

Assessing the impacts of economic growth on consumption and the environment

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Executive Summary

This study assesses the environmental impact of economic growth in the North East of England. It sets out to answer the question: if the North East region were to be successful in meeting its economic objectives what consequences would this have for the environment? It addresses this question from the perspective of consumption: that is, what impacts arise through the products and services either purchased directly by people living in the North East or purchased on their behalf by government institutions.

Each product or service that is purchased has its own environmental impact embedded within it. Within this study, these environmental impacts are measured primarily in terms of greenhouse gas emissions and the term **consumer emissions** is used to describe these emissions (see box). The focus on consumer emissions distinguishes this report from the *Greenhouse Gas Emissions Baselines and Trajectories Study* carried out by AEA in 2008. The AEA study provides a comprehensive overview of greenhouse gas emissions generated by activities occurring within the North East of England (**producer emissions**). Producer emissions do not take into account emissions generated elsewhere by imports into the North East.

The two approaches serve different purposes, have different applications and complement each other. Producer emissions help pinpoint greenhouse gases produced by the North East economy. Consumer emissions show the extent to which the North East's consumption behaviour is a driver of greenhouse gas emissions: emissions which may occur both in the North East and elsewhere.

To answer its central question the study sets out three economic scenarios covering a 20 year period from 2006 to 2026. The economic scenarios are based on different assumptions about levels of economic growth, measured by the annual rate of growth in regional GVA. Higher rates of economic growth are reflected in higher levels of household income. In turn, this translates

Consumer Emissions

In a physical product, the embedded environmental impacts arise as a result of: extraction of the raw materials used in making the product; energy used in manufacturing at various stages from raw materials through part-finished goods to final product; and, energy used to transport the product and its components across the supply chain to the point of final use. For services, the impacts are perhaps less obvious but even an intangible product such as an insurance policy has embedded environmental impacts which include a share of the energy and materials utilized by the organization issuing the policy.

Within the study, these environmental impacts are measured mainly through the greenhouse gas emissions released across the entire supply chain associated with each product/service that is consumed as final demand by households and government in the North East. The term **consumer emissions (CE)** is used to describe these emissions. Consumer emissions include the emissions generated in other countries for the production of goods and services imported into the North East but exclude emissions from production in the North East that is exported to other parts of the UK and abroad.

into higher levels of spending by households which changes the mix and quantities of products and services purchased in the North East. It is these changes to spending patterns that lead to different levels of environmental impact arising in each economic scenario.

The use of scenarios allows understanding of how different levels of economic growth result in different levels of environmental impact. The three scenarios used within the study are

- *Scenario 1*: regional GVA grows at its past trend level
- *Scenario 2*: regional GVA grows at the past trend level of UK GVA growth
- *Scenario 3*: regional GVA grows at a rate to meet the ‘silver target’ set out in the Regional Economic Strategy.

The rate of economic growth is lowest in Scenario 1 and highest in Scenario 3.

An important feature of this study has been the use of geodemographic profiles to understand the spending patterns of different groups within the population and how these patterns change under each of the scenarios. This feature has been based on a proprietary product: the MOSAIC suite of products from Experian. This allows the spending patterns of 11 different groups within the population to be identified in each scenario and their associated environmental impacts to be assessed. Further, for any specific product or service, this analysis provides an understanding, of which particular groups are mainly involved in its purchase. This knowledge will have clear value in the development of policies aimed at reducing the environmental impacts of consumption by influencing consumer behaviour.

Finally, the study has considered the extent to which technology plays a role in mitigating consumer emissions. On a £ spent basis, the consumer emissions of many products and services have been on a declining trend. These decreases are generally the result of technological improvements. For each economic scenario, two technological cases have been considered. In the first case, past trends in technological improvement are assumed to continue. Products and services which have been on a declining trend of consumer emissions per £ spent continue these trends into the future. In the second case, levels of consumer emissions are assumed not to continue on a declining trend. Instead, the rate of consumer emissions for each product and service is held constant into the future at its 2006 level. By comparing the results from the two cases, an indication is provided of the extent to which growth in consumer emissions from economic growth is mitigated by continuing technological improvements.

