WEST MIDLANDS
COMBINED AUTHORITY

STRATEGIC ECONOMIC PLAN

Technical appendix
DYNAMIC ECONOMIC
IMPACT MODEL (DEIM)

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Context

The West Midlands Combined Authority (WMCA) commissioned a new, bespoke economic modelling framework which was delivered in summer 2016. The Dynamic Economic Impact Model (DEIM) is a best-in-class regional model which provides a robust mechanism to measure the economic impact of investments in a spatial context.

Although it draws upon modelling methods that have been developed over several decades, this kind of modelling is a relatively recent phenomenon – the first example being Greater Manchester in 2009. As a result, the techniques used have been developing rapidly in response to (1) new academic evidence on the effects of infrastructure investment on the economy and (2) new funding streams linked to the delivery of net national growth (e.g. Payment-by-Results).

The West Midlands therefore required a new methodology for prioritising investment against both its own economic and balance metrics, and for understanding the likely impact of that investment on net national growth.

What DEIM enables: Core capabilities

The DEIM model represents a significant departure from previous modelling techniques which could only consider projects in isolation. Instead, it has the ability to consider investments of different types both individually and jointly, and to forecast synergies or conflicts in their consequences.

On a project-by-project basis, DEIM can help to:

- ☑ Understand the impact of individual investments in terms of their economic impact (as measured by GVA) in order robustly and transparently prioritise investment across the three WM LEP areas
- ☑ Appraise and prioritise different types of interventions (e.g. housing versus transport) on a level playing field

At the programme level, DEIM can help to:

- ☑ Assess investment programmes against secondary criteria that ensure local balance
- ☑ Provide robust analysis of national impacts by taking account of growth any growth that might have been displaced from elsewhere in the country
- ☑ Create an integrated spatial investment strategy and assess that against the WM vision
- ☑ Consider the level and spatial distribution of land-use needed to achieve the WM vision
- ☑ Test and optimise investment programmes

Investments 'in scope' for DEIM

The DEIM model builds on the latest methodological advancements in city region economic impact modelling and can appraise all types of 'hard' infrastructure. These typically include a combination of the following elements:

- *Transport* improvements by mode (road, rail, active)
- *Land use* changes (e.g. site remediation, drainage projects, public realm)
- '*Other*' types of infrastructure changes including tourism schemes, district heating, etc.

Additionally, the DEIM extends the scope of previous economic models to 'soft' infrastructure including:

- *Skills* programmes, including NVQ and apprenticeship schemes
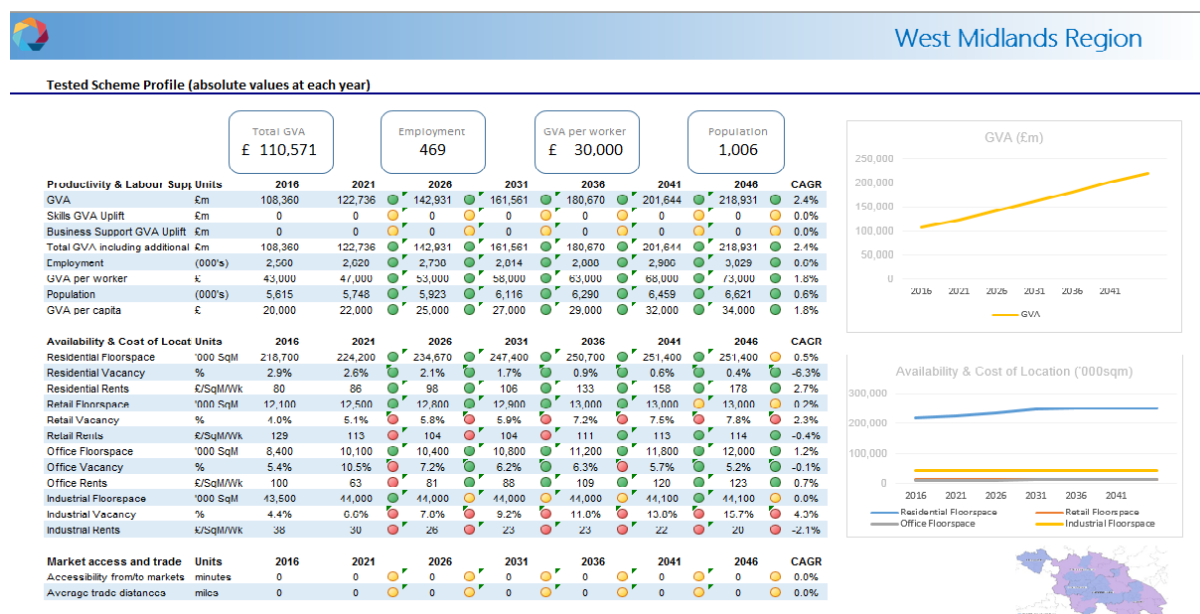- *Business support* (e.g. access to finance, trade facilitation)

