ANNEX 4: SUPPORT TO ELECTRICITY NETWORK DEMAND FORECASTS BY CEPA

Electricity North West Limited
Registered Office:
304 Bridgewater Place,
Birchwood Park,
Warrington,
Cheshire.
WA3 6XG.
Registered no: 2366949 (England)

UPDATE TO "SUPPORT TO ELECTRICITY NETWORK DEMAND FORECASTS"

A REPORT FOR ELECTRICITY NORTH WEST LIMITED

19 January 2013

FINAL REPORT

Submitted by:

Cambridge Economic Policy Associates Ltd

CONTENTS

EXECUTIVE SUMMARY

Cambridge Economic Policy Associates (CEPA) provided support to ENWL's electricity demand forecasting work in early 2012. The present report documents our updates to that work and new results. The updates were focused on two questions: how would we change our results for the period to 2022/23 in the light of the latest available data, and how would we extend them to 2030/31.

Approach

In addressing the first question – the need to change our results to 2022/23 - we have focused on changes to input assumptions rather than to the structure of our economic model. We have re-run our regression analysis to update the co-efficients in our economic models to reflect the latest year of historic data, but not changed the factors ("exogenous variables") themselves.

We have also reviewed the public forecasts of these factors. These were sourced largely from UK Government publications, such as those from the Office for National Statistics and the Office for Budget Responsibility.

In addressing the second question – extending the results to 2030/31 – we have sourced data for the additional years from the same sources as before, where available. Where this data was not available, we assumed a continuation of existing trends.

Results

Our economic models are very similar to those from our previous work, although they do show a slightly higher sensitivity to prices and income. Our input assumptions in general show lower projected growth than for our previous work. This leads to our projections all being significantly *lower* than those from our previous work.

The main driver for this is that the Office of Budget Responsibility has revised its forecasts of economic growth down significantly since this time last year. This means that our projections of commercial and industrial demand growth, in particular, are lower. There are also some small reductions in domestic demand growth because of reductions in forecasts of household growth and household income. In all but one scenario, demand does not return to current levels until after 2020.

1. INTRODUCTION

This report documents the results of an update to the electricity demand work that Cambridge Economic Policy Associates (CEPA) carried out for ENWL in early 2012. The results of that work were provided to ENWL on 8 March 2012[1].

As required, this update has reviewed the original work to check that its conclusions were still valid, and extended the results up to, and including, the year 2030/31. That is, the results now cover the regulatory periods RIIO-ED1 and RIIO-ED2. The results were also updated to use 2011/12 as the base year.

The rest of this document is structured as follows:

- Section 2 briefly sets out the approach we have taken, which followed the approach set out in our proposal to ENWL[2]. We also describe any issues that we found and how we resolved them.
- Section 3 describes the changes to the model, including as a result of the 2011/12 data received from ENWL.
- Section 4 describes our results, including a comparison of those results to the results of the original study.

A list of data sources is in Annex A. Annex B includes a short narrative description of each scenario, and a summary of the key inputs for each. The economic model equations are in Annex C. An explanation of the exogenous variables (or "factors") that we considered is in Annex D.

[1] "*ENWL demand forecasts final.zip*", sent to Dr Rita Shaw from Iain Morrow on 8 March 2012.

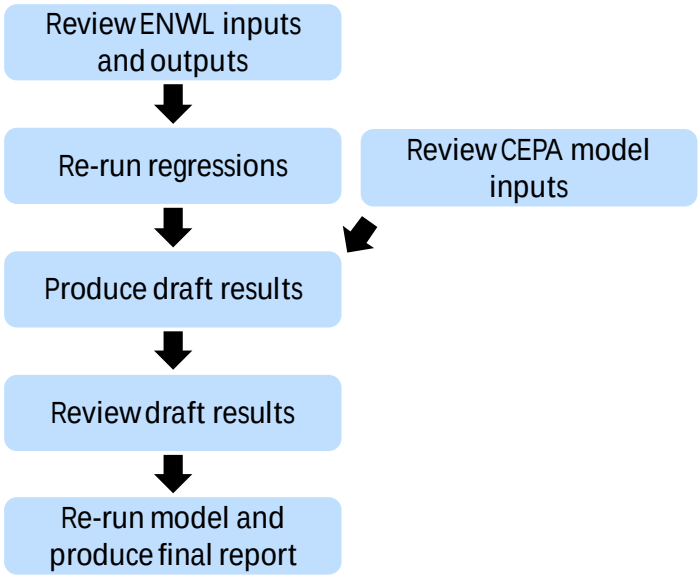
[2] "*Proposal for update to demand forecasting FINAL.pdf*", sent to Dr Victor Levi on 20 November 2012

2. APPROACH

Our approach to this work was as set out in our proposal to ENWL, dated 20 November 2012. We reproduce this below for ease of reference.

Our approach had six stages, as Figure 2.1 below illustrates.

Figure 2.1: Outline of approach



Each stage is described by one of the sections below.

2.1. Review ENWL inputs and outputs

In this stage, we did an initial sense-check on the data received from ENWL, including comparing it with previous data, previous projections and other data sources where available.

This found no major issues. The only query was about data provided for November 2012. We confirmed with ENWL that they wished us to use the December 2011 data as the baseline.

We have also reviewed the updated output spreadsheet provided by ENWL. There were no issues.

2.2. Re-run regressions

We re-ran our regression analysis to allow the model to take account of the additional year of historic data. This gave us our updated models, which we set out in section 3, including showing how they differ from the previous models.

In summary, the models are not significantly different although they do show a slightly higher sensitivity to price and income changes.

2.3. Review CEPA inputs

We also reviewed the CEPA inputs. This had three parts.

2.3.1. Use of latest data

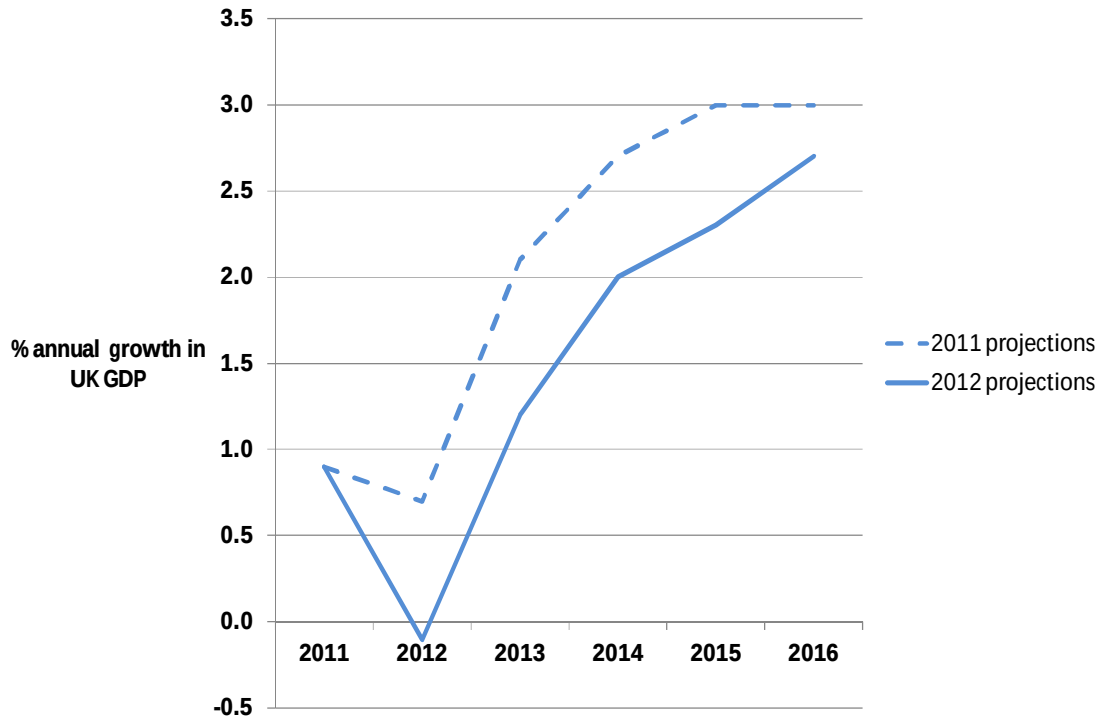
The first part was to check that we were using the latest data. We found that some of the sources (such as the Office for Budget Responsibility (OBR)) have updated their projections, and we have used the latest data available. A complete list is in Annex A.

There were three issues. In descending order of impact, they were: economic growth projections, energy prices and the North West Regional Development Agency (NWRDA).

OBR economic projections

The major issue relates to changes in the economic projections from OBR. These are noticeably lower than the previous forecasts which we used for our original work. To illustrate this, we compare the OBR's November 2011 forecasts of GDP to their most recent forecasts, in Figure 2.2 below.

Figure 2.2: Comparison of OBR 2011 and 2012 forecasts of GDP growth (central case)



As this shows, the new projections (solid line) are well below previous projections (dashed line), out to 2016. As GDP[3] is the major driver for commercial and industrial demand in our model, this has the effect of depressing our results compared to the previous ones. On the other hand, there is some positive economic news, such as the fact that the number of people in employment is at the highest level since records began in 1971[4]. Increasing employment will tend to increase household incomes, which our model suggests is a key driver of domestic electricity demand.

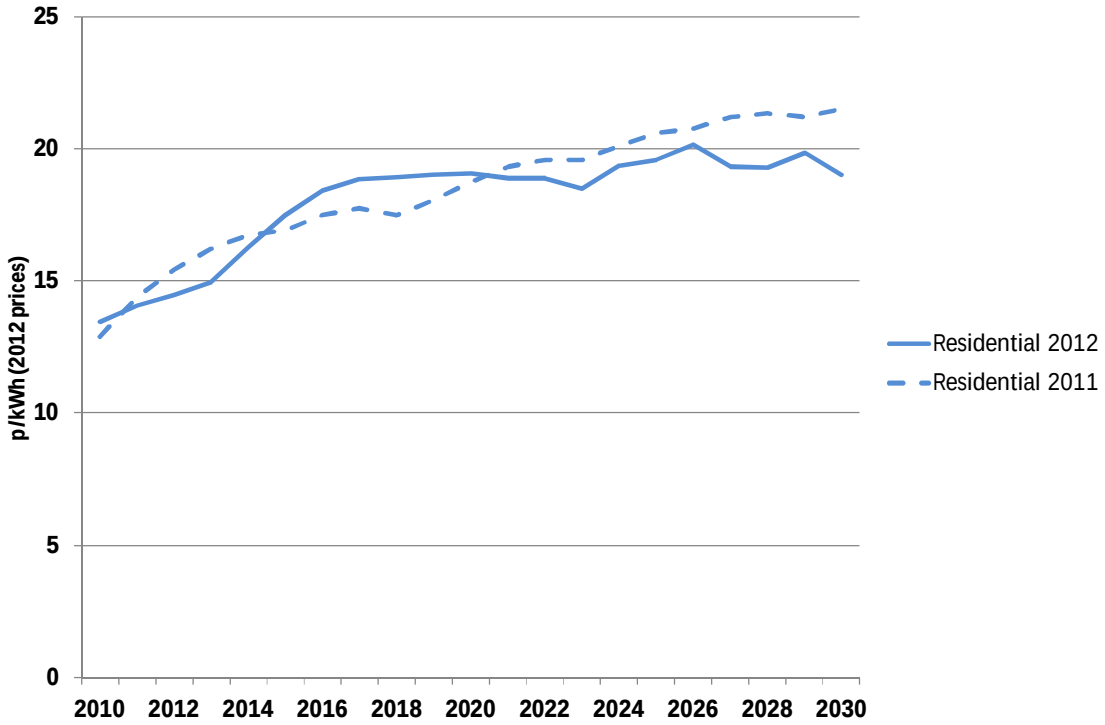
[3] Or GVA for the North West.

[4] Source: Financial Times, 12 December 2012, based on ONS Labour Market Statistical Bulletin

DECC prices

The second issue is that DECC has changed its projections of future electricity prices. The projections now have quite a different shape, and this can make the figures for changes by 2014/15 and by 2022/23 look misleadingly different to those from our previous work. As an illustration, Figure 2.3 below shows the differences in DECC's forecasts for retail residential prices (central case) from both 2011 and 2012.

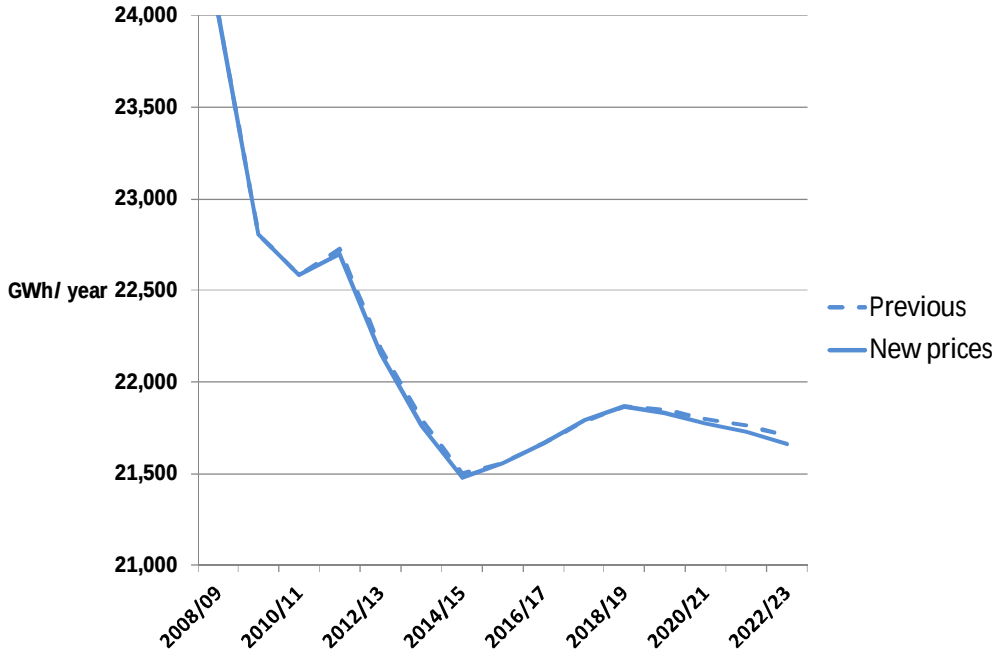
Figure 2.3: DECC price projections



As this shows, prices are higher in say 2016, but lower by 2022. This can make comparing figures for price changes over time misleading.

However, the overall impact on the results is minimal, as Figure 2.4 shows.

Figure 2.4: Changes to results in Green Recovery scenario due to new DECC electricity price forecasts



The figure shows our previous results for annual demand[5], and then a new set of projections using the new DECC prices (and no other changes).

NWRDA

The first issue arose because some of our data was sourced from the NWRDA. This was abolished in July[6] and no updates to the previous data have been published. We have used the existing data, even though it is now over a year old, since we are not aware of any other economic forecasts specifically for the North West.

2.3.2. Figures to 2030/31

The second part of our work was to source inputs for the period 2023/24 to 2030/31. In some cases (such as the ONS figure or DECC price projections) the data sources give us figures to 2030/31 directly. In other cases, we have assumed a continuation of the trend for 2022/23.