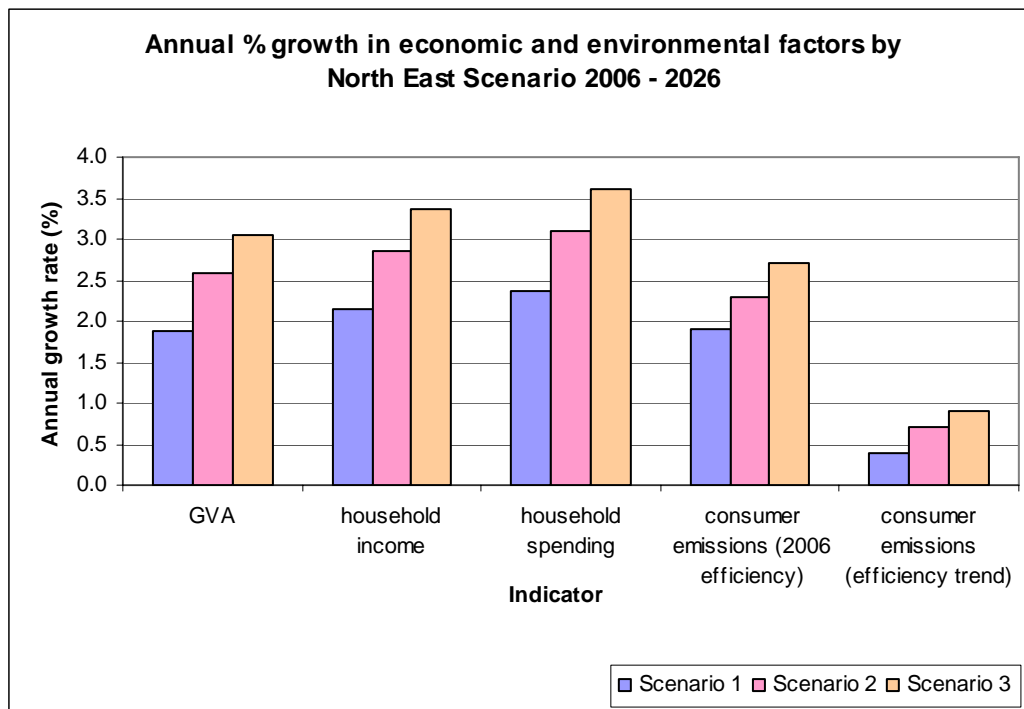
Key findings

The main findings of the study are summarized in graphical format in Figure 1, below. This figure shows the average annual percentage change at regional level for five different indicators over the 20 year period 2006 to 2026. The results are shown for each of the three different economic scenarios. The five indicators are:

- GVA growth – this is the indicator which underpins each scenario: GVA growth is the assumed value on which each economic scenario is built
- Household income
- Household spending
- Consumer emissions (2006 efficiency) – the average growth in total consumer emissions under the assumption that the rate of consumer emissions per £ spent is held at 2006 levels for each product/service
- Consumer emissions (efficiency trend) – the average growth in total consumer emissions under the assumption that the rate of consumer emissions per £ spent continues along past trends for each product/service

Household income, spending and consumer emissions are all related to economic growth.

Increased rates of economic growth cause increased rates of growth in each of these indicators.



Specific observations emerging from the study are detailed below.

- Continuing patterns of historical economic growth in the North East will be matched by continuing growth in consumer emissions. If the North East maintains its economic position relative to the UK average (as in Scenario 1), total consumer emissions are set to increase by around 9% over 20 years (an annual average rate of 0.4% pa).
- Higher levels of economic growth will need to be accompanied by measures to mitigate higher levels of consumer emissions. If the performance of the North East economy matches UK GVA growth from 2006 onwards (Scenario 2) or meets the 'silver target' set out in the Regional Economic Strategy (Scenario 3) then the corresponding estimates of consumer emissions increase between 2006 and 2026 are 15% and 19%, respectively.
- Continued improvements in the technological efficiency with which products are produced globally and consumed in the North East will not bring about actual reductions in consumer emissions over time. If the efficiency of products does not continue to improve at historical rates then, depending on the scenario chosen, consumer emissions would grow by between 40% and 55% between 2006 and 2026.
- If trends through the 1990s continue then imports to the UK will account for the supply of over a quarter of all goods and services consumed in the North East by 2026. As a consequence the proportion of consumer emissions associated with imports could rise to 49% in 2026 from a base of 31% in 2006.
- Under the highest rate of economic growth the North East's annual per capita consumer emissions will grow from 15 tonnes pa to over 17 tonnes pa by 2026. This matches levels of consumer emissions found in the South East of England, which has the highest per capita emissions in the UK today. In the absence of continuing technological improvements the average per capita emissions of a North East resident could grow to almost 23 tonnes pa in 2026.
- Consumer emissions from households in the North East are dominated by expenditure on housing, fuel and power and transport¹. In 2006 these account for 27% of household expenditure and 53% of household consumer emissions. Increases in consumer emissions from transport mean that this proportion rises to 64% by 2026 in the highest economic growth scenarios.

¹ Housing and transport are 2 of the 11 aggregated household activities used in this report to group expenditure and consumer emissions from households. For a full description of each see appendix A

- The geodemographic profile of North East households differs considerably from that for the UK. The North East has around half the UK proportion of households belonging to **Mosaic** group A (**Symbols of Success**) but nearly 3 times the UK's proportion of group G (**Municipal Dependency**)². In consequence, the consumer emissions profile of the North East, the proportion of total consumer emissions attributable to different groups within the population, is markedly different to that for the UK as a whole.
- Mosaic groups which account for the largest proportion of total consumer emissions have relatively low consumer emissions on a per household basis. Group G (**Municipal Dependency**), account for 18% of total consumer emissions but have the 3rd lowest emissions on a per household basis of the 11 Mosaic groups. See Figure 2 for a summary of North East consumer emissions in 2006 on a per household basis by MOSAIC group.

