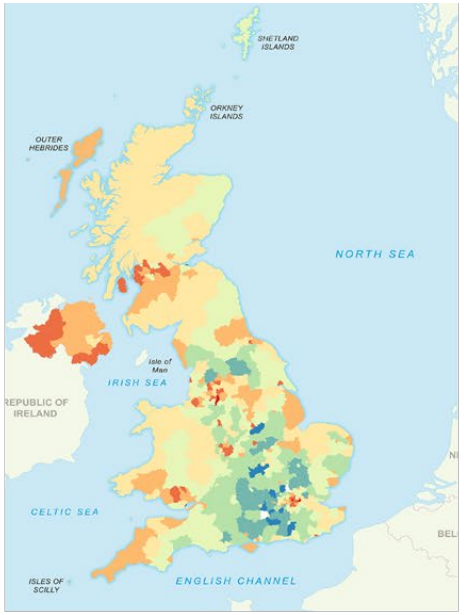
2071 (Dynamic Growth)



It is the more even spread of high skilled jobs that engenders a gradual elimination of multiple deprivation



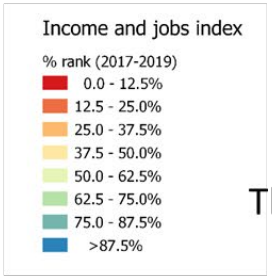
Index of income and jobs deprivation 2017-2019



2031 Dynamic Growth

2051 Dynamic Growth

2071 Dynamic Growth



The higher the % rank, the less poor

Explanation: The spread of good jobs across the UK reduces the level of income and jobs deprivation over time: the above maps show the level of income and jobs deprivation using the benchmark for 2017-2019 (see legend)

Conclusions: what have we learnt from the model and scenario tests?

- Under the UK's circumstances, job/housing balance is achieved more easily with a jobs-led growth, rather than housing-led growth
- Centres of new jobs are unlikely to emerge if they are more than 1 hour 45 min away door to door from existing centres (for business- and social-critical trips)
- Interregional and intraregional transport have a powerful steer on productivity
- All equilibria/balances are temporary – they are easily destroyed

Acknowledgments

The Study Team for this work comes from the Cities and Transport Research Group, within the Martin Centre for Architectural and Urban Studies, Dept of Architecture, University of Cambridge.

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The usual disclaimers apply and the Study Team is solely responsible for the model analyses, views expressed and any remaining errors.