In most cases, the trend is a straight line. However, the DECC electricity price forecasts show a slight dip in the mid 2020s, and this leads to our results having a similar dip. We asked DECC what the basis for this is, and they responded that the dip is "*mainly due to an oscillation in policy costs on consumers*". They also note that "*...there's great uncertainty about when/if such fluctuations might occur*" and they consider that it is "*...probably best to focus on the long run trends rather than specific yearly movements*".

[5] "Green Recovery" scenario only. The results for other scenarios would be similar.

[6] Source: Department for Business Innovation and Skills

2.3.3. Review of previous assumptions

Finally, we had an independent review of our assumptions (as opposed to sourced input data). This found no significant issues.

2.4. Adjustments for change in base year

In our previous results, the figures were presented with a base year of 2010/11. For the new results, the base year is 2011/12. We therefore had to adjust some of our assumptions to reflect this.

For example, our assumptions on energy efficiency from the previous report were for the impact from 2010/11 to 2014/15 and 2022/23. We had previously assumed a linear energy efficiency trend, so have simply assumed that the reduction between 2011/12 and 2014/15 is three quarters of that from 2010/11 to 2014/15. The reduction from 2010/12 to 2022/23 has been similarly reduced.

2.5. Produce draft results

The next stage was to combine the revised model and input assumptions to produce new draft results. These are shown in section 4. There were no particular issues with doing so.

2.6. Review results with ENWL

We presented our draft results to ENWL at a meeting in their offices on 13 December. Following that meeting, we made a number of changes to this report, largely to include additional information about the scenarios. This information is in Annex B.

2.7. Re-run model and produce final report

Our revised model results are shown in Section 4. We will also provide completed input spreadsheets showing the results by local authority. In this report we have focused on bringing out the key messages and so only present the overall results for the ENWL region. We expect that the results for each local authority will follow a similar pattern to those for the previous results, in terms of how each local authority compares to the average for the region as a whole. In the presentation on 13 December, we noted the risks associated with placing too much emphasis on figures for individual local authorities, particularly more than a few years into the future.

3. MODEL CHANGES

In this section we describe the changes we have made to the ENWL models as a result of new data.

We received new data from ENWL, consisting of actual customer numbers for December 2011. We also updated our figures from the ONS and OBR.

To determine the new models, we ran a regression on the new figures, using the same form of the model as before. That is, we assumed that the factors driving future electricity demand are the same as in our previous models, but that the relative importance of the factors might change slightly, based on the new historic data. The model equations, and an explanation of how we came to choose the factors we did, are in Annex C. An explanation of how we forecast those factors is in Annex D. In summary, the statistical analysis we did in our previous work showed that the most significant factors ("exogenous variables") are income and price for households, and price and GVA for other consumers.

Table 3.1 below compares the co-efficients[7] for the new and previous domestic models. Note that the results in the tables relate to the entire ENWL area.

Table 3.1: Domestic model co-efficients (standard errors in brackets)

Variable	Previous model	New model	Increase / (decrease)
Constant	-2.88 (0.29)	-3.16 (0.38)	-0.28
Income	0.41 (0.02)	0.42 (0.03)	0.01
Price	-0.14 (0.02)	-0.17 (0.03)	-0.03
2005 Dummy	0.03 (0.01)	0.04 (0.02)	0.01
2008 Dummy	0.06 (0.01)	0.07 (0.02)	0.01

As can be seen, the model is very similar to the previous one. While the impact of a change in price or a change in income is slightly higher than before, the differences are relatively small.

Table 3.2 does the same for the models of non-domestic electricity demand.

Table 3.2: Non-domestic model co-efficients (standard errors in brackets)

Variable	Previous model	New model	Increase / (decrease)
Constant	4.21 (0.43)	4.39 (0.56)	0.18
Electricity Price	-0.11 (0.02)	-0.13 (0.02)	-0.02

[7] Note that our model looks at the relationships between the *log* of demand and the *log* of price and income.

Variable	Previous model	New model	Increase / (decrease)
GVA	0.49 (0.04)	0.48 (0.05)	-0.01

As this shows, the new model is virtually identical to the previous one. It suggests that there is a slightly higher fixed component of demand, and that electricity price is slightly more significant (relative to GVA) than before. However, the differences are small and within one standard error of the previous model. It would therefore be wrong to attach great significance to these changes.

In summary, there is little significant difference between the new models and the previous ones. This is as might be expected, since they are based on a single additional year of data. The major changes to our results (shown in the next section) are because of changes to data rather than changes to the model. There is one effect of the increased sensitivity to prices. As the next section shows, the results in all scenarios are lower. This drop is larger in scenarios based on high prices, because of the increased price sensitivity.

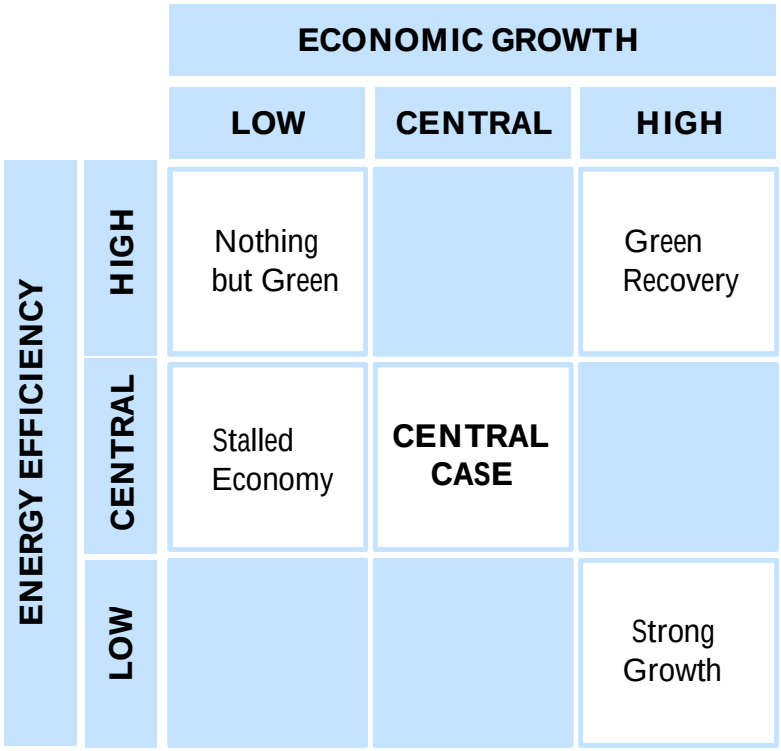
4. INITIAL RESULTS

This section presents our initial high-level results, for the ENWL region as a whole. For our final results, we will also present the figures for each local authority.

4.1. Scenarios considered

As for our previous analysis, we ran five scenarios. These are illustrated in Figure 4.1 below; more detail is presented in Annex B. To make it easier to discuss the scenarios, we have given them descriptive names, as Figure 4.1 shows.

Figure 4.1: Scenarios considered



The differences between the scenarios are shown in Table 4.1 below. A more detailed explanation of the factors we considered and how we derived them is in Annex D.

Table 4.1: Assumptions underlying each scenario

Scenario	Economic factors	Energy efficiency factors
Central Scenario	• Central economic growth • Central price growth	• Central energy efficiency • Central peak load change
Strong Growth	• Relatively high economic growth • Central price growth	• Relatively low energy efficiency • Low peak load change
Stalled Economy	• Relatively low economic growth • Low price growth	• Central energy efficiency • Central peak load change
Green Recovery	• Relatively high economic growth • High prices	• High energy efficiency • Central peak load change

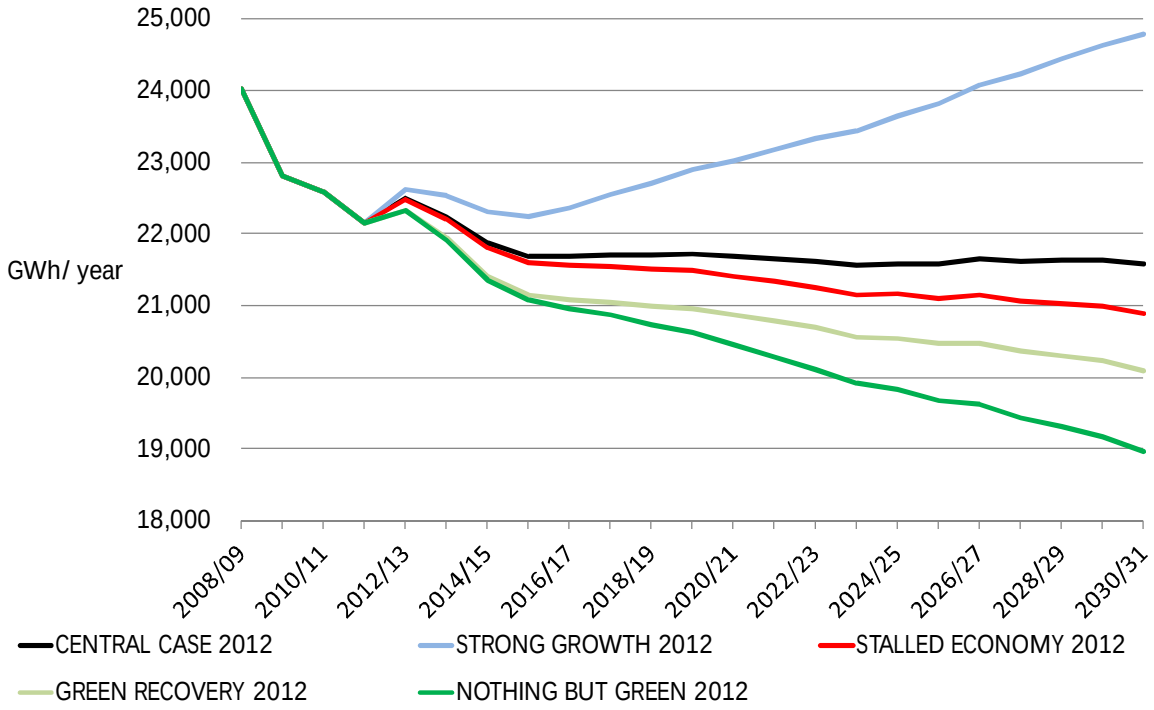
Scenario	Economic factors	Energy efficiency factors
Nothing but Green	• Relatively low economic growth • Central case price growth	• High energy efficiency • High peak load change

The main results for each scenario are shown below. Detailed results for each local authority will be provided in the outputs spreadsheet[8].

4.2. Overall annual demand to 2030/31

Figure 4.2 shows the overall annual demand results for each scenario.

Figure 4.2: Total annual demand to 2030/31, all scenarios



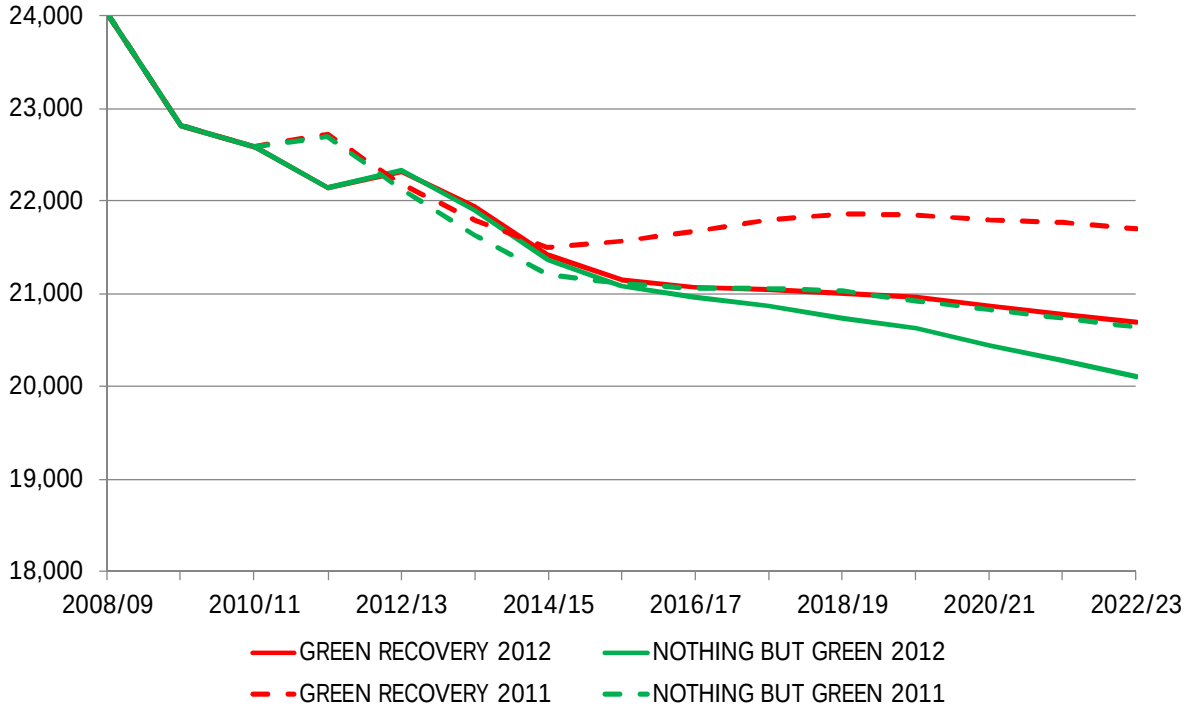
In summary, we see falling demand in the "green" scenarios, driven by higher prices and greater energy efficiency. In the "stalled economy" and "central" scenarios, demand is more or less flat to 2030. Only in the "strong growth" scenario do we see constantly rising demand, although it does not return to 2008 levels until well into the 2020s.

4.2.1. Comparison with previous results

We also present a comparison of our results to those from our previous work (note that that only included projections to 2022/23). Figure 4.3 compares the two "Green Scenarios". Current results are shown as solid lines, and the previous results are shown as dashed lines.