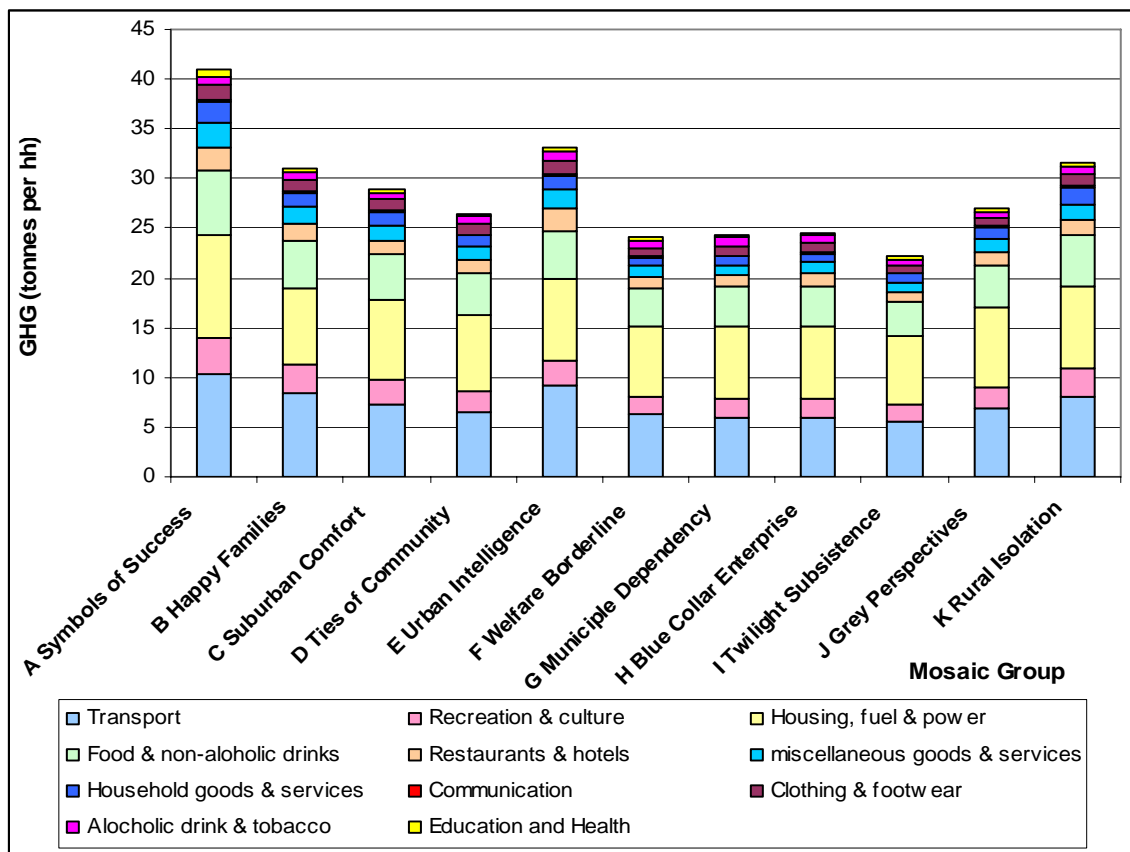


Figure 2: Annual consumer emissions per Mosaic household in the North East for 2006

² The list of 11 MOSAIC Groups used in this study along with thumbnail descriptions characterizing each group is contained in Appendix B.

By bringing the evidence of this study together, it is possible to inform policy designed to mitigate climate change and tackle consumer emissions. Further opportunities to improve the evidence base lie in understanding differences in attitudes towards and understanding of climate change across the Mosaic groups. Combining this with evidence on the nature and condition of local infrastructure (public transport, housing conditions), should provide the information needed to help underpin the development of a low carbon and sustainable economy. A sustainable economy is one in which economic progress ‘can be sustained and is within environmental limits but also enhances the environment and social welfare and avoids greater extremes in cycles³’

If we are concerned about our great appetite for materials, it is plausible to seek to increase the supply, to decrease waste, to make better use of the stocks that are available, and to develop substitutes. But what of the appetite itself? Surely this is the ultimate source of the problem. If it continues its geometric course, will it not one day have to be restrained? Yet in the literature of the resource problem this is the forbidden question.

John Kenneth Galbraith, 1958⁴

³ See Objective 1 ‘Strengthening the North East Economy’ in the Integrated Regional Framework for the North East. Available at: <http://www.goneweb.co.uk/sustaine/documents/irf.pdf>

⁴ Quotation taken from Alcott, B. 2008. The sufficiency Strategy: would rich world frugality lower environmental impact? Ecological Economics 64. pp 770-786

1. Introduction

In 2008 Defra published a report prepared by the Stockholm Environment Institute and the University of Sydney which showed that total UK consumer emissions, measured in greenhouse gases increased by 13% between 1992 and 2004⁵. In 2004 the UK's consumer emissions stood at 974Mt CO_{2e}⁶, these were higher than the UK's producer emissions. These trends were reflected at the regional level, with each of the English regions experiencing growth in total consumer emissions over the same period. In the North East total consumer emissions grew by 5% to 38Mt between 1992 and 2004.

On a per capita basis consumer emissions in the North East grew at a below average rate for the UK. Figure 3 provides a comparison of consumer emissions per capita and growth in consumer emissions per capita between 1992 and 2004. The North East's emissions grew by 2 tonnes per capita between 1992 and 2004, but still stand at a considerably lower level (15t/cap), than those of any other region in the UK with the exception of Northern Ireland.