DEIM outputs

The main output from DEIM is the economic impacts of projects or programmes in terms of GVA. It can also produce a range of secondary outputs including:

- Jobs by sector
- Earnings or household income
- Number of learners
- Accessibility to employment (i.e. job opportunities)
- Floor space by type (housing, commercial, retail, industrial)

Diagnostics Tool

A reporting dashboard has been created which reports on the impact of investments against key economic indicators:

West Midlands Region

Tested Scheme Profile (absolute values at each year)

Total GVA	Employment	GVA per worker	Population
£ 110,571	469	£ 30,000	1,006

Productivity & Labour Supply	Units	2016	2021	2026	2031	2036	2041	2046	CAGR
GVA	£m	108,360	122,736	142,931	161,561	180,670	201,644	218,931	2.4%
Skills GVA Uplift	£m	0	0	0	0	0	0	0	0.0%
Business Support GVA Uplift	£m	0	0	0	0	0	0	0	0.0%
Total GVA including additional	£m	108,360	122,736	142,931	161,561	180,670	201,644	218,931	2.4%
Employment	(000's)	2,560	2,620	2,730	2,014	2,000	2,900	3,029	0.0%
GVA per worker	£	43,000	47,000	53,000	58,000	63,000	68,000	73,000	1.8%
Population	(000's)	5,615	5,748	5,923	6,116	6,290	6,459	6,621	0.6%
GVA per capita	£	20,000	22,000	25,000	27,000	29,000	32,000	34,000	1.8%

Availability & Cost of Location	Units	2016	2021	2026	2031	2036	2041	2046	CAGR
Residential Floorspace	'000 SqM	218,700	224,200	234,670	247,400	250,700	251,400	251,400	0.5%
Residential Vacancy	%	2.9%	2.6%	2.1%	1.7%	0.9%	0.6%	0.4%	-6.3%
Residential Rents	£/SqM/Wk	80	86	98	106	133	158	178	2.7%
Retail Floorspace	'000 SqM	12,100	12,500	12,800	12,900	13,000	13,000	13,000	0.2%
Retail Vacancy	%	4.0%	5.1%	5.8%	5.9%	7.2%	7.5%	7.8%	2.3%
Retail Rents	£/SqM/Wk	129	113	104	104	111	113	114	-0.4%
Office Floorspace	'000 SqM	8,400	10,100	10,400	10,800	11,200	11,800	12,000	1.2%
Office Vacancy	%	5.4%	10.5%	7.2%	6.2%	6.3%	5.7%	5.2%	-0.1%
Office Rents	£/SqM/Wk	100	63	81	88	109	120	123	0.7%
Industrial Floorspace	'000 SqM	43,500	44,000	44,000	44,000	44,000	44,100	44,100	0.0%
Industrial Vacancy	%	4.4%	6.0%	7.0%	9.2%	11.0%	13.0%	15.7%	4.3%
Industrial Rents	£/SqM/Wk	38	30	26	23	23	22	20	-2.1%

Market access and trade	Units	2016	2021	2026	2031	2036	2041	2046	CAGR
Accessibility from/to markets	minutes	0	0	0	0	0	0	0	0.0%
Average trade distances	miles	0	0	0	0	0	0	0	0.0%

GVA (£m)

Availability & Cost of Location ('000sqm)

Residential Floorspace — Retail Floorspace — Office Floorspace — Industrial Floorspace

How it Links to the Project Lifecycle?