[8] *As emailed by Dr Victor Levi to Iain Morrow, 7 December 2012*

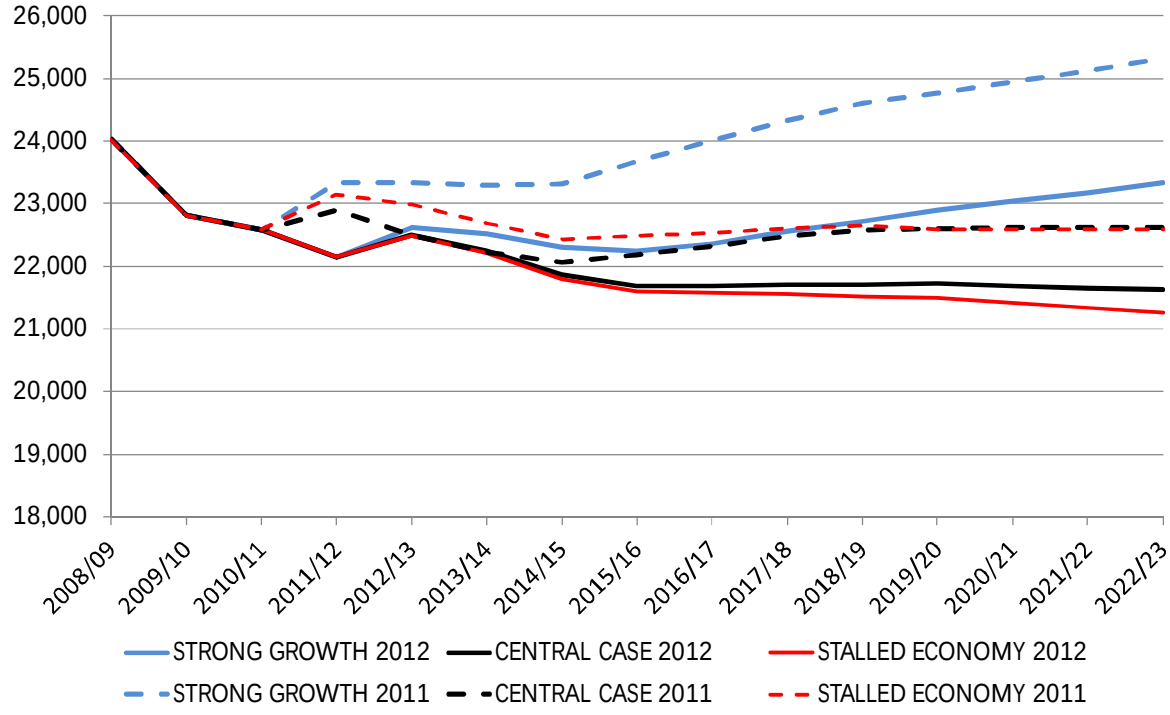
Figure 4.3: Comparison of current and previous "Green" scenarios



The figure shows that our current projections are significantly below our previous ones for both scenarios, with the differences widening over time. The difference is particularly marked in the "Green Recovery" scenario, because of our model's now greater sensitivity to high prices. These prices are used for the "Green Recovery" scenario but not the "Nothing but Green" scenario, as Table 4.1 above shows.

Figure 4.4 compares the "Strong Growth", "Stalled Economy" and "Central Case" scenarios.

Figure 4.4: Comparison of current and previous Strong Growth and Stalled Economy scenarios



Again, the projections are lower in all cases. The difference is particularly pronounced for the "Strong Growth" scenario, because it assumes higher prices than the low prices assumed in the "Stalled Economy" scenario.

In summary, all the projections are lower, mainly because of lower projections of future economic growth (see Figure 2.2). There is also a slight reduction in new domestic connections and in household income growth. These are driven from the ONS's forecasts of household growth, and the OBR's forecasts of income growth. Both forecasts are lower than last year's.

4.3. Longer-term projections

In developing our longer term projections, we have considered what changes there might be in the factors driving electricity supply and demand in the 2020s. Some of these cannot be fully captured in a quantitative analysis, and so we briefly discuss them here.

Our main conclusion is that there is a great deal of uncertainty, and it is difficult to point to definite trends within the period. Policy and trends are relatively well-defined to 2020, but the picture thereafter is much less clearly defined. In general, where policies for the 2020s are set out at all, they are seen to be continuations of policies in the 2010s[9].

For this reason, we have assumed that the factors driving electricity demand continue on the same trend beyond 2022/23 and on to 2030/31. This gives us a relatively wide range of possible outcomes by 2030/31.

[9] See for example the recent analysis by Arup:
http://www.arup.com/Publications/UK_Energy_Legislation_Timeline.aspx

In many ways, this is as expected. Projecting nearly twenty years into the future in a complex area such as energy demand is extremely difficult. There are possible developments on the horizon which could push demand very high. One in particular would be an abundance of cheap shale gas. Greater interconnection of global gas markets could also change the future profile of prices. Conversely, there are potential developments that could push demand very low (for example, the widespread roll-out of highly efficient lighting).

We discuss some of these qualitatively below. We have divided the factors that might affect demand into four categories: the nature of demand, policy, industrial development and price effects.

The first category is changes in the nature of consumer demand. These could include an increasing use of appliances with high electricity demands, such as IT equipment or home entertainment systems. Of course, these are likely to be dwarfed by the demands from electric vehicles and heat pumps, if those technologies are taken up in large numbers[10]. Changes in consumer demand are, on past trends, only likely to increase total electricity demand. This is before taking account of changes such as efficiency standards, which are discussed below.

The second change relates to policy changes. These can be about product efficiency standards, requirements to deploy smart meters or other new technologies, or about other energy efficiency standards, such as home insulation.

Product efficiency standards of course only ever go in one direction – towards lower consumption per unit of output. The question is about how fast standards will be driven. In our work, we have assumed that the expected rate for the 2010s continues into the 2020s. Factors that could mean that this is not valid include technical limitations on efficiency or diminishing returns. Efficiency might, for example, become increasingly expensive per watt, and there might be a move to look at other sources of demand reduction than appliances. For the moment, however, we see no reason to assume either of these.

Industrial development is a factor that could affect the level of non-domestic demand in particular. Put simply, some industries are more electricity-intensive than others, and a shift towards or away from these could make significant changes to electricity demand.

Price is another factor likely to affect future demand. In a scenario where energy is relatively cheap in the 2020s, perhaps because of abundant unconventional or shale gas, electricity prices are likely to be relatively low. Our analysis suggests that price is a significant driver (although not as significant as household income or GVA). Therefore, in a world of low prices, demand is likely to be noticeably higher. Conversely, if prices rise at a faster rate than we expect, demand could be further suppressed.

[10] Heat pumps and electric vehicles are specifically excluded from our terms of reference.

5. CONCLUSIONS

Our key conclusion from this piece of work is that in most scenarios, electricity demand remains low in the North West over the next few years. Based on our econometric analysis, the strongest driver of this low demand in the non-domestic sector is the projected low levels of economic growth. For the domestic sector, the strongest driver is the projected slow growth in incomes, but again much of this can be traced back to low projections of economic growth.

The projected growth in electricity prices is also a contributing factor. In the "high" case, DECC's projections show growth of nearly 80% by 2022/23, and even in the "central" case the increase is nearly 60% (both figures are for non-domestic prices). Continuing improvements in energy efficiency will also have an effect, although as noted in our previous report many of these relate to heating and so to gas rather than electricity.

That said, there is a significant range of possible outcomes, and in a world where economic growth returns and prices are low (perhaps because of shale gas), demand might grow significantly. Our analysis also takes no account of heat pumps or electric vehicles.

ANNEX A: DATA SOURCES

Table A.1 shows the data sources we have used, and how they have been updated if required.

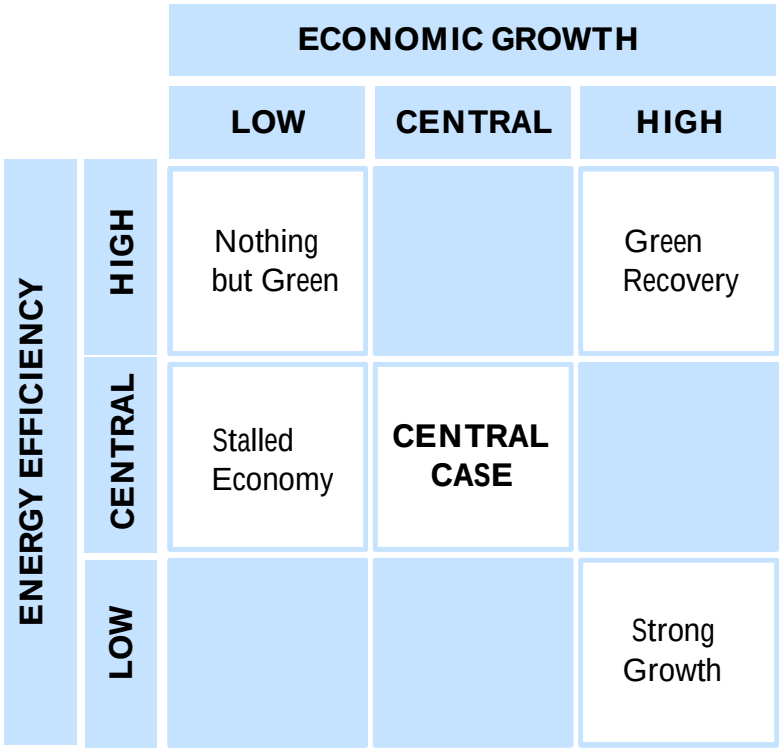
Table A.1: Data sources used

Data	Source	How updated?
Customer numbers	ENWL	Using Dec 2011 actuals rather than Dec 2010
Historic electricity consumption figures	ENWL	Provides updated values for 2010/11 and 2011/12; data in terms of kWh consumed; as sent on 22 November 2012
Peak demand data	ENWL	Sent on the 22nd of November, 2012; includes data from January 2012.
Data on large EHV customers	ENWL	Includes figures for 2011/12. Sent on the 22nd of November, 2012.
Employed individuals and labour force	ONS Nomis	Updated data from 7 Dec 2012. Data applies up to end-2011.
Public v private employment shares	ONS Nomis	Updated data from 7 Dec 2012. Data applies up to end-2011.
Public employment projections	OBR and ONS Nomis	Updated data from 7 Dec 2012.
Private employment projections	OBR, NW RDA analysis and ONS Nomis	Updated data from 7 Dec 2012.
Total employment projections	OBR, NW RDA analysis and ONS Nomis	Based upon public and private employment projections.
Labour force participation	ONS Nomis	Updated data from 9 Dec 2012. Data applies up to end-2011.
Working age participation	ONS Nomis	Updated data from 9 Dec 2012. Includes projections out to 2030.
Productivity	OBR	Data updated to include OBR Economic and Fiscal Outlook from Dec 2012.
GVA by LA	OBR and ONS Nomis	Based upon projections of total employment and productivity.
Household income projections	OBR and ONS Nomis	Data updated for 11 Dec 2012. Includes total employment projections.
Household income by LA	OBR and ONS Nomis	Based on household income projections, and total employment projections.
Electricity price forecasts	DECC	DECC Updated Energy & Emissions Projections - October 2012
Historical electricity price information	DECC	Annual prices of fuels purchased by manufacturing industry (p/kWh) (QEP 3.1.4), Tables last updated 27 September 2012

ANNEX B: DESCRIPTIONS OF SCENARIOS

In this annex we include a brief narrative description of the scenarios we have considered. They are as shown in Figure B.1 below.

Figure B.1: Scenarios



Nothing but Green

This is our scenario for the North West going green without strong economic growth ("Nothing but Green"). It assumes that economic growth continues at a relatively low level. Price remains in line with our central projections as we do not consider there will be sufficient pressure from lower growth for any significant price falls. Energy efficiency savings, however, are relatively high. This results from a continued effort by businesses and consumers to reduce electricity usage, as well as the high growth in prices relative to income. We also expect in this scenario a greater reduction in peak demand in addition to the other changes resulting from the efficiency savings and economic factors.

A summary of our assumptions for this scenario is shown in Table B.1 below.

Table B.1: Nothing but Green – Key assumptions for changes in the factors, from 2011/12

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Domestic			
Number of household	2.5%	9.5%	15.2%
Household income	-1.4%	9.6%	25.0%
Price	16.8%	32.6%	34.2%
Energy efficiency	-7.6%	-17.0%	-27.0%

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Peak demand	-2.2%	-8.8%	-15.4%
Non-domestic			
GVA	1.3%	14.9%	31.8%
Price	31.7%	58.2%	61.0%
Energy efficiency	-9.1%	-19.4%	-30.4%
Peak demand	-0.5%	-2.0%	-3.5%

Green Recovery

This is our scenario for strong economic growth coupled with strong energy efficiency savings. High UK economic growth is driven by a global recovery, which results in high employment, but also pushes up electricity prices (through higher commodity prices). As economic growth is driven by higher employment rather than labour productivity growth, household income growth is driven by additional occupants being employed rather than real income growth. Electricity prices will be relatively high and will push business and households towards relatively high energy efficiency savings. Again, impact on peak demand alone is in line with our central estimates.

A summary of our assumptions for this scenario is shown in Table B.2 below.

Table B.2: Green Recovery – Key assumptions for changes in the factors, from 2011/12

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Domestic			
Number of households	2.5%	9.5%	15.2%
Household income	-1.8%	11.7%	30.4%
Price	26.2%	47.0%	50.2%
Energy efficiency	-6.2%	-14.9%	-24.3%
Peak demand	-0.5%	-2.0%	-3.5%
Non-domestic			
GVA	2.1%	24.3%	52.3%
Price	40.6%	78.2%	82.2%
Energy efficiency	-8.7%	-18.0%	-29.4%
Peak demand	0.0%	0.0%	0.0%

Stalled Economy

In this scenario we assume that the global downturn lasts longer than anticipated and the North West is stuck in an aggregate demand trap. This affects the UK through lower growth. On the positive side, low global demand keeps commodity prices relatively low and therefore price growth is relatively low. As the low economic growth is offset by low prices we do not consider there will be additional pressure for efficiency savings over our central projection. Peak demand will therefore also be in line with our central projections.

A summary of our assumptions for this scenario is shown in Table B.3 below.

Table B.3: Stalled Economy – Key assumptions for changes in the factors, from 2011/12

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Domestic			
Number of household	2.5%	9.5%	15.2%
Household income	-1.4%	9.6%	25.0%
Price	5.5%	16.1%	17.4%
Energy efficiency	-7.9%	-16.2%	-24.6%
Peak demand	-0.5%	-2.0%	-3.5%
Non-domestic			
GVA	1.3%	14.9%	31.8%
Price	10.2%	33.7%	38.1%
Energy efficiency	-8.8%	-14.7%	-21.9%
Peak demand	0.0%	0.0%	0.0%

Strong Growth

In this scenario we consider that the UK is able to achieve relatively high economic growth, through high employment. As noted in the main body of this report, UK employment is already growing, and is now at the highest level in absolute terms since records began.

Electricity price growth remains in line with DECC's central forecasts. However, as economic growth is driven by higher employment rather than labour productivity growth, household income growth is driven by additional occupants being employed rather than real income growth. The strong economic growth coupled with relatively stable price growth, puts less pressure on households and businesses to achieve energy efficiency savings. Therefore, in this scenario energy efficiency savings are on the low side and we also expect that peak loading reduction is on the low side.

A summary of our assumptions for this scenario is shown in Table B.4 below.

Table B.4: Strong Growth – Key assumptions for changes in the factors, from 2011/12

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Domestic			
Number of household	2.5%	9.5%	15.2%
Household income	-1.8%	12.8%	35.4%
Price	16.8%	32.6%	34.2%
Energy efficiency	-1.9%	-3.4%	-5.4%
Peak demand	0.0%	0.0%	0.0%
Non-domestic			
GVA	2.1%	24.3%	52.3%
Price	31.7%	58.2%	61.0%

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Energy efficiency	-4.7%	-8.8%	-14.4%
Peak demand	0.0%	0.0%	0.0%

Central Case

Finally we present the results for our central case. In this scenario, we use central or base case values for all assumptions.

A summary of our assumptions for this scenario is shown in Table B.5 below.