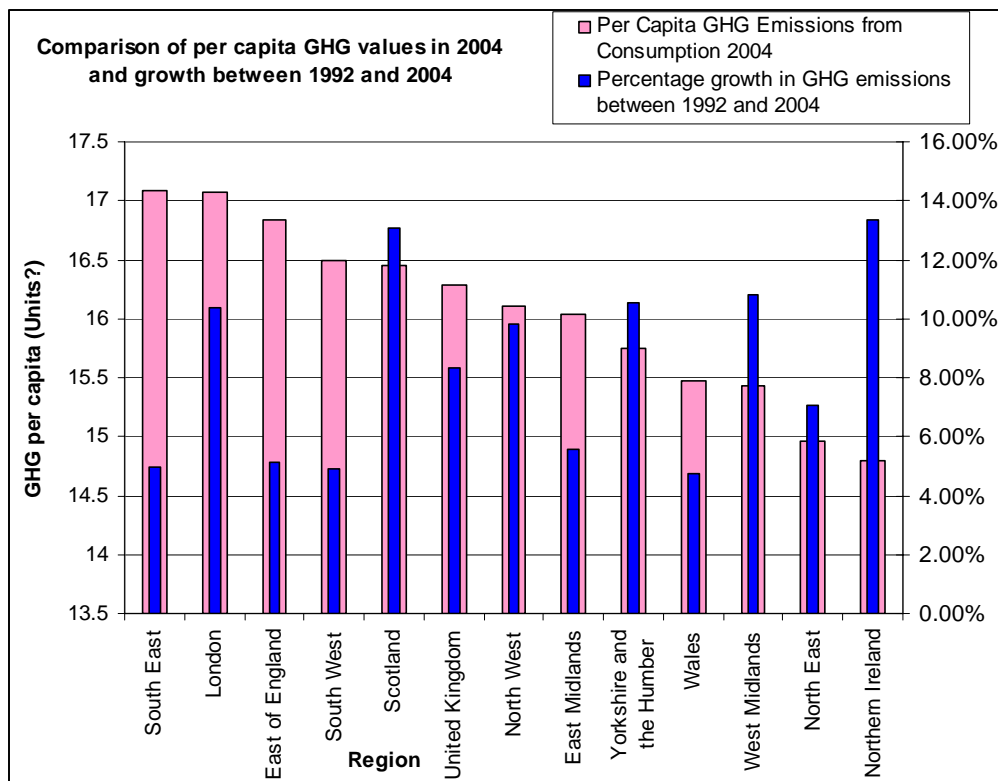


Figure 3: Per capita consumer emissions in 2004 and growth in consumer emissions between 1992 & 2004

⁵ Wiedmann, T. Wood, R. Lenzen, M. Minx, J. Guan, D. and Barrett, J. 2008. Development of an embedded Carbon emissions indicator – Producing a time series of Input-output Tables and Embedded Carbon Dioxide Emissions for the UK by Using a MRIO Data Optimisation System. Report to the UK Department for Environment, Food and Rural Affairs by Stockholm Environment Institute at the University of York and Centre for Integrated Sustainability Analysis at the University of Sydney. Defra, London. UK

⁶ Million tonnes of greenhouse gases measured in carbon dioxide equivalent

The below average rates of growth in consumer emissions in the North East between 1992 and 2004 appear to mirror its economic performance through the 1990s. More recently the North East has enjoyed positive rates of economic growth, these in turn have had positive impacts on incomes and consumer spending in the North East. This leads to questions about the future relationship between economic growth and global environmental impacts. Namely, can continued economic growth in the North East be decoupled from growth in global environmental impacts?

To answer this question this study sets out to provide an entirely new component to the North East's evidence base. Using a range of models it quantifies the relationship firstly between economic growth and household consumption and secondly between household consumption and the global environment. In doing so it provides three scenarios for the North East for the period 2006 to 2026 which:

- Link rates of economic growth to household level changes in employment, income and expenditure at a local authority and regional level.
- Project changes in the make-up of the North East population by 11 Mosaic geodemographic groups as well as changes in 11 categories of household expenditure for each Mosaic group.
- Project changes in consumer emissions per pound spent for product groups purchased by North East households.
- Compare growth rates for GVA and total consumer emissions for the North East economy
- Establish consumer emissions profiles for households classified under each Mosaic group broken down by 11 categories of household expenditure
- Identify Mosaic groups which account for the highest proportion of consumer emissions from households on a total and per household basis

This report provides selected results only, full data sets in spreadsheet format are held by the North East Regional Information Partnership. These include additional results which measure the environmental impacts in terms of carbon dioxide emissions and the ecological footprint. The full data sets provide information for more detailed spending categories and at a local authority level.

The report is structured to provide a brief overview of the study approach (chapter 2), followed by a summary of the economic, demographic and efficiency factors which contribute to changes in the North East's global environmental impact (chapter 3). Chapters 4, 5 and 6 document the resulting changes in consumer emissions in the North East together with ideas for future development of the evidence base. This report is accompanied by a technical report which sets out the study methodology in detail.

2. Study approach

2.1 Rationale

It is generally accepted that economic growth and household consumption are closely linked. Robust rates of economic expansion generate income growth and provide individuals with greater consumption opportunities through increased means (higher incomes) and greater choice (increased production). If economic growth flows through to increases in consumption without changes in the structure or efficiency of the economy this results in an increase of pressures on the environment.

Consumption exerts pressures on the environment through the quantity of resources used and through the toxicity of resources used in relation to a consumed product or service. Resource use can take the form of the use of energy, land, raw materials or biodiversity. Toxicity may be translated into water, soil and air pollution.

Pressures may occur at every stage of the life cycle of a product, from raw material acquisition through to production, use and disposal⁷. The global nature of supply chains means that consumption activities may be associated with dispersed pressures, which themselves may affect a wide range of ecosystems.

For these reasons it is important to consider how full supply chain impacts can be taken into account incorporating trade and global supply chains and a range of environmental themes. This is why the study uses the consumer emissions indicator. Consumer emissions can be used to attribute all supply chain emissions to households (consumers) instead of to factories (producers). This is in accordance with the statement attributed to Adam Smith that ‘consumption is the sole end and purpose of all production’⁸.

The study uses Greenhouse gases as a measure of consumer emissions and in doing so places a focus on climate change. Although there are many other environmental pressures associated with household consumption, most are not measurable in a consistent fashion or at the level of detail required for this study⁹. Some evidence also suggests that the delivery of optimum measures to tackle consumer emissions also reduce a wide range of other environmental pressures¹⁰.

⁷ For a good overview see Hendrickson, C. Lester, L. Matthews, H. 2006. Environmental Life Cycle Assessment of Goods and Services – an input-output approach. Resources for the Future. USA.

⁸ Quotation taken from Dey, C. Et al. 2007. Household environmental pressure from consumption: an Australian environmental atlas. Sydney University Press.