The model will interact in two ways:

Development Stage: The DEIM provides a tool to facilitate proposition development and the creation of programmes to maximise economic impact.

Outline Business Case Stage: Once programmes are developed the DEIM can also help provide advice to the investment board on the economic impact of the proposal. It is anticipated that programmes are fed in post Outline Business Stage case so sufficient information is available to provide the estimated economic impact of the project in a spatial context.

Limitations of the model

- ☑ It is primarily an economic impact tool – broader considerations of the project (e.g. environmental or air quality impacts) would take place at Full Business Case phase
- ☑ Detailed transport analysis would have to be undertaken outside the model using alternative models (i.e. PRISM)

Model Structure

The DEIM modelling framework consists of the six core elements numbered in the diagram below:
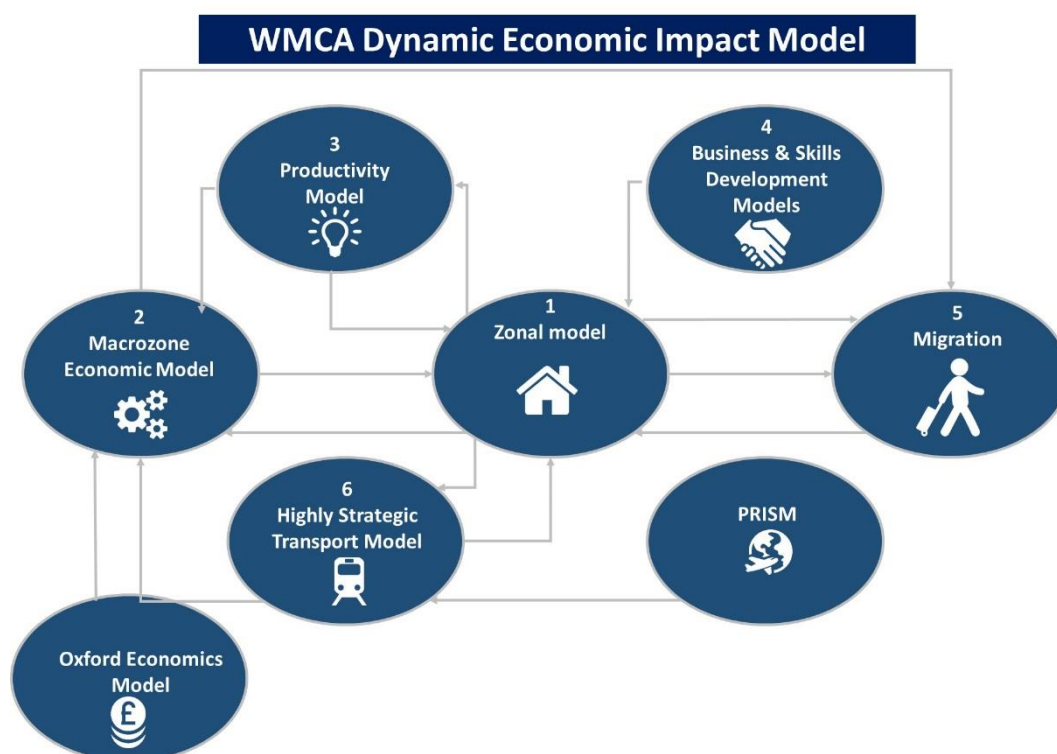
