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
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?
UK GDP 2020 looks to be 12-13% down from 2019

‘Low Growth’ scenario: like Japan since 2000
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‘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 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

Had the pre-2008 trend continued, productivity would have been 20% higher than it was in 2017 Q4

Source: Labour productivity, UK: July to September 2017

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

<table>
<thead>
<tr>
<th>Rates of overall economic growth in the UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Growth</td>
</tr>
<tr>
<td>Gradual Recovery</td>
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</table>

### Geographic spread

<table>
<thead>
<tr>
<th>Business as Usual</th>
<th>Scenario B</th>
<th>Scenario A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continued</td>
<td>Continued Regional Recession</td>
<td>Persistent Regional Imbalance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Convergent Economy</th>
<th>Scenario C</th>
<th>Scenario D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow Levelling-up</td>
<td>Dynamic Recovery</td>
<td></td>
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</tbody>
</table>
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 North and the Midlands.
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...
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 travel 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


• 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/
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

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%

Maps showing 'Continued Regional Recession' and 'Dynamic Recovery'
Under low economic growth, there isn’t a good way out ...

‘Business-as-usual’
Annualised dwelling rents
£/unit in 2011 prices

‘Slow levelling up’
Annualised dwelling rents
£/unit in 2011 prices
Under gradual recovery, spatial planning and design makes all the difference

‘A – Persistent regional imbalance’
Annualised dwelling rents
£/unit in 2011 prices

‘D – Dynamic recovery’
Annualised dwelling rents
£/unit in 2011 prices
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
It is the more even spread of high skilled jobs that engenders a gradual elimination of multiple deprivation.

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
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.