⁹ Read the accompanying technical report for further discussion on this

¹⁰ Nansai, K. Inaba, R. Kagawa, S. Moriguchi, Y. 2008. Identifying common features among household consumption patterns optimized to minimise specific environmental burdens. Journal of Cleaner Production. 16. pp538 - 548

2.2 Methodological framework

In 1971 Ehrlich and Holdren explained how the Environmental Impacts (I) of a given population can be influenced by three major determinants: Population (P), Affluence (A) and Technology (T). Population refers to population size, Affluence to wealth or income and Technology to industrial efficiency. The resulting formula is commonly referred to as IPAT and forms the basis of many debates on human interaction with the environment¹¹:

$$\text{Environmental Impact} = \text{Population} * \text{Affluence} * \text{Technology}$$

This formula is the basis for the study methodology; consumer emissions (CE) are determined by the the size of the North East Population (P), the level of North East Consumption activities (C) and the Efficiency in which goods and services are consumed (E). Figure 4 shows the economic, social and technological factors that are explicitly modelled in this study. Changes in Population and Consumption are directly linked to economic growth projections produced using an economic projections model. Changes in Efficiency are modeled separately based on changes in the structure of the national economy and trade with the rest of the world. An increase in Consumer emissions may be a result of a change in any one of these three proximate variables (Population, Consumption and Efficiency).

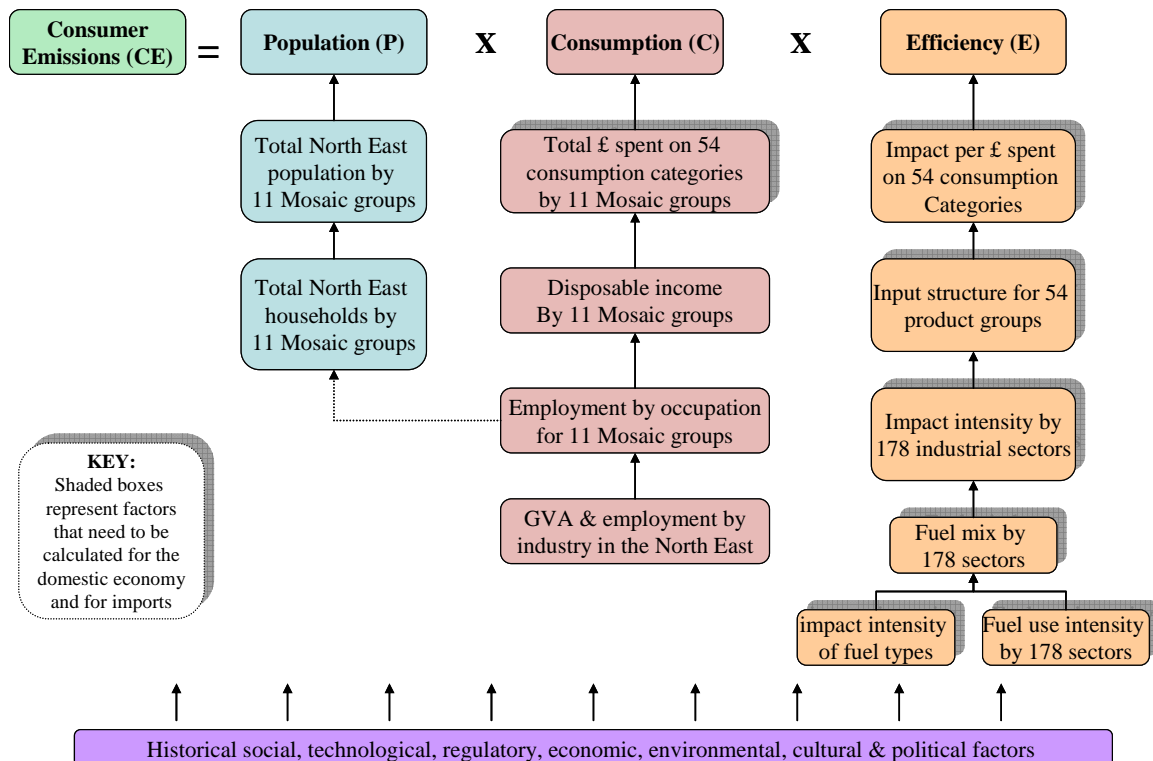


Figure 4: IPAT based methodological framework

¹¹ Wikipedia provides a basic introduction to the concept: http://en.wikipedia.org/wiki/I_PAT

Efficiency measures the consumer emissions per pound spent on a product. The consumer emissions per pound spent on a product may improve over time due to production efficiency or due to government interventions or changes in consumption behaviour. As an example; the impact per pound spent of travel declines when fuel duty is imposed because it is costing car drivers more to emit the same level of pollutants. Similarly, changes in the mode of transport used by a household or the efficiency of car used may increase or decrease the impact per pound spent of travel.

The Consumption component of the model assumes that robust rates of economic expansion generate income growth and provide individuals with greater consumption opportunities through increased means (higher incomes) and greater choice (increased production). Much of the seminal literature on this topic supports this observation although there is debate as to the extent to which a change in income is reflected in a change in consumption. A key concept in this regard is that of income elasticity which measures the percent change in consumption generated by a one percent change in income. An income elasticity of 0.8 suggests that if income increased by 1%, consumption would rise by 0.8%. This is a useful measure in gauging the sensitivity of consumption to income and the technical report sets out in detail how income elasticity is modelled across consumption categories and Mosaic groups.

Some market factors cannot be easily addressed in the model. We do not know at what level different consumption activities will reach saturation point although the potential for saturation is clear. There is a limit to the temperature people will heat their homes or the time they want to spend driving but larger housing stock and better roads may encourage further consumption of energy and fuel. Similarly new products may be introduced which change patterns of household spending¹².

All components of the model draw to some extent on historical trends. This means that factors which are not explicitly modeled are to some extent implicitly accounted for as underlying trends. So although future government interventions are not explicitly modeled, the scenarios presume that historical conditions, including the impact of government policy, continue.