1. **Zonal model**: A detailed spatial model which represents approximately 100 zones within the WMCA geography and the surrounding area plus simpler zones for the rest of Great Britain. This forms the heart of the model, capable of predicting the movement of jobs and residents in response to changes in land use, housing, and labour demand. The coverage of the whole of GB is in line with best practice in other models and allows explicit consideration of how interventions in the West Midlands will affect other regions and of their net national impacts.
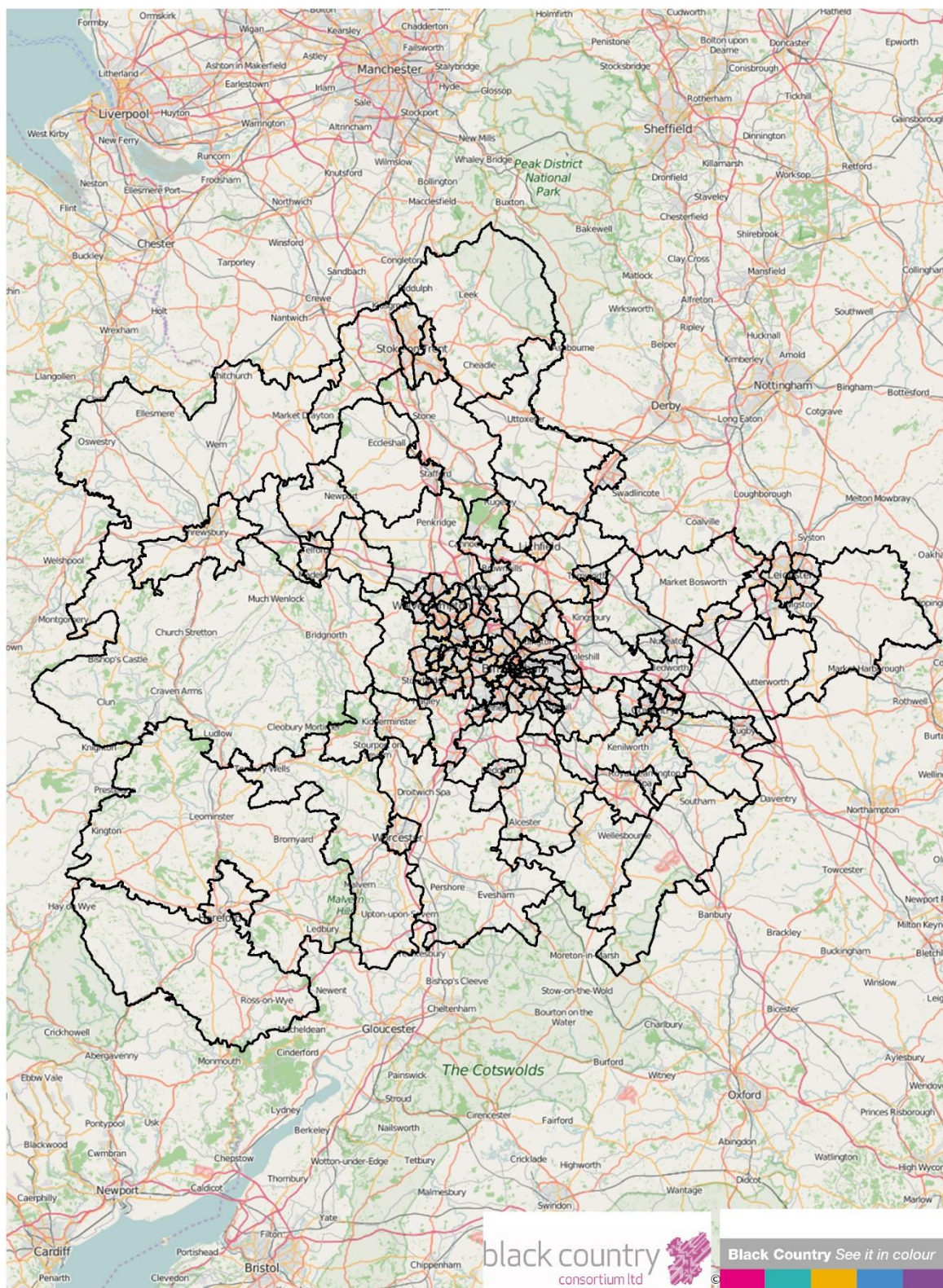
2. **Macro zone model**: A regional economic model built on travel-to-work areas (i.e. labour markets) which are defined as groups of individual zones. This appraises the effect of investment and industrial change which have long-term implications on urban and regional growth, as well as the trade flows and competition between regions. The design of this model again draws on recent best practice in other studies.