Table B.5: Central Case – Key assumptions for changes in the factors, from 2011/12

	2011/12 to 2014/15	2011/12 to 2022/23	2011/12 to 2030/31
Domestic			
Number of households	2.5%	9.5%	15.2%
Household income	-1.5%	11.1%	29.7%
Price	16.8%	32.6%	34.2%
Energy efficiency	-6.0%	-13.5%	-21.5%
Peak demand	-0.5%	-2.0%	-3.5%
Non-domestic			
GVA	1.6%	19.0%	40.6%
Price	31.7%	58.2%	61.0%
Energy efficiency	-6.1%	-12.2%	-19.8%
Peak demand	0.0%	0.0%	0.0%

ANNEX C: ECONOMIC MODEL – EQUATIONS

This annex shows the key equations in the economic models we used for our previous work for ENWL. They are taken directly from our previous report.

Equation C.1: Model of domestic electricity consumption

$$DEC_t = \beta 0 \quad + \beta_I I_t + \beta_{PD} PD_{t-1} + \beta_{2005} D_{2005} + \beta_{2008} D_{2008} + \varepsilon_i$$

In this equation:

- DEC_t represents (the log of) domestic electricity consumption per household in year t;
- I_t represents (the log of) income per household in year t;
- PD_{t-1} represents (the log of) retail electricity prices (lagged by one year) in year t;
- D_{2005} represents the dummy variable for 2005;
- D_{2008} represents the dummy variable for 2008;[11]
- β_i are the co-efficients; and
- ε_i are the error terms.

Using this model, we ran multiple ordinary least squares linear regression analyses, testing for the relative significance of each variable with respect to domestic energy consumption in the North West. We also ran the same model using both North East data and national data in order to determine if the North West findings were consistent in the area and on a national scale. We found our results to be roughly consistent with the national findings, but very different from those of the North East. Additionally, we tested for the impact of gas prices on domestic electricity consumption but found that the related variable skewed our results and rendered our model less efficient.

All of the linear regression tests that we ran included both robustness tests to determine whether or not there was heteroskedasticity in the model and an analysis of correlation matrices in order to mitigate any multicollinearity.

We now present the corresponding model for non-domestic electricity consumption, in Equation C.2 below.

Equation C.2: Model of non-domestic electricity consumption

$$NDEC_t = \beta_0 + \beta_{PC} PC_{t-1} + \beta_V V_t + \varepsilon_i$$

In this equation:

- $NDEC_t$ represents (the log of) non-domestic electricity consumption in year t;

[11] With the exception of the dummy variables, all variables included in the model were in logarithmic form. We consider that the logarithmic form better reflects the consumption decisions of domestic users and the impact of the variables in their decisions.

- PC_{t-1} represents (the log of) non-domestic electricity prices (lagged by one year) in year t;
- V_t represents (the log of) North West GVA in year t;
- β_i are the co-efficients; and
- ε_i are the error terms.

We ran this linear regression model using ordinary least squares. We tested for heteroskedasticity, multicollinearity and autocorrelation, using a combination of correlation matrices, robustness and error tests. The linear regression results produced a very low Durbin Watson statistic, which led us to consider whether or not the model might be faulted by serial correlation. In order to examine this further, we ran a correction for autocorrelation followed by a Cochrane-Orcutt AR(1) regression. This second regression analysis produced very weak results. After a review of econometric literature, we believe that the original linear regression model provides the most accurate results and the best fit for the data. While a very low Durbin Watson statistic may be indicative of serial correlation, it is also true that with relatively small data samples, Durbin Watson statistics are not always accurate. Moreover, if serial correlation does exist in the model, the OLS regression will still be unbiased, albeit highly inefficient. According to Meetamehra, a common issue among electricity consumption forecasts models is the assumption that "*fuel prices are determined independently of both total energy consumption and the distribution of consumption by fuels.*" In other words, the assumption indicates a "*failure to recognise the interdependence between prices and quantity*", which can lead to inefficiencies in the model (Meetamehra, 2002).

Other factors considered and rejected

In an ideal world data would be available for every variable that is considered to drive electricity consumption. In theory, this would ensure that the model would be able to better predict electricity consumption. However, consistent and accurate data is not always available for all variables that you may wish to include. In addition, when using the model to forecast future consumption the more variables you include, the more forecasts are required (for each of these variables) and this will add to the uncertainty of the model. Given these points, if a parsimonious model can be developed with a high goodness-of-fit this may be preferable to a model with a slightly higher goodness-of-fit but which requires additional variables to be forecasted.

Below we discuss a number of variables that we considered for our model, and the reasons why we concluded not to include them:

Weather

Variance in the weather from year-to-year can affect household consumption of electricity; a particularly cold year can increase the demand for electricity (although this is to a lesser extent in GB than other countries given the main source of heating is gas). If one wanted to examine daily electricity consumption, a temperature variable would be required. However, on an annual basis producing a usable measure to account for weather patterns is difficult, as an average daily temperature for a year is not necessary meaningful in relation to consumption. In addition,

forecasting the weather is notoriously difficult to achieve. Given these arguments we have excluded weather from our model.

Income demographics

There is a positive correlation between income and electricity consumption. An area where the model could be improved is with regards to its ability to account for the impact of demographic changes. Including a breakdown of, for example, low, medium and high income households in the North West could improve the model's predictive power. If the stock of households grew at different rates for each of these categories then this would likely affect demand. However, in order for this to improve our model's ability to predict consumption we would need forecasts for income demographics out to 2022/23.

Occupants per household

Data on the average annual occupants per household is available from ONS. The number of occupants in a household is likely to effect the consumption of the household (i.e. the more occupants, the greater the electricity consumption). We have analysed the available data and it can be seen that the average number of occupants per household has been falling over time – from 2.48 in 1990/91 to 2.28 in 2010/11. We included this variable in our model and found that it was not significant. In addition, we found a slight increase in electricity use per household between 1990 and 2011. This is supported by Ofgem's findings[12] in which they conclude that average household electricity consumption did not decrease between 2003 and 2011. Given the lack of significance in our model and the lack of anecdotal support for its impact on electricity demand, we have excluded this variable from our model.

Gas prices

It is a generally accepted principle that the demand for a good will be affected by the price of a substitute good(s). Gas can be considered as a substitute for space and water heating, in particular, which would indicate that it is a potential explanatory variable in our model. However, when we included a gas price variable in our model it was not significant and in fact led to multicollinearity in the model. We have concluded that the difference between gas and electricity prices (where gas per unit equivalent energy prices are much lower than those of electricity) and the cost of the capital investment to switch fuel sources, means that electricity is not yet considered as a substitute heating source for many households.

[12] Ofgem (2011), *Typical Domestic Energy Consumption Figures.* Accessed at: http://www.ofgem.gov.uk/Media/FactSheets/Documents1/domestic%20energy%20consump%20fig%20FS.pdf

ANNEX D: DEFINITION AND DEVELOPMENT OF THE FORECAST VARIABLES

The ToRs set out that ENWL require economic forecasts to be provided for GVA growth and household income. In this annex we set out our approach to developing the baseline GVA forecasts, discuss the evidence that we have considered in developing the forecasts and then summarise the results. Given the level of uncertainty surrounding growth forecasts over the period 2011/12 – 2022/23, we have also developed GVA scenarios, which we discuss at the end of this section. Next, this annex will set out the approach and results that we have used to develop the household income and household formation growth assumptions. Before either of these components however, we will first present definitions of the key variables under consideration.

D.1. Definition of the forecast variables

GVA

GVA is a measure of the goods and services produced by a sector, industry or region of an economy. In National Accounting terms it is equal to total output (i.e. the total value of sales) minus intermediate consumption (i.e. the cost of inputs used in production).[13]

GVA is linked to the GDP measure of output; it is equal to GDP – taxes + subsidies. As taxes and subsidies are available on aggregate at the national level, GVA is used to estimate regional growth.

The measurement of GVA can carried out using either the income or production approach. The production approach involves measuring the value of output of goods and services produced and removing the value of inputs used in the production process. While the income approach is based on measuring the incomes earned by resident individuals and corporations in the production of the goods and services, excluding transfer payments (e.g. state benefits). As data is more readily available on incomes, the GVA income measure is the most commonly used measure of regional GVA.

The main determinants of income based GVA are the incomes of employees (which is a function of the total number in employment and the average wages) and the profits made by corporations (defined by the ONS as gross operating surplus).

In economic terms GVA growth is therefore driven mainly by changes in employment (the total number in employment) and productivity (which will be a key driver for both employees' wages and employers' profits).

Real Household Income Growth

Household income is simply defined as the combined income from all sources (can include labour income, pension and benefits, income from investments and savings) for all adult members of a household. The biggest sources of household income are labour income and income from pension and benefits. The real growth in household income is the year on year growth in income adjusted for inflation.

[13] ONS Regional Accounts methodology guide.

D.2. Baseline GVA forecasts by LA

In Section 2.1 of our previous report, we describe our approach to developing the baseline GVA forecasts. Here, we discuss the evidence that we have considered to develop these forecasts and then summarise the results. Given the level of uncertainty surrounding growth forecasts over the period 2011/12 to 2022/23, we have also developed GVA scenarios, which we discuss at the end of this section.

The baseline GVA forecasts are broken down into the following three components:

- public sector employment growth;
- private sector employment growth; and
- productivity growth.

Below we summarise our forecasts for each of these components.

D2.1. Public sector employment growth

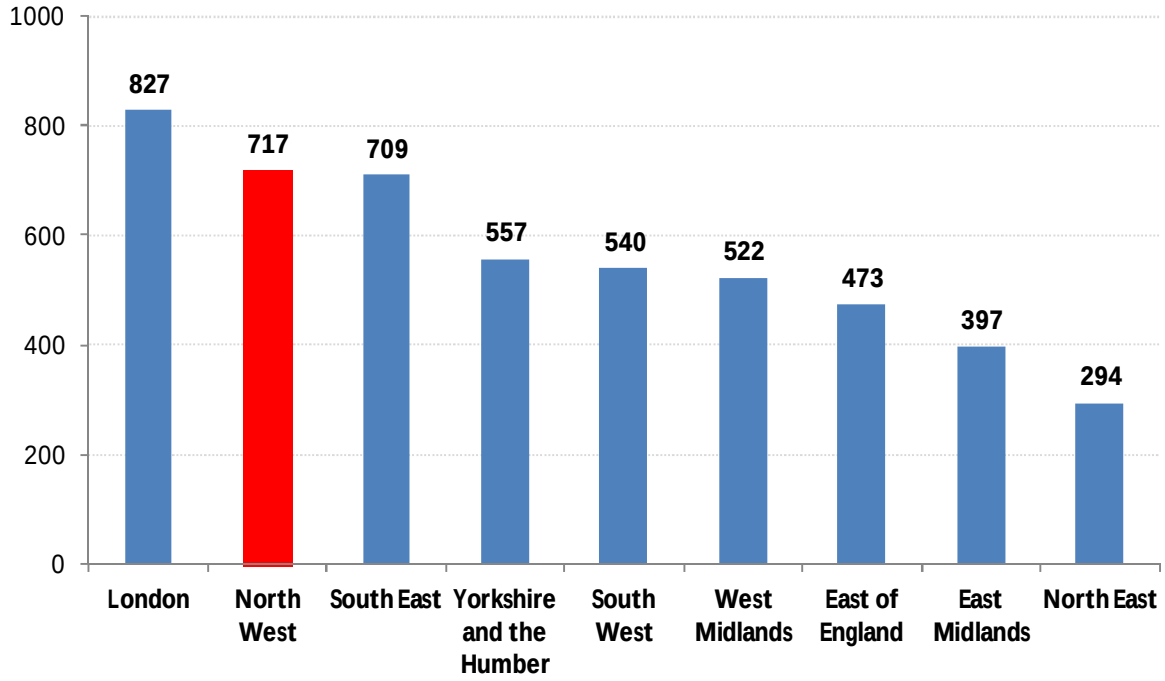
To develop the public sector employment growth forecasts we have considered:

- the current level of public sector employment in the ENWL LAs;
- the OBR's updated public sector employment projections for 2011/12 to 2016/17 as published in the November Economic and Fiscal Outlook;
- the GAD long-term public sector employment projections 2017/18 to 2022/23 (which are the same assumptions used in the OBR's long-term fiscal analysis); and
- the extent to which evidence exists to suggest that there is a material difference in the composition of public sector employment in the ENWL LAs compared to the rest of England. This helps us to understand the vulnerability of the region to public sector job cuts, and also if the region will potentially see a materially different trend in public sector jobs to the OBR forecasts.

Public sector employment in the ENWL LAs

We have reviewed data on the total public sector employment numbers by Local Authority, so we can analyse the exposure of each of ENWL's LAs to the public sector job cuts. Figure D.1 shows that the North West is the second biggest employer of public sector employees in England, employing 717,000.

Figure D.1: Total public sector employment 2010 (000's)[14]



However, this is in part because the North West is one of the biggest regions in the country in employment terms; therefore, it is also worthwhile to consider the proportion of the workforce in public sector employment. Overall, in 2010/11 22.4% of the those in employment in the ENWL region were public sector workers, this is marginally lower than the proportion for the North West – 22.8%, but higher than average across England – 21%.

Our analysis suggests that the ENWL region as a whole is highly exposed to the spending cuts in terms of the total number of job losses, but in percentage of employment terms is broadly similar to the rest of England.

OBR Forecasts

The OBR provide an analysis of the implications of the Government's spending cuts on public sector employment. Following the Chancellor's Autumn Statement, the OBR produced updated forecasts, which are published in the Economic and Fiscal Outlook 2011. In these updated forecasts the OBR revised their initial assessment of the level of public sector job cuts that might take place as a result of the Government's planned fiscal consolidation. The OBR now estimate that there will be a **total of 710,000 job cuts across the country by 2016/17 if the Government achieves its fiscal targets** (this was revised up from the 400,000 estimate published by the OBR in March 2011). The OBR analysis currently estimates that public sector employment will fall by 2.2% on average each year until 2016/17, which equates to a reduction of approximately 12% in the total size of the public sector workforce over that time period.

Over the longer-term the GAD public sector employment projections assume that public sector employment growth will average 0.25% each year until 2022/23. The GAD projection is based on the assumption that over the longer-term, total public sector employment will remain broadly

[14] ONS

constant as a share of total employment (given assumptions on the growth of the working age population and the unemployment rate).

Consideration of evidence to adjust OBR forecasts

Having reviewed the OBR's economic forecasts for the UK, we have considered the extent to which they are applicable to the ENWL LAs. To do this we looked at the composition of public sector employment in the North West to determine the need to make adjustments to the OBR projections to take account of structural differences in public sector employment in the North West versus the rest of the country.

Ideally we would have looked at the breakdown of total public sector employment at the ENWL LA level; however, the required dataset was only available at the regional level. In practice there should not be material differences in the composition of public sector employment between different regions in the North West area.

We focused on reviewing current levels of employment by both sector (Central Government, Local Government and Public Corporations - primarily Non-Departmental Public Bodies) and by industry (i.e. NHS, education, administration), in which public sector employees in the region are employed.

This analysis is relevant because we know that Local Government spending is being cut more significantly than Central Government; therefore if the region has a much higher proportion of its public sector workers employed in Local Government than the rest of the country this might imply that the region will suffer from higher rates of public sector job losses. Similarly, as we know that the NHS budget is being protected in real terms over the current Comprehensive Review Settlement, if the region has a higher share of NHS workers than average this might suggest that the North West will experience a lower level of public sector job losses than presented in the OBR forecasts.