¹² These factors are discussed in Agnolucci, P et al. 2009. Different scenarios for achieving radical reduction in carbon emissions: a decomposition analysis. *Ecological Economics*, 68 (6). pp. 1652-166

2.3 Work plan

The linkages between the various analytical components required within this study are set out in Figure 5 and explained in depth in the accompanying technical report. The work plan followed the following distinct stages:

- The first stage established output growth trends for the North East and its constituent districts under three selected scenarios.
- The second stage derived employment, household income and household spending growth patterns consistent with each of these the scenarios.
- The third stage translated this economic information into consumption spending patterns on products and services by consumer group.
- The final stage assessed the implied environmental impact of changes in spending patterns.

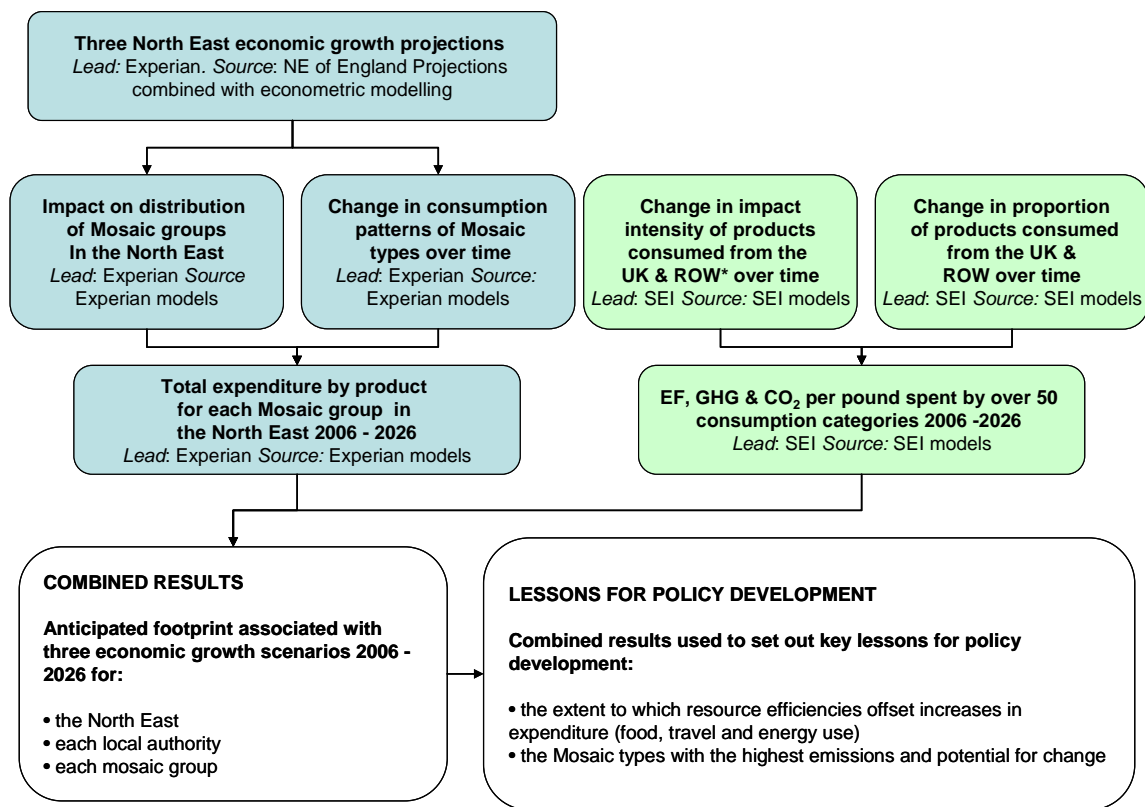


Figure 5: Study work plan

These stages bring together Experian’s economic modeling and Mosaic geo-demographic profiling (blue shaded elements in Figure 5), with the Stockholm Environment Institute’s environmentally extended input-output analysis (green shaded elements). Experian have models which assess the current position and future prospects of local, national and global economies in

terms of employment and skills, demographics, output, consumer spending and housing. Experian also have profiles of household expenditure by Mosaic type have been created for all small areas in the UK using the Office of National Statistics Expenditure and Food Survey and proprietary Experian datasets, including the MORI financial services survey. By combining economic scenarios with the Mosaic classification Experian were able to project changes in the distribution and consumption of Mosaic population segments in the North East and for each of the North East local authorities over time.

The environmental impacts attributed to the Mosaic household expenditure profiles were generated based on a macroeconomic technique called input-output analysis. Input-output analysis was developed in the late 1930s by Nobel prize winning economist Wassily Leontief to capture all the complex interactions of an economy. It has been applied to national data on resource use and pollution in a number of countries in recent years including Australia, Japan, Sweden the USA and Spain¹³.

The input-output model employed in this study uses a combination of national statistics that describe how the UK economy works and interacts with the rest of the world. Two sets of greenhouse gas coefficients¹⁴ are assigned to industrial sectors¹⁵, one for industries in the UK, the other for industries which produce UK imports.

This methodology takes complete account of the UK's economic interactions with the rest of the world at an aggregated product level. Products provide a link between industrial sectors and households. Products (meat, clothing, tobacco), are the output produced by a combination of industrial sectors (agriculture, retail etc). By understanding the contribution of industrial sectors to fifty plus products it is possible to estimate the full supply chain impact associated with each product. The next step is to measure expenditure on product groups by households and government. This makes it possible to allocate supply chain impacts to what households buy and use.

On a £ spent basis, efficiency factors have generally reduced the environmental impacts of product consumed. Therefore, the environmental impact of household expenditure in each of the three economic scenarios has been compared using two projections of technological change. Under a continuing trends scenario historical changes in the environmental impact of products consumed in the UK from 1992 to 2004 are continued up to 2026. Under a stability scenario, no further technological improvements are assumed and the environmental impact (per £ spent) of products is held at 2006 levels. This provides an insight into to the extent to which Efficiency factors (E) outweigh Population (P) and Consumption (C) factors for the North East.

¹³ See for example: Wiedmann, T., Lenzen, M., Turner, K., and Barrett, J., 2007. Examining the Global Environmental Impact of Regional Consumption Activities - Part 2: Review of input-output models for the assessment of environmental impacts embodied in trade. *Ecological Economics*, 61(1):15-26

¹⁴ greenhouse gases produced per unit of sector output

¹⁵ In this case the coefficients describe the units of environmental impact generated by each unit of economic output

3. The North East Economy: trends & forecasts

The purpose of this chapter is to set out three economic scenarios for the North East in detail with a focus on illustrating the projected relationship between economic growth, population, income and expenditure by area and by Mosaic group. This chapter will also document the role of efficiency factors in changing the impact per pound spent of consumption over time.

3.1 Economic trends in the North East

Despite strong growth in 2004-06, economic performance in the North East has lagged behind the UK average over the last decade. When the region's performance is compared with national performance over a longer historical period, markedly lower levels of GVA growth are evident. Gross Value Added (GVA) in the North East increased by 2.5% per annum in 1996-2006 while the national growth rate exceeded 3.5% per annum. The fastest growing sector in the region was Financial & Business Services. Nonetheless, the industrial structure of the North East has affected the region's capacity to attain high growth rates. Public Services account for the largest share of the region's activity (26%), higher than the UK average. Financial & Business Services has the second largest share (20%), albeit much smaller than for the UK as a whole. Distribution, Hotels & Catering and Construction generate about 15% and 7% of GVA respectively, while manufacturing accounts for 19%. Despite the emergence of business services in the region, there is a relative dearth of high-value added services. The region's relatively disadvantageous skills mix also dampen growth potential.

The employment rate in the North East is low and the unemployment rate markedly higher than the UK average. Participation rates are lower and dependency rates higher than the national average. Moreover, the region clearly underperforms the UK in terms of qualifications. Employment growth in the North East over 1996-2006 (at 1% per annum) slightly underperformed the UK rate (of 1.2% per annum) although the period 2001-06 saw much improved growth of 2% per annum. Construction and Financial and Business Services saw the strongest rates of job creation in this period.

Demographic trends have also remained weak in the region which has found it difficult to attract and retain younger, skilled workers. The region has historically suffered a net outflow of workers as the region's relatively high unemployment rate and proximity to high-growth urban centres in other regions continues to attract workers. The region's population has seen a small decline in its total population (a loss of about 20,000 people) over 1996-2006, in contrast to the strong increase seen nationally.

The fastest growing districts in the region were Darlington, the former district of Easington, North Tyneside and Durham while the former district of Sedgfield and South Tyneside showed the weakest performance over the last decade.

3.2 Three economic scenarios for the North East

To evaluate the impact of economic growth in the North East over the forecast period, three alternative growth scenarios were developed relative to the historical trend:

1. The first scenario assumes that the North East follows historical growth patterns and maintains its relative position to the national average.
2. The second scenario assumes that GVA growth in the North East matches UK GVA growth after 2006.
3. The third scenario assumes that the North East successfully meets the 'silver target' as set out in its RES.

The first scenario was based entirely on Experian's Regional Planning Service regional and local area forecasts finalised in October 2008. While this set of forecasts does not take into account the full extent of the economic downturn that set in across the UK regions in summer 2008, the longer term performance of the regions between the October 2008 vintage used and Experian's latest forecast release is fairly consistent, and so using this earlier set of forecasts would not affect the findings and implications of this study of the longer term. Under this scenario, GVA growth in the North East is 1.4% per annum over 2006-16 and 2.1% per annum over 2016-2026.

The second scenario assumed that after 2006 the North East follows the same rate of output growth as the UK according to the October 2008 release and it is, as such, consistent with the first scenario. Under this scenario, GVA growth in the North East is 1.9% per annum over 2006-16 and 2.8% per annum over 2016-2026. This is an improved performance compared to the first scenario.

The third scenario assumes that the North East reaches 90% of the UK average GVA per head by 2016, and then maintains this share in the longer term. To achieve this target, it was calculated that GVA in the North East needed to increase by 3.0% per annum over 2006-16 and 2.4% per annum over 2016-2026. This is the most optimistic of all three scenarios, generating an additional £7.8bn GVA in the region by 2026.

The GVA projections for the North East under each scenario are shown in figure 6. Forecasts for GVA, employment, population and household incomes were produced under all three scenarios for the local authorities in the North East for the period 2006-2026.

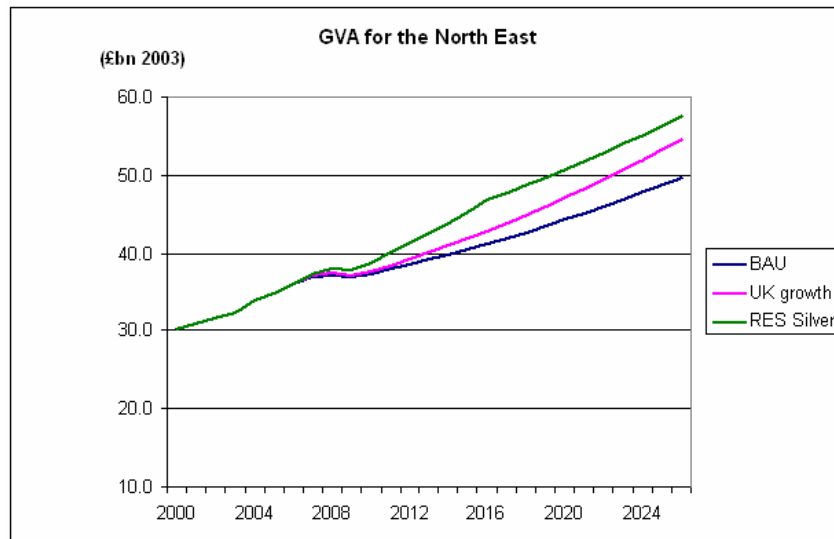


Figure 6: Historical trends and future scenarios for GVA in the North East

GVA growth in the region is driven by two sources in all three scenarios: an increase in productivity and an increase in employment (either through higher participation or via an increase in population). These assumptions of the drivers of growth, along with the GVA growth targets mentioned earlier, were run through Experian’s economic model of the North East (described in detail in the technical report) to derive a set of output, employment, demographic and household forecasts for the three scenarios that are fully consistent with the wider economic assumptions.

The favourable demographic assumptions in the three scenarios will result in additional employment in the region boosting GVA growth. Participation rates are forecast to remain static at 74% between 2006 and 2026 in the first scenario. However, in the second and third scenarios the rates accelerate to 76% and 77% respectively. Nonetheless, the participation rate will remain below the assumed UK rate of 82% in 2026 in all three scenarios.

From 2016 onwards higher economic growth rates are associated with higher population growth rates. In the first scenario, which assumes that historical trends will persist, population in the region is forecast to rise by 85,000 between 2006 and 2016 and by 72,000 between 2016 and 2026. The second scenario, which assumes that output growth in the North East will equal UK output growth after 2006, sees population in the region rise by 175,000 between 2006 and 2026. The third, most optimistic, scenario based on RES targets sees the strongest rise in population in all the three scenarios. Population will rise by 85,000 between 2006 and 2016 and by almost 100,000 between 2016 and 2026. Total population, which stood at 2.56m in the North East in 2006, is forecast to reach 2.71m, 2.73m and 2.74m by 2026 under the first, second and third scenarios respectively.

In addition to an increase in population and participation rates, the three scenarios also entail an increase in productivity and a decline in the dependency ratio (proxied by the share of non working-age population in total population). Productivity (defined as GVA per unit of full-time

equivalent employment) is forecast to rise from 30.8 in 2006 to 43.5 in 2026 in the first scenario. In the second and third scenarios, however, productivity increases to 45.6 and 46.6 respectively. Again, even under the most positive scenario, productivity remains below the national average in 2026 (49.4). This translates into employment rates of 74%, 76% and 77% by 2026 in the first, second and third scenarios respectively.

Household income is forecast to increase from £28.2bn in 2006 to £40.3bn in 2026 in the first scenario. The two more optimistic scenarios see household incomes rise to £44.3bn and £47.1bn in the region. The most prosperous districts in the region in all three scenarios will be Newcastle, North Tyneside, Gateshead and Sunderland. In contrast, the former districts of Berwick-upon-Tweed, Alnwick and Teesdale will remain the least prosperous

Improved economic growth prospects in the scenarios benefit households in the form of generally higher disposable incomes as shown in Figure 4. The strongest increase in incomes is seen in the third scenario in which the North East is assumed to meet the RES Silver target. In contrast, the weakest increase is observed in the first scenario under which the region continues to lag national indicators in line with long-term historical trends, with long-term growth potential relatively weak.

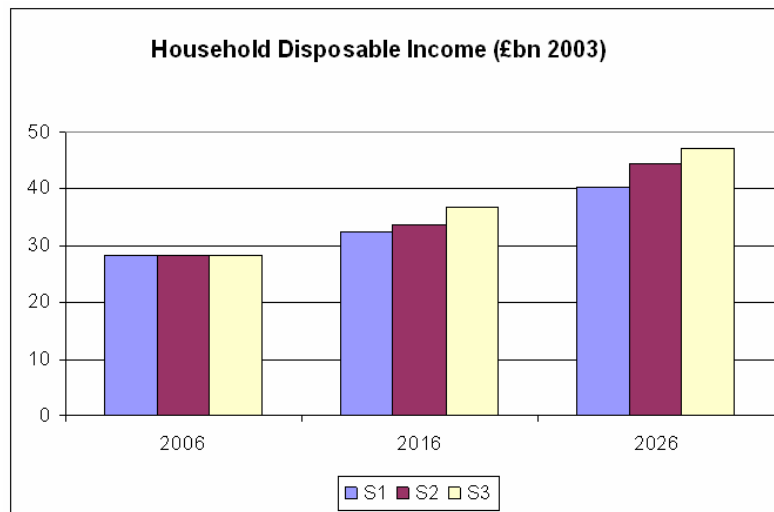


Figure 7: Household disposable income in the North East by economic scenario

3.4 Changes in the demographic composition of the North East

Regional agencies collect in depth information on the demographic structure, economic activity levels, earnings, skills education and health of the North East population. Particular challenges that the region faces include levels of economic inactivity which are higher than the UK average and a population ageing at a greater rate than all other UK regions except the South West of England. This is reflected in Experian’s Mosaic segmentation of the North East.

Figure 8 shows the socio-economic make up of the North East and the UK split into 11 Mosaic groups¹⁶. In comparison to the UK the North East of England is more clearly dominated by two Mosaic groups; Municipal Dependency (G) and Ties of Community (D) make up 40% of the North East population between them. In the UK as a whole they account for 22% of households with the biggest difference accounted for by households classified as Municipal Dependency.