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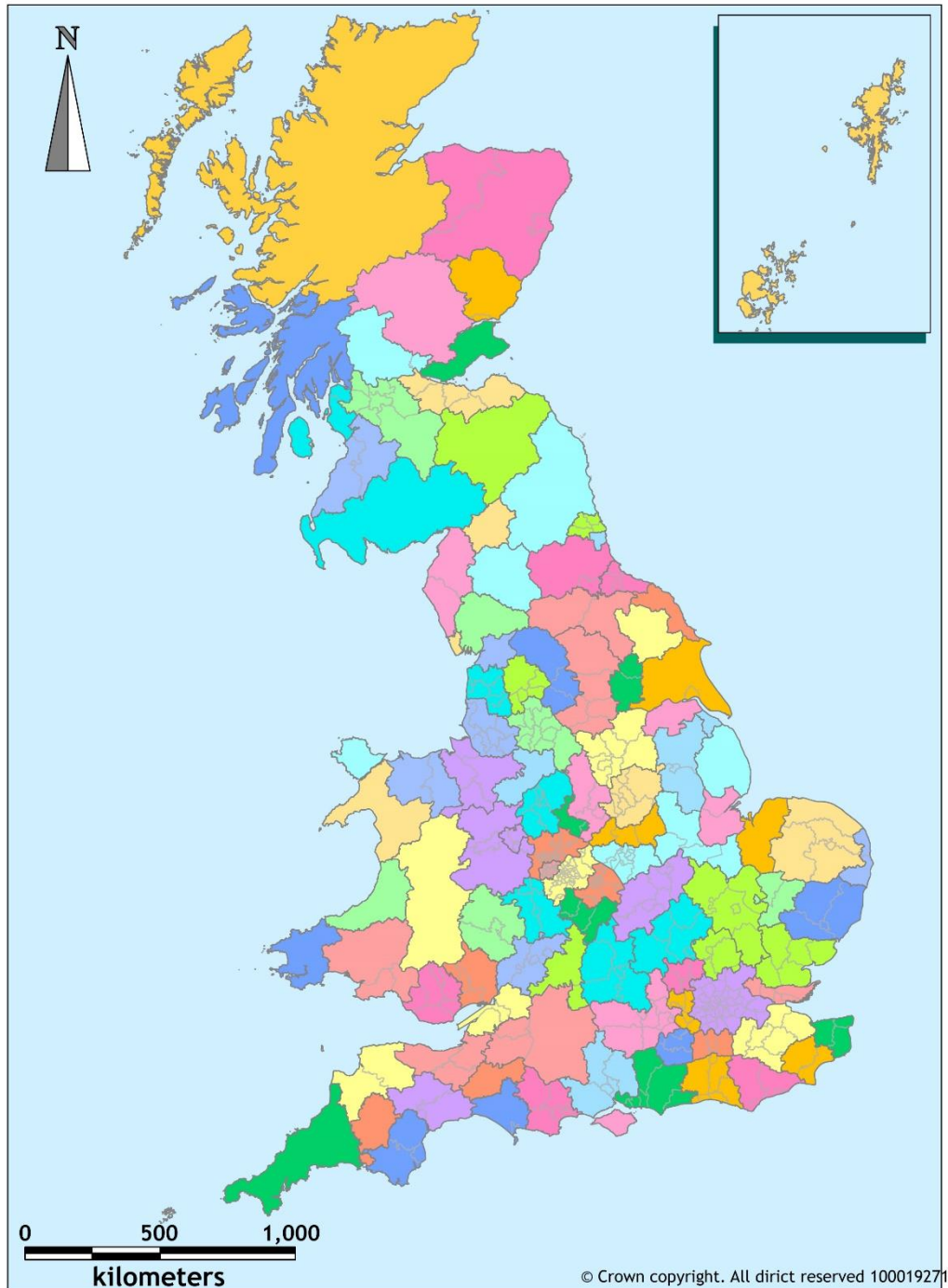
3. **Productivity model**: Provides a detailed matrix of productivity (GVA/worker) estimates by zone, industry, and socio-economic level, and then calculates how changes in location and

density affect GVA per worker. This represents the most recent methodological advances by putting productivity changes at the heart of the model, ensuring that the consequences of enhanced productivity (e.g. high incomes and increased housing demand) are considered in the analysis.