Figure D.2 below shows the breakdown of public sector employment by sector in 2010, across the country. The chart suggests that the North West region has a similar breakdown of public sector employment as the rest of the country. For instance, the average proportion of workers employed in Central Government is 51%, which is equal to the North West's average; employment in both Local Government and Public Corporations is therefore also very close to the UK average.

Figure D.2: Regional public sector employment by sector in 2010[15]

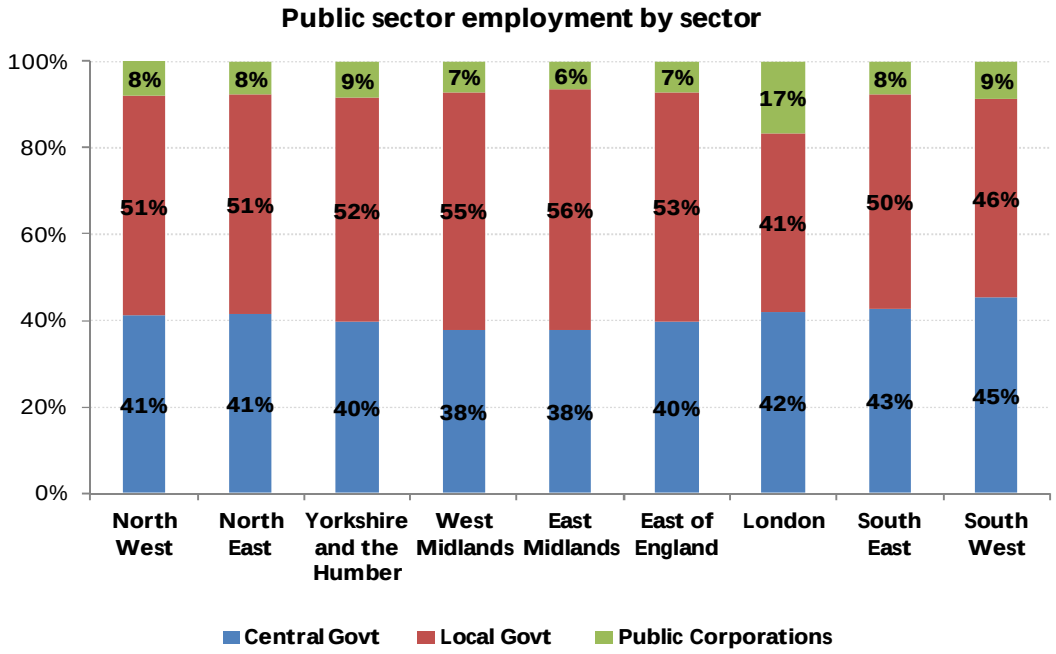
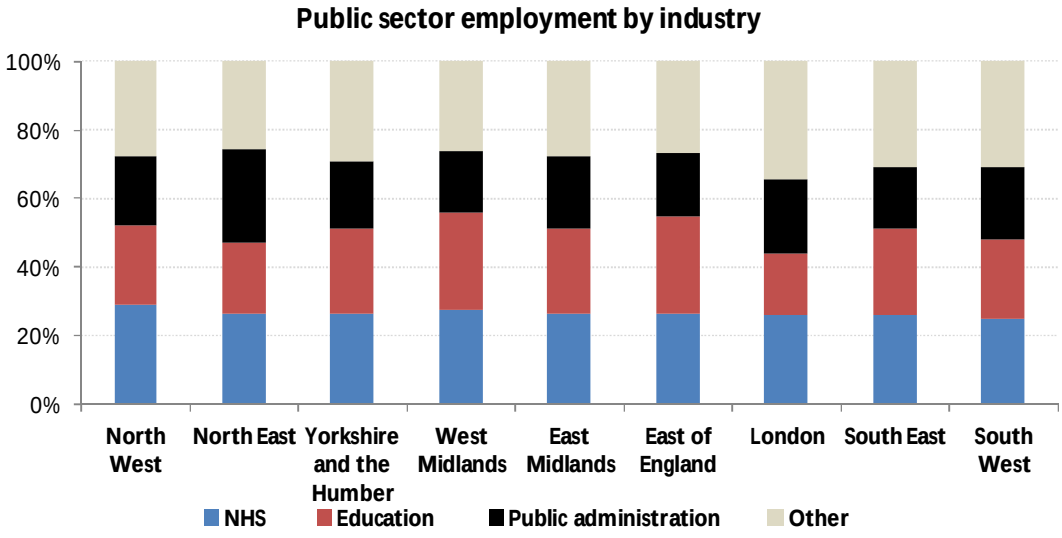


Figure D.3 below considers the 'industrial' classification of public sector workers in the North West. Again the evidence, suggests that the composition of the public sector in the region is similar to the rest of the country. We note that the North West employs a slightly higher proportion of staff in the NHS (2% higher than average), and a marginally lower proportion in Education (1% lower than average), but do not consider that these small differences will create a material difference in the overall level of job reductions in the region.

Figure D.3: Regional public sector employment by industry in 2010[16]



[15] ONS
[16] ONS

Public sector employment growth results

Overall, the evidence that we have assessed suggests that the region has a broadly similar sectoral and industrial composition of public sector workers to the rest of the country. This would imply that it will suffer from a proportionate level of job cuts as part of the Government's efforts to reduce the deficit, making it reasonable to apply the OBR / GAD forecasts to the ENWL LAs. However, we have made a minor adjustment to the GAD projections for 2017/18 to 2022/23 to account for the ONS population projections, which indicate that the working age population in the ENWL LAs will decline slightly over the period (rather than increase, as is the case with the rest of the country).

Table D.1 below summarises the public sector employment forecasts.

Table D.1: Summary of the public sector employment forecasts

	2011/12 – 2016/17	**2017/18 – 2022/23**
Public sector employment growth (average)	-2.2% per annum	0.2% per annum
Sources	• OBR Economic and Fiscal Outlook 2011. • ONS public sector employment by ENWL LAs. • ONS total employment by ENWL LAs.	• OBR Fiscal Sustainability Report 2011. • ONS working age population projections for ENWL LAs.

Applying our forecast growth rate for public sector employment growth across the ENWL LAs implies that total public sector employment will fall from just under 520,000 in 2010/11 to around 450,000 in 2016/7 when Government plans to have achieved the target of eliminating the budget deficit. This implies that total public sector jobs in the ENWL LAs will fall by approx 65,000 over the given time period. Over the longer-term our baseline public sector employment forecasts show total employment in the 35 LAs increasing by around 5,000 between 2016/17 to 2022/23.

D.2.2. Private sector employment growth

Similar to our analysis of public sector jobs growth, to develop the private sector employment assumptions we have reviewed the OBR forecasts and considered the extent to which evidence suggests there is a need to make adjustments to take account of differences between the ENWL LAs and the rest of the country.

OBR forecasts for private sector employment growth

The OBR analysis presented in November 2011 forecasts that private sector employment in the UK will increase by 1.7 million between 2010 and 2017, increasing at an average rate of around 1.1% per annum over the period. To immediately put their forecast into context, during the boom years of the last decade private sector employment growth in the country was 0% per annum on average.

Overall, the OBR base case assessment implies that private sector employment growth in the UK will more than compensate for the reduction of jobs in the public sector. The key assumption that underpins their judgement is that there has been no structural deterioration in the UK labour market as a result of the 'Credit crunch', which implies that there has been no increase in the UK's NAIRU (Non-Accelerating Inflation Rate of Unemployment).

This implication of this for their forecasts is that unemployment in the UK will not change significantly from current levels before falling back to the long-term average in the next few years. They do however acknowledge that there are a number of uncertainties inherent in their private sector employment projections; in particular they note that significant increase in youth unemployment rates (18-24) experienced in recent years may create long-term problems for the labour market.

The OBR private sector employment forecasts provide an important reference point for our forecasts for the ENWL LAs. However, a number of independent forecasters - including the NWRDA forecasting Panel – have a more pessimistic assessment of the private sector's ability to absorb all the job losses in the public sector, while at the same time creating additional new jobs over the next few years.

As part of our analysis we have considered the following when determining the need to adjust the OBR forecasts to make them applicable to the ENWL LAs:

- historic evidence from previous recessions to consider how long it has typically taken for the labour market to return to pre-recession levels;
- a consideration of recent employment growth in the region to assess the current status quo of the private sector employment market; and
- a review of evidence for future prospects for employment growth in the region.

Historic evidence from previous UK recessions

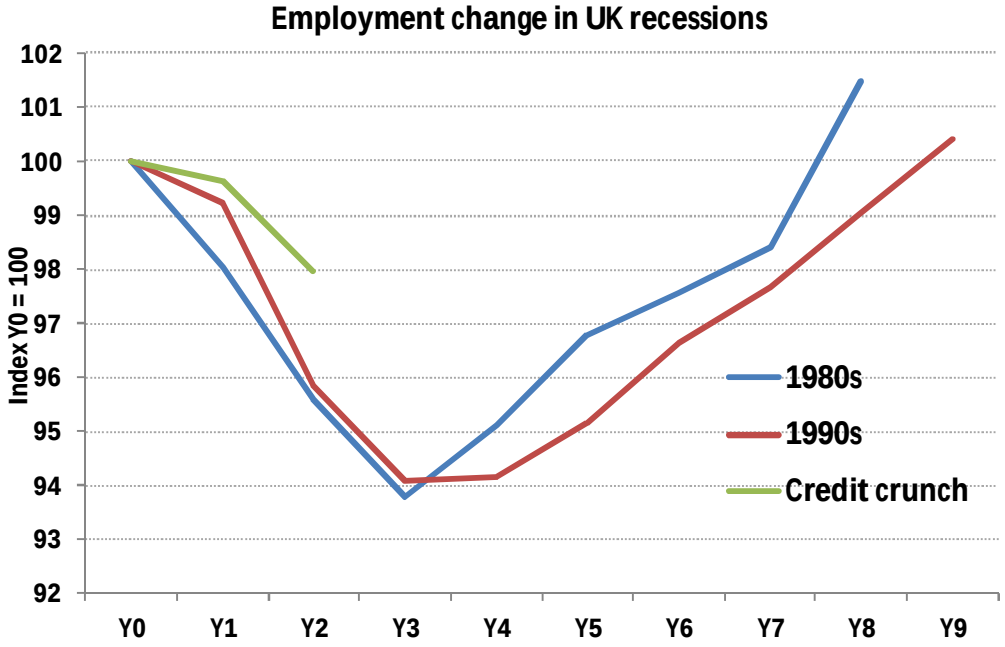
As mentioned above private sector employment growth in both the UK and the North West region has been stagnant over recent years. During the relatively favourable economic conditions experienced in the period of 2000 – 2009 only a total of 1300 new private sector jobs were created in the North West, with private sector employment growth averaging only 0.1% per annum, which is very similar to the 0% average growth per annum experience in the rest of the UK.

It is argued by many economists that the ability of the private sector to create jobs in the last decade was hindered by the strong growth in public sector jobs (public sector employment in the North West grew by 1.8% per annum over the same period); i.e. they believe that public sector employment in the last decade crowded out private sector jobs growth. In their view this implies that the Government's policy of cutting public sector employment will free-up the private sector to deliver significant wage growth in the next few years.

However, the sheer scale of public sector job cuts combined with the weak record of private sector job creation in both the UK and North West, and also the surrounding macroeconomic uncertainty created by the Euro crisis, make it possible that the employment market will take longer to readjust than the OBR currently estimates.

Evidence from the experience of the labour market in previous recessions in the UK supports this assessment. In previous recessions, employment levels have typically taken around seven to eight years to return to their pre-recession peak as the labour market takes time to adjust. For instance, in the recession of the 1990s, unemployment peaked at 10.7% three years after the end of the recession and did not return to pre-recession levels until around 1998. This is illustrated in Figure D.4 below. Further, it is important to note that in the rescissions of the 80s and early 90s public sector employment was contributing to the recovery in the labour market, rather than shedding jobs, the Euro area was not in the same difficult position, and the credit markets were not as constrained as they are at present.

Figure D.4: Employment change following previous UK recessions[17]



Overall, the evidence suggests that the private sector employment market will take longer to readjust than implied by the OBR forecasts. We note that an important feature of the credit crunch recession is the resilience of the employment market – as the above chart shows total employment has not fallen as far as in previous recessions. However, the chart also shows that job losses have typically not peaked until 3-4 years after the recession. Further, current evidence suggests that many employers decided to hold on to their workers during the recession, but reduce wage growth instead, which simply implies that the total scope for employment growth when the economy returns to growth will be lower than in previous recessions; i.e. if private sector employment has fallen more slowly in this recession compared to the past, it will also grow more slowly as the economy recovers.

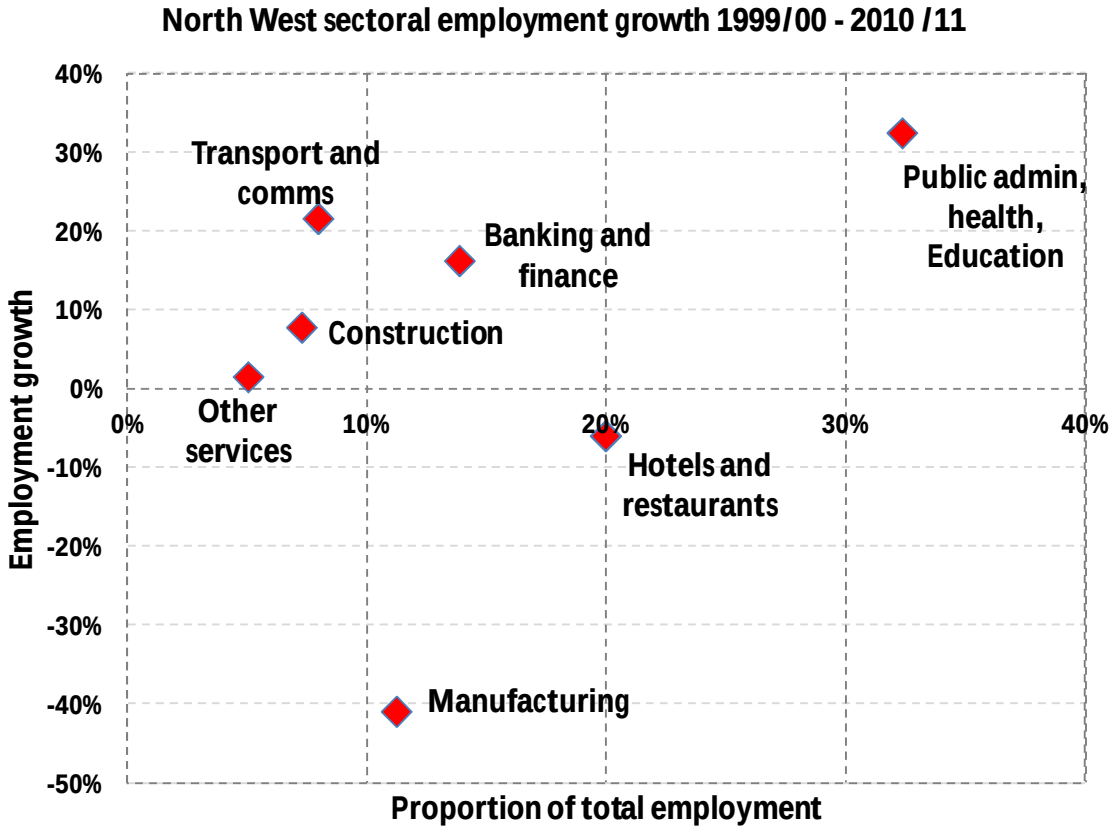
Historic private sector employment growth in the region

We have carried out a detailed sectoral review of recent employment growth in the North West, the data to carry out this analysis was available only at the regional level rather than specifically for the ENWL LAs.

[17] CEPA Analysis

Figure D.5 below provides a detailed look at the sectors in which jobs have been created in the North West in the recent years. It shows the different sectors in which jobs have been created in the region (on the y-axis), and also each of the sectors relative importance in terms of their share of total jobs in the region (on the x-axis). So a reading on the top right of the chart implies that the sector contributes a significant share of jobs in the region and has experienced high levels of employment growth in the last decade. Hence, the chart shows that the public sector has experienced high employment growth and is also the biggest employer in the region (in sectoral terms).

Figure D.5: Sectoral employment growth in the North West[18]



The key message coming from the above chart is that over 50% of the regions jobs are in the public admin (which includes public sector jobs) and hotels/restaurants sector, and that the manufacturing sector has seen the biggest total decline in jobs between 1999/00 – 2010/11, with a 40% decline in jobs, while most jobs have been created in public admin, banking and transport.

In the following sub-section we consider the prospects for employment growth in the key sectors based on the evidence available.

Employment prospects in the region

We consider briefly the prospects for the key areas of the private sector in the region. In this analysis we have considered information presented in the Autumn Statement, the ENWL LAs individual economic plans where available and the NWRDA survey presented in their long-term projections:

[18] *ONS Nomis database*

- **Manufacturing employment** has declined by over 40% between 1999/00 – 2010/11. Going forward the prospects for significant employment growth in the sector are not good. For instance the UK Markit Purchasing Managers Index (PMI) is currently below 50 (December 2011 figure), which suggests that the sector will fall into recession. Furthermore, given that over 50% of manufacturing exports typically go to the Euro area, the sector is highly exposed to ongoing uncertainties caused by the debt crisis. In addition, the NWRDA survey (published in their 2011 forecasts) suggests that employers in the manufacturing sector in the region report that they do not expect to make any significant increase in employment in the coming years. Analysis for the Greater Manchester region by Oxford Economics also suggests that manufacturing employment will continue to fall, albeit at a slower rate over the forecast period.[19]

- The available evidence suggests that employment prospects in the **construction sector** are particularly bleak. The sector is highly reliant on Government spending, and therefore the announced cuts to the budget for social housing, regeneration budgets and the building schools for the future programme. In total the North West Development Agency forecasts estimate that the construction sector will experience a 10% decline in jobs in the region as a result of the cuts to public spending**.**

- Regional forecasters are also pessimistic about the potential for the **hotels and restaurants sector** to act as a source for significant employment growth in the future. In particular the increased uncertainty caused by public sector job cuts and the low growth in real household disposable incomes are cited as factors which will limit growth in the services sector in the region in the future. Though in contrast areas such as Cumbria expect to benefit from increased UK tourism, as UK travellers may be forced to cut back on international travel as a result of lower incomes and the increase in travel costs resulting from Government taxation decisions.

- The prospects for the **transport and communications sector** in the region may be more positive than for other sectors. The Government have announced a number of infrastructure investments in the region, such as the Mersey Gateway Bridge and a £200m plan to electrify railway routes in the region in the years 2013 to 2017. In the 2011 Autumn Statement the Government also announced additional support for technology clusters, with Manchester selected as a location for investment, which may also support employment growth in the sector. Finally, the completion of MediaCity and the relocation of the BBC will be an important driver of employment growth in the sector. In total 2,300 BBC jobs are expected to move to the area over time; furthermore, the presence of the BBC in Salford might attract other businesses involved in the communications sector to locate there. Overall there may be some scope for additional employment creation in this sector.

- Similarly it is not expected that the **banking and finance sector** will experience any significant decline in jobs, particularly given Government's commitment to protect the sector from excessive regulation. However, the sector's exposure to the Euro area financial crisis may limit the scope for employment growth in the short-term.

[19] Oxford Economics (2011) Greater Manchester Forecasting Model

Private sector employment forecasts

The range of evidence that we have considered provides quite a sober assessment of the prospects for private sector employment growth in the region over the period during which the Government will be making cuts to public spending and the public sector workforce. Both the backward looking (recent private sector jobs growth and employment creation following recessions) and forward looking (the sectoral assessments) analysis suggests that it may take some years for the private sector to adjust to the changing economic environment and create the additional jobs necessary to re-balance the economy and return total employment to the pre-recession peak of 2008. While it is difficult to quantify directly much of the analysis that we have carried out, it does suggest that private sector employment growth will not be able to match the central OBR forecasts, over the next five years.

Therefore, our view is that there is sufficient evidence to consider alternative forecasts for private sector employment growth to develop the baseline forecasts. Validation of this judgement comes because simply applying the OBR forecasts would imply unrealistic unemployment rate assumptions given the most recent ONS working age projections for the ENWL LAs.

We have therefore considered the ONS working age population projections for the ENWL LAs, the NWRDA projections and the implied time lag for the LAs to achieve a similar level of employment as experienced in previous recessions for the period to 2016/17. For the period 2017/18 – 2022/23 we assume that private sector employment grows at a rate that is consistent with the region achieving the level of employment that implies that the implies trend levels of unemployment.

Table D.2 below summarises the public sector employment forecasts.

Table D.2: Summary of the private sector employment forecasts

	2011/12 – 2016/17	**2017/18 – 2022/23**
Private sector employment growth (average)	0.53% per annum	0.12% per annum
Sources	• OBR Economic and Fiscal Outlook 2011. • NWRDA 2011 long-term forecasts. • ONS working age population projections for ENWL LAs. • ONS private sector employment by ENWL LAs. • Historic evidence on labour market experience following a recession (ONS employment data). • Regional assessment of future employment prospects by sector (ONS NOMIS database, HM Treasury Autumn Statement, individual ENWL LA economic plans, NWRDA survey).	

D.2.3. Productivity growth

To develop our projections for baseline productivity growth we have focused primarily on top-down analysis given the limited availability of data. As the availability of productivity data at the Local Authority level is very limited the assessment is based largely on regional data.

We base the analysis on:

- consideration of OBR and other independent forecasters' projections to identify current consensus views of productivity growth in UK;
- analysis of historic productivity growth in the North West compared to the UK to determine if there is any significant difference between productivity in the region, compared to the rest of the UK; and
- consideration of underlying regional trends in key drivers of productivity growth: enterprise growth; skills; innovation and Research & development. This analysis helps to determine if any evidence exists to suggest that there is likely to be a material change in the long-run productivity performance of the region compared to the rest of the UK.

OBR assessment

The OBR assessment focuses on estimating the productivity potential for the UK for the period to the end of 2016/17. Their analysis identifies that in the years immediately following the recession productivity growth in the UK has been very limited in particular in comparison to productivity growth following previous recessions in the UK – growing at only around 1%p.a. They suggest that this is potentially because unemployment has not increased as significantly as would have been expected following the large drop in total output experienced during the recession, this has correspondingly restricted productivity growth. In addition the OBR note that the low levels of credit available to businesses has also potentially restrained productivity growth in recent years, and may continue to do so in the immediate term.

Overall, the OBR judge that the economy will take a few more years to return to trend levels of productivity growth, with below trend levels of productivity growth persisting until 2013-14, beyond which time the economy will return to trend. Underlying this judgement is an assumption that the Credit crunch has not reduced permanently the long-term growth potential of the UK economy.

Therefore, the OBR assume that the economy has the potential to achieve productivity growth of around 1% p.a. in 2011/12 and 2012/13, before returning to the 2% trend growth rate (the UK long-term historic average since 1961).

Consideration of productivity growth in the region

The available evidence suggests that the ENWL LAs have historically underperformed in terms of productivity growth compared to the rest of the UK. In the period 1998 – 2010 GVA growth in the region has fallen below UK GVA growth by an average of around 0.5% per annum. A review of NWRDA analysis suggests that this is marginally higher than the longer-term productivity growth gap of 0.4% per annum that the region has experienced compared to the rest of the UK.

The recent productivity performance in the region is in part explained by the shift away from the higher productivity manufacturing jobs in the region to less productive public sector and service sector jobs. Over the longer-term the underlying productivity gap is explained by the region's

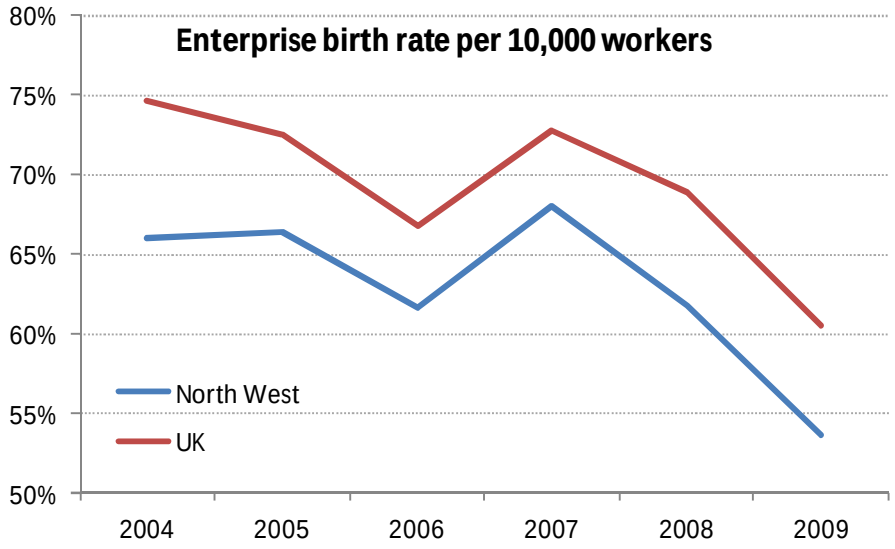
underperformance on the key drivers of productivity: skills, innovation, investment and research & development.[20]

To understand why productivity growth in the region has lagged behind the UK, and to help us consider the prospects for closing the productivity gap over the forecast period, we consider the available information on these key drivers of productivity.

Enterprise growth

The available information on enterprise data suggests that the North West continues to lag in performance when compared to the rest of the UK. Data is only available for the period 2004 – 2009 and shows that the number of new enterprises created in the region, as a proportion of the workforce, continues to lag behind the rest of the UK. With the enterprise birth rate currently standing at approx 0.53 per 10,000 working age people in the North West compared 0.61 per 10,000 workers in the UK. See Figure D.6 below.

Figure D.6: Enterprise birth rate 2004 - 2009[21]



However, the evidence does show that new enterprises created in the North West have managed to survive at similar rates to the rest of the United Kingdom, and indeed has a marginally higher survival rate over the longer-term, as shown in Table D.3 below. This suggests that once new enterprises have been established in the region, the overall supporting business environment is broadly comparable to the rest of the country.

[20] The other key driver of productivity is competition policy; there is nothing to suggest that competition policy differs significantly across different regions of the country.

[21] *ONS Nomis database*

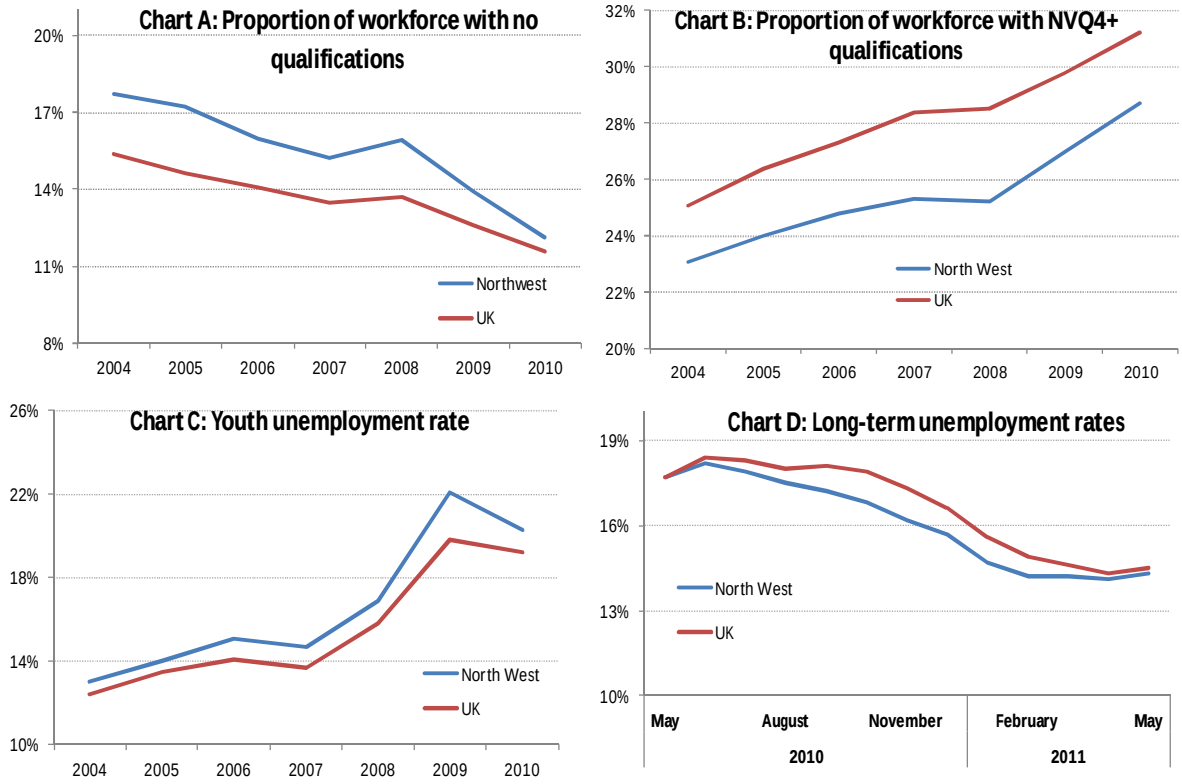
Table D.3: Business survival rates in the region[22]

	1 year	2 year	3 year	4 year	5 year
North West	94.1%	79.1%	66.2%	55.3%	46.8%
UK	94.2%	78.7%	65.3%	54.7%	46.8%

Skills

The available information on current developments in the skills profile in the region compared to the rest of the UK presents a mixed picture, though the higher rates of youth unemployment may be storing up long-term productivity problems in the region. We illustrate a range of indicators in the figure below.

Figure D.7: Indicators of skills and qualifications in the region[23]



The key points to note from the available evidence are as follows:

- Chart A shows that the region has made progress in reducing the proportion of the adult population with no qualifications, falling from 17.7% in 2004 to 12.1% in 2010 and at the same time closing the gap with the rest of the UK.
- However, Chart B shows that over the same time period the gap in the proportion of workers with the highest qualifications (level NVQ 4 and above) between the North West and the rest of the UK has increased marginally from 2.0% in 2004 (overall in the

[22] *Ibid.*
[23] *Ibid.*

North West 23.1%) to 2.5% (28.7%) in 2010, suggesting that the region continues to have a skills gap for the most skilled workers compared to the rest of the country. This is important because the highly skilled workers are crucial in creating new jobs and stimulating enterprise growth.

- Another key indicator for both skills and productivity is the youth unemployment rate (16 – 24). This is because unemployment at a young age can cause workers to lose some of the skills that they developed through education and training affecting their long-term productivity rates. Historic evidence indicates that periods of joblessness for young workers is highly correlated with higher rates of unemployment throughout out the rest of their career compared to individuals of the same age. As illustrated in Chart C the North West has seen a significant increase in the youth unemployment rate since the start of the recession, greater than that experienced in the rest of the country. 2010 data shows that 20.3% of 16-24 year olds are unemployed in the North West compared to 19.2% in the UK.

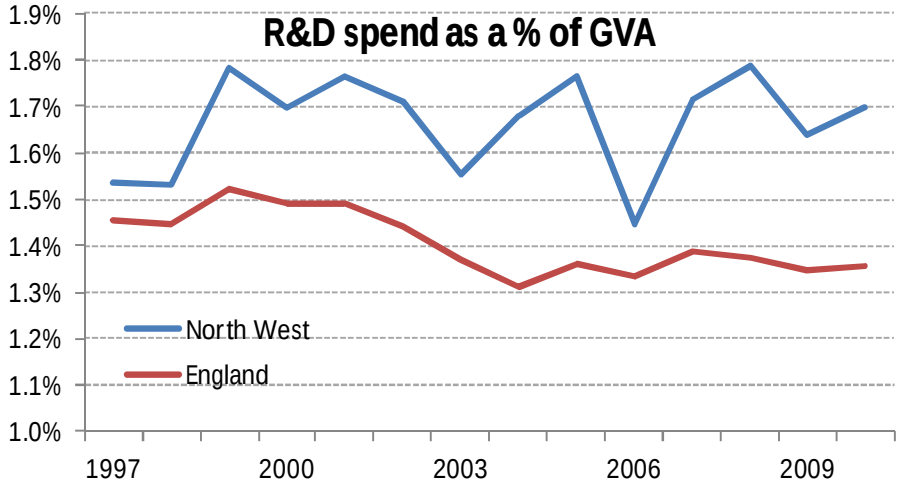
- Chart D presents the long-term unemployment rates (unemployed for more than 1 year) in the North West compared to the UK. Again high rates of long-term unemployment are an important driver of both skills and productivity, as employees experiencing long periods of unemployment may become de-motivated and leave the labour force and also can see their skill levels fall. As chart D shows the North West currently has a similar rate of long-term unemployment as the rest of the UK at around 14.3% of the workforce, compared to 14.5% in the rest of the UK. In the last year rates of long-term employment have begun to fall, though evidence suggests that this is because some individuals have decided to leave the workforce.

Innovation and Research & Development

The available evidence on innovation and Research & Development (R&D) is mixed. Overall, it suggests that the region has an important advantage in R&D spend compared to the rest of the UK; however, the North West lags behind the rest of the UK on based on the available information on innovation.

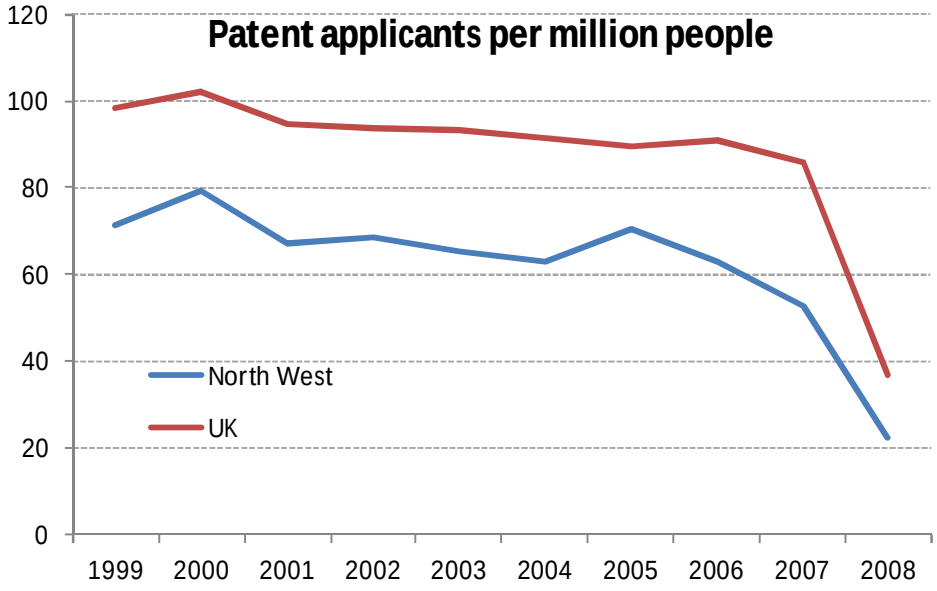
As mentioned above the North West does enjoy higher rates of R&D spend as a proportion of economic activity than the rest of England, this is shown in Figure D.8 below. This is an area of relative strength for the regional economy and could support increased productivity growth in the future. Though it is a puzzle why the higher levels of R&D has potentially not translated into higher levels of innovation in the region.

Figure D.8: R&D spend as a % of GVA[24]



The available evidence on innovation, shown in Figure D.9, shows that the region has on average made significantly lower level of patent applicants than the rest of the country. This is important because patent applications are an important indicator of innovation and suggests that there may be a disconnect between the amount of research being carried out and the ability of that research to generate new products/business ideas to support increased growth.

Figure D.9: Rates of innovation in the region[25]



Investment

There is limited publically available information on investment in the region, so have reviewed published material for this indicator.

[24] *ONS Nomis database*
[25] Eurostat

A review of the North West Regional Development Agency forecasts suggests that investment levels in both the services and manufacturing sectors in the North West have outperformed the UK average over the period (1998 – 2007), when measured as investment as a % of economic activity. This has the potential to support higher growth in these specific sectors in future years, though it should be cautioned that the data might have changed significantly since 2007.

However, overall levels of capital investment per business in the region are shown to lag behind the rest of the UK, with the average business in the region investing £44,200 on capital expenditure compared to £44,800 in the country as a whole.

Summary of evidence on productivity growth

Overall the evidence available to us on the key drivers of productivity performance helps us to understand why the region has continued to lag behind the performance of the rest of the UK.

Compared to the rest of the country the region suffers from lower rates of enterprise, has a skills gap for the most skilled members of the workforce and according to the most recently available information has lost its advantage in terms of investment as a proportion of economic activity. Furthermore, while the region currently suffers from marginally lower rate of long-term unemployment than the rest of the UK, youth unemployment rates in the region have increased rapidly in recent years, which is problematic as youth unemployment is a key indicator of long-term productivity performance.

Therefore, our assessment is that while there has been some progress in some areas, such as the significant reductions in the proportion of the working-age population with no qualifications, there is little evidence in our analysis to suggest that the region has been able to close the historic underlying productivity growth gap with the rest of the country.

Thus for the purposes of our forecasts we assume that the long-term underlying productivity gap of 0.4% per annum between the UK and the North West is maintained over the forecast period. We make an adjustment to take account of the different employment forecasts that we have adopted. This is necessary because over the medium-term, our forecasts imply that the labour market in the region will take longer to recover than suggested by the OBR forecasts and this will lead to a corresponding impact on short-term productivity growth (measured as output per worker), i.e. as employment growth in the UK is higher than we estimate for the ENWL LAs, this would tend to have some impact on reducing productivity.

Table D.4: Summary of the productivity growth forecasts

	2011/12 – 2016/17	**2017/18 – 2022/23**
Productivity growth average	1.9% per annum	1.8% per annum
Sources	• OBR Economic and Fiscal Outlook 2011. • NWRDA 2011 long-term forecasts. • ONS working age population projections for ENWL LAs. • ONS indicators on key drivers of productivity growth.	

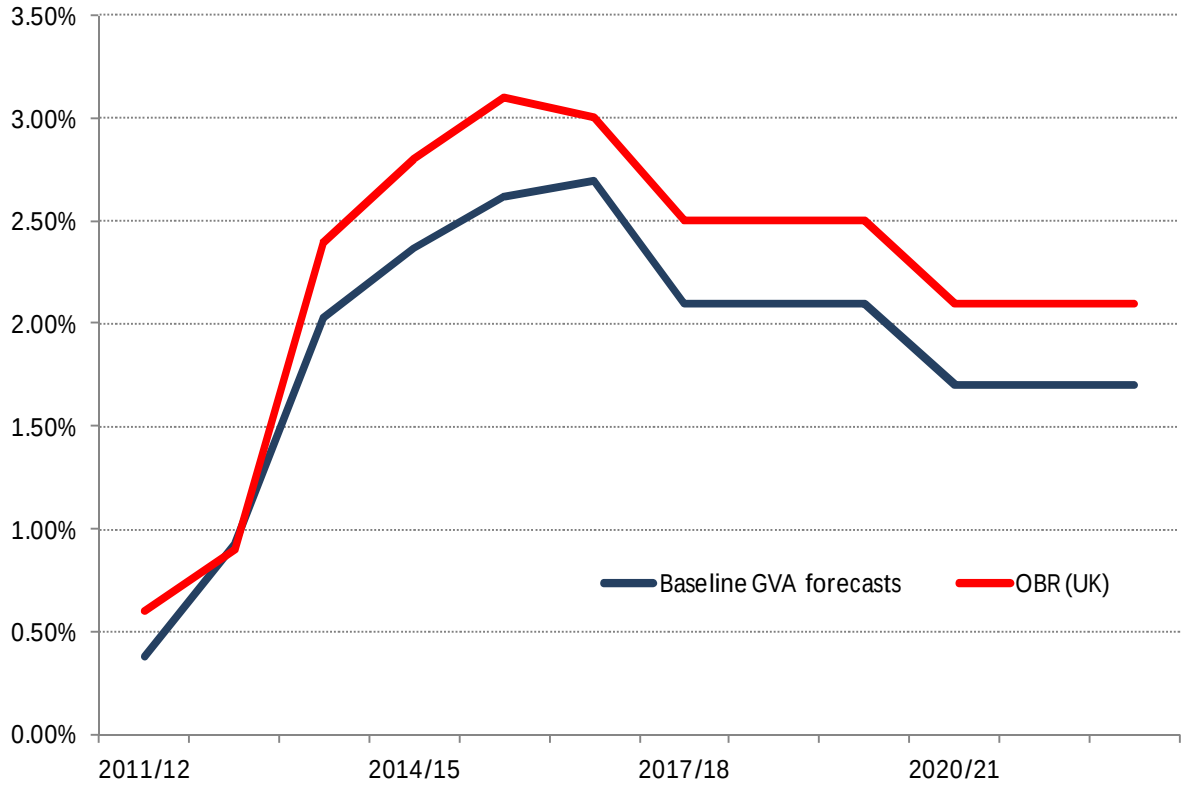
D.2.4. Summary of baseline results

In the previous sections we have carried out a detailed assessment of the prospects for:

- Public sector employment growth;
- Private sector employment growth;
- Productivity growth.

We combine these forecasts to give our overall GVA growth projections for the forecast period. Please note that these forecasts are unique for each of the ENWL LAs, but that for ease of presentation we have combined the results for all the ENWL LAs in Figure D.10 below. For the purpose of comparison we also show the OBR central forecasts for the UK economy in the figure.

Figure D.10: Baseline GVA forecasts for ENWL LAs[26]



The chart shows that our forecasts track below the OBR estimates for the UK throughout the forecast period. This is consistent with the evidence that we have considered, as well as the NWRDA region-specific assessment, both of which suggests that the region will experience a lower rate of jobs growth and productivity growth than implied by the OBR.

[26] *CEPA analysis, OBR*

D.2.5. GVA scenarios

Given the ongoing uncertainty created by the potential impact of the Government's spending cuts and the Euro debt crisis on the recovery, there is clearly a great deal of uncertainty about how the economy will grow over the forecast period. To help manage this uncertainty it is good practice to develop alternative scenarios that illustrate the impact of varying the key assumptions that underpin the baseline forecasts.

In this section we describe both the rationale and assumptions behind the scenarios that we have developed, and present the summary results (please note that we for presentational purposes we have again aggregated the results for all the ENWL LAs).

Economic growth scenarios

As described in Section D.2.4., the baseline forecasts are dependent on assumptions on employment and productivity growth in the ENWL LAs over the forecast period. In our scenarios we thus consider the impact of varying these assumptions, taking account of both upside and downside risks.

We have considered the following scenarios:[27]

- **Aggregate demand trap**, which can be described as a low employment and low productivity scenario, in which the Government's spending cuts, leads to a reduction in economic activity that necessitates additional spending cuts over a longer time period that causes employment growth to weaken in both the private and public sector.
- **High growth**, which includes high employment and productivity assumptions. In this scenario we assume there has been no structural impairment to economic growth in the UK economy, which enables productivity growth to grow much faster than trend for much of the forecast period and for the ENWL LAs to achieve similar rates of private sector jobs growth as the rest of the economy (based on the OBR forecasts) as a result of Government's initiatives to stimulate growth in the North.

We describe each of the scenarios in more detail below.

Aggregate demand trap

While it is generally accepted that the UK needs to take strong action to reduce the size of the fiscal deficit, many economists differ in their views on the overall economic impact of the Coalition Government's planned fiscal consolidation on the UK economy. Some economists believe that the reduction in Government demand and employment will be compensated for by higher private sector demand, i.e. they assume that the Government has been 'crowding-out' private sector activity in the past decade. In contrast, other economists believe that Government is cutting back demand too far and too fast in the middle of a highly uncertain period for the economy. This school of thought is based on the assumption that the private sector in the UK is too weak to increase activity quickly enough to compensate for the reduction in Government

[27] To develop these scenarios we have considered the scenarios presented by the OBR in the November Economic and Fiscal outlook.

demand; i.e. they are of the view that the fiscal multiplier is currently greater than one, as such a reduction in Government demand leads to a larger reduction in overall demand in the economy. In this scenario we illustrate the impact of applying the assumption that the fiscal multiplier is greater than one.

In the aggregate demand trap the key economic outcomes are as follows:

- Government's spending cuts also depresses economic activity in the private sector, as the parts of private sector that are reliant on Government contracts are unable to recover, which then also causes a knock-on impact on other segments of the private sector. This causes private sector employment to grow more slowly than predicted by current OBR forecasts in 2011/12 and 2012/13, which in turn causes private sector growth in the ENWL LAs to fall as well.

- As a result of this outturn, economic growth in the UK falls below OBR forecasts for the next two years, which forces the Government to cut back spending further than currently planned to enable it to meet the deficit reduction targets over the rolling five-year period. We assume that the Government has to cut public spending for an additional two years beyond current plan, which implies that fiscal consolidation will be complete by 2017/18 instead of 2016/17. The net result of this is that public sector employment continues to fall until 2017/18; which causes public sector employment in the ENWL regions to fall as well.

- In this scenario we also assume that the weakness in the employment market also has a knock-on effect on underlying productivity growth in the UK. The higher-rates of unemployment experienced increases the incidence of both long-term unemployment and youth unemployment, both of which are key long-term determinants of productivity growth. In the aggregate demand trap scenario, we therefore assume that underlying productivity growth in the ENWL regions falls over the forecast period, falling marginally more than the rest of the UK because of the higher rates of youth unemployment that the region has suffered from.

High-growth scenario

The high-growth scenario is built on the twin assumptions that productivity growth and employment growth in the region are higher than the baseline forecasts. The rationale for the scenario is drawn from the OBR no structural impairment scenario, which assumes that the recession did not cause any structural damage to the UK economy. This assumption implies that there is currently a much higher than forecast level of spare capacity in the UK economy at present, which means that over the coming years the economy has the potential to grow quickly without causing higher levels of inflation.

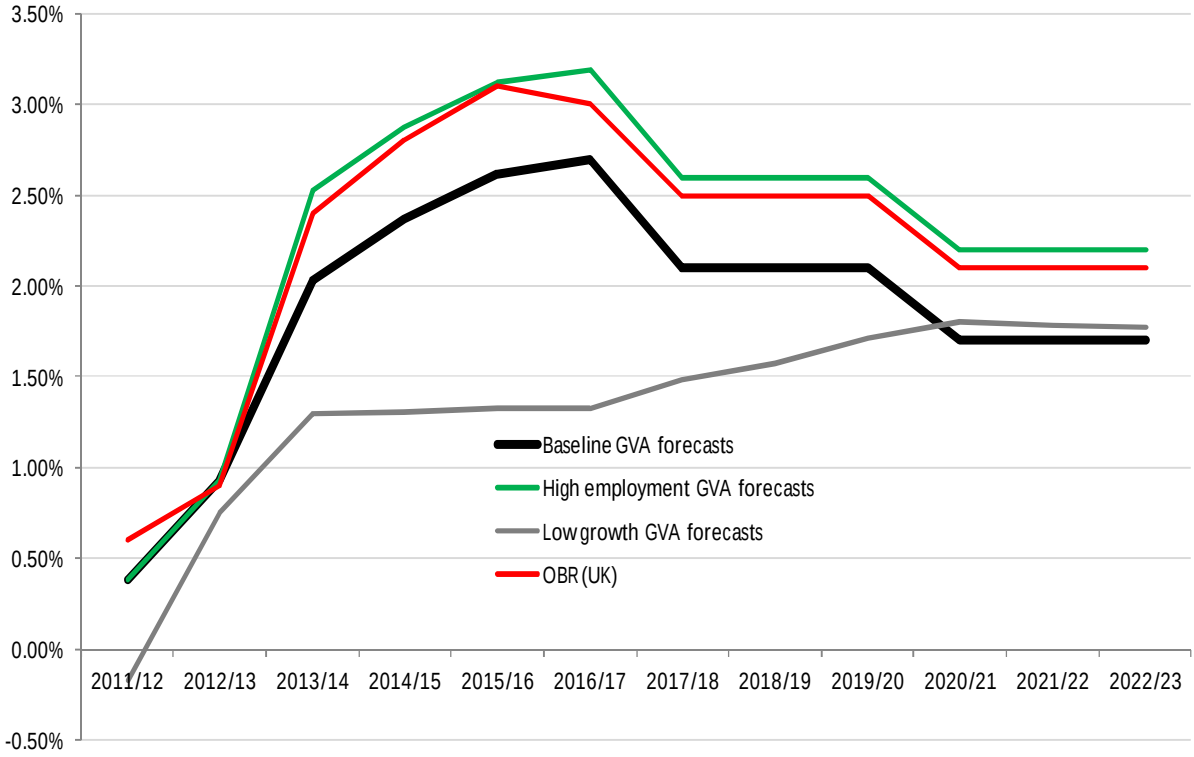
In this scenario we the higher productive potential in the economy stimulates higher private sector employment growth in the ENWL region than assumed in the baseline case. We assume that the region is able to achieve the higher private sector employment forecasts for the UK developed by the OBR. The higher levels of private sector employment growth could derive from the impact of Government interventions announced in the Autumn statement to support growth in the North West such as the Electrification of the Transpennine Express, combined

with the more general support to the private sector through initiatives to improve the coverage of broadband and to extend credit to small businesses in the region.

D.2.6. Scenario results

The results of the scenario analysis are presented below in Figure D.11. We can see that GVA is projected to grow on average by 1.9% per annum in the baseline case, which compares to 2.3% in the high-growth scenario and 1.3% in the aggregate demand trap case. This provides a range within which GVA might grow in the ENWL regions within the forecast period. It is important to note that there are further still downside risks to these forecasts, particularly if there is a disorderly breakup of the EURO area. We have not developed a scenario to take account of this possibility because there are so many different ways in which the EURO area might unravel, each of which would create a variety of economic outcomes that at this stage cannot be quantified in any meaningful way.

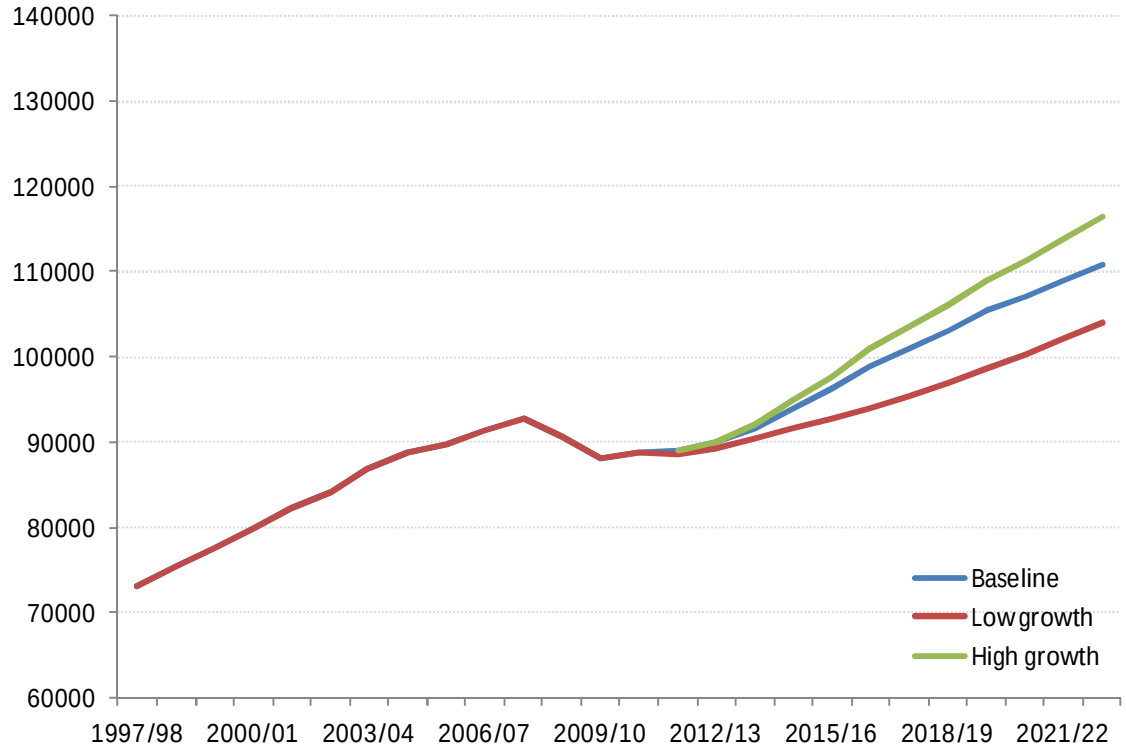
Figure D.11: Economic growth scenarios[28]



We can apply the projected percentage growth rates in the ENWL LAs to the total level of GVA (in £ 2010/11 terms) to consider the impact of the scenarios on economic activity in the region over the forecast period, and also to assess what it implies given the historic growth context. This is illustrated in Figure D.12 below.

[28] *CEPA analysis*

Figure D.12: GVA growth (£m, 2010/11)[29]



In economic terms the GVA scenarios imply quite different outcomes for the ENWL LAs' economy over the forecast period.

- The baseline case implies that the region returns to long-term trend levels of growth experienced before the economic boom of the last decade. This is consistent with the views of economists who believe that the higher levels of economic growth experienced in that period were unsustainable and the result of debt accumulation rather than any structural increase in the UK's productivity potential.
- In contrast the high-growth scenario is consistent with the view that productivity growth did increase significantly in the last decade, as such the economic growth potential in the region (and the UK as a whole) returns to the levels experienced in the last decade.
- The low-growth scenario is based on a more pessimistic economic rationale that the 'Credit crunch' has damaged the long-term growth potential of the UK economy, which has the implication that the economic activity lost during the recession will never be recovered.

D.3. Household income and household formation projections

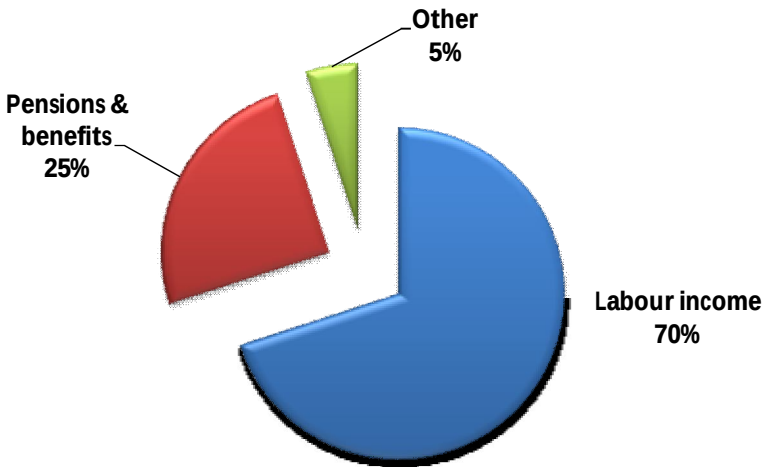
In this section we further set out the approach and results that we have used to develop the household income and household formation growth assumptions.

[29] *CEPA analysis*

D.3.1. Household income growth

To develop the forecasts for real household income growth we have analysed ONS data to establish the key sources of household income. This analysis suggests that household income in the region is derived from income from employment (around 70%), income from pensions and other benefits (around 25%) and income from other sources, which includes sources of income such as returns from savings and investments. This is illustrated in Figure D.13 below.

Figure D.13: Sources of real household income growth[30]



Employment income

The OBR also provide forecasts for earnings growth. These forecasts are broken down into forecasts for public sector and private sector wage growth.

The forecasts for public sector wage growth are provided for the five year period until 2016-17, and reflect announced Government policy. As we have demonstrated in the consideration of public sector wage growth, the composition of the public sector in the North West is broadly comparable to that of the rest of the country. It is therefore appropriate to use the OBR forecasts for public sector wage growth in the ENWL LAs for the period until 2016/17. Beyond 2016/17 the OBR assume that both public and private sector employment wages both increase in line with productivity growth, we again adopt that assumption.

The OBR also produce implicit forecasts for private sector real earnings growth. However, it is not appropriate that we adopt these for the baseline forecasts, as we are assuming a different set of outcomes for the labour market in the ENWL LAs compared to the OBR's assumptions for the overall economy. The different productivity and employment growth assumptions that we have adopted in the baseline forecasts would most likely lead to different rates of private sector income growth.

Instead of using the OBR forecasts we instead assume that real private sector income will grow in-line with our region-specific productivity growth rate assumption. Such an approach is common, and is used by the OBR for their economic projections. We note that income growth is a function of a number of variables such as economic growth, union density, surrounding

[30] ONS

labour market conditions and inflation. We do not have access to a rich enough dataset to carry out the analysis required, for instance, data on the median income for private sector workers is not available as a historical series on the ONS database (data is only available for 2009 – 2011).

Pensions and benefits

The Government has announced its intentions for the growth of pensions and other benefits for the period 2011/12 – 2015/16. The OBR provide estimates of the growth rates in the Economic and Fiscal outlook. It is appropriate to adopt the OBR assumptions for our forecasts as they are based on Government policy that has been announced.

Post 2015/16 we assume that pension and benefits increase in line with earnings growth. This is the approach taken by the OBR in their Fiscal Sustainability report (July 2011), which provides longer-term economic and fiscal forecasts for the economy. The OBR make a few small minor adjustments to this assumption, such as increasing state pension benefits by earnings growth +0.2%. However, as we do not have the data available to disaggregate the proportion of household income sourced from the different types of pensions and benefits, we cannot make a suitable adjustment in our forecasts. Therefore, we simply assume that benefits and pensions increase with prices as well over the longer-term.

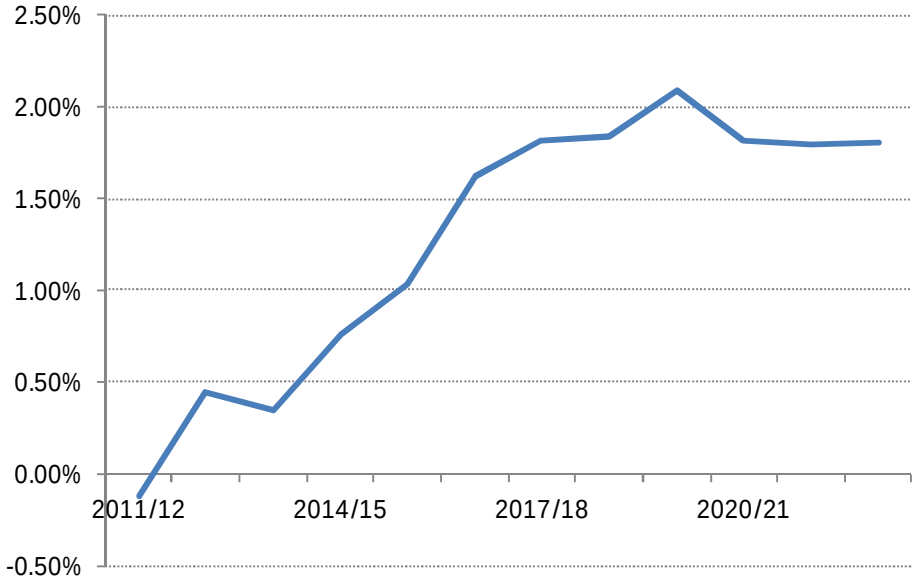
Summary of household income growth forecasts

In summary we adopted the following approach to develop the household income forecasts.

- We adopt the OBR forecasts for the growth in pensions and benefits.
- We adopt the OBR forecasts for the growth in household income gained from public sector employment.
- We assume that private sector wage growth in the region grows in line with the productivity assumption.
- We also assume that household income gained from other sources (estimated to be around 5%) also grows in line with private sector earnings growth.
- We combine these assumptions to develop an overall weighted estimate for real household earnings growth by ENWL LA for each year; the forecasts are unique for each LA given that they each have different rates of public sector employment.

Overall our baseline income forecasts estimate that real income will grow at an average rate of 0.7% per annum to the period 2016/17 and then by around 1.9% in the following years.

Figure D.14: Baseline real household growth forecasts[31]



[31] CEPA Analysis