4. **Business development and skills model**: The City REDI group at Birmingham University developed a sub-model to estimate the direct economic impacts of skills and business development.

5. Migration model: Represents the household movements between different labour market areas which has identified the key drivers of internal migration at different distances (for example, medium-distance 'quality of life' migration versus long-distance 'economic migration).

6. Highly strategic transport model (HSTM): Provides an aggregated view of the transport system. This has been built using outputs from the West Midlands current transport model (PRISM), but by aggregating the transport network offers a practical alternative to the detailed transport model which often has an average run time of 3 - 6 weeks, when work on optimising a SEP programme will require run times measured in minutes.

These six components form the core of the DEIM model. However, the core model also draws on inputs from existing models, primarily the existing transport model for the West Midlands (PRISM) as outlined above, as well as the Oxford Economics model for macroeconomic forecasts. The DEIM itself is based on David Simmonds Consultancy's widely-applied DELTA software, supplemented by additional analysis for business development and skills.

Example demonstration test results

DEIM can be used at the development stage to quickly, efficiently and fairly appraise any number of potential transport schemes improving the sifting process transport professionals often have to undertake. As part of the model's development, several synthetic schemes testing all aspects of its functionality were undertaken. Examples of two entirely illustrative results are shown below.

Demonstration Test - Reduced Housing Supply

Demonstration Description

Demonstration 1 presents a simple scenario in which we've constrained housing supply

The intervention: Commercial development and Transport Costs consistent with the Base Case.

No further housing development compared with local authority plans.

Model inputs: Compared to local authority plans:
- West Midlands Combined Authority housing stock is down by 4.9% in 2046
- Fully Modelled Area housing stock is down by 6.2% in 2046.

Modelling Interactions and effects

- Reduced housing supply increases rents and hence the cost of living in the Fully Modelled Area which leads to fewer in-moves and more out-moves and a reduction in Fully Modelled Area population
- The combination of reduced consumer demand and higher labour costs lead to some loss of employment.

Incremental Impact on Key Economic Indicators in 2046

	West Midlands Combined Authority	Fully Modelled Area
Population	-2.5%	-2.2%
Employment	-3.8%	-2.7%
GVA	-4.6%	-3.3%

Commentary on Results

As a result of constraining housing supply, there is a negative impact across the economy. There is a differing response to the constraint - the impact is greatest at the CA geography than at the national level.

Initial findings also show:

- All key indicators – Population, Employment, GVA (£8bn p.a. at FMA) have a negative impact compared to Base
- The results reflect a combination of:
  - lower population leading to lower consumer demand
  - increased labour costs (due to higher housing costs) leading to reduced private investment
  - some loss of agglomeration
  - A further net increase in out-migration.

Demonstration Test - Skills Intervention

Demonstration Description

A hypothesised new apprenticeship centre is funded in Warwick.

Suggested model inputs:

- Location of intervention: Warwick
- Qualifications gained: 4,000 Construction Sector Apprenticeships
- Of which 200 otherwise unemployed
- Number of Apprentices employed in West Mids.: 3,000
- Difference reflects loss to outside (migration) and drop out
- Programme run for: 2017-2022

Modelling Interactions and effects

- Sector specific multipliers based on national data with local adjustments
- Critical questions include decay over time: drop-out and migration levels and demand
- Effects split between upskilling workers and increased labour market participation.

Incremental Impact on Key Economic Indicators in 2046

Mature GVA impact per person per annum: £5k

Lifetime per person GVA impact: £100k, if skills provided remain relevant for 20 years

6 year horizon is more certain

Mature total annual impact per annum: £20m

Commentary on Results

- Results sensitive to location (differences in construction sector, labour market participation and wage rates)
- The same programme in would achieve lower GVA impact in all other areas apart from North Warwickshire, Rugby and Stratford. Because of sector / local labour market interventions supply
- It is assumed that benefits mature 6 months after qualification, which may take 2 – 4 years, but with ramp-up
- Decay rate assumptions over time critical for long term impact.

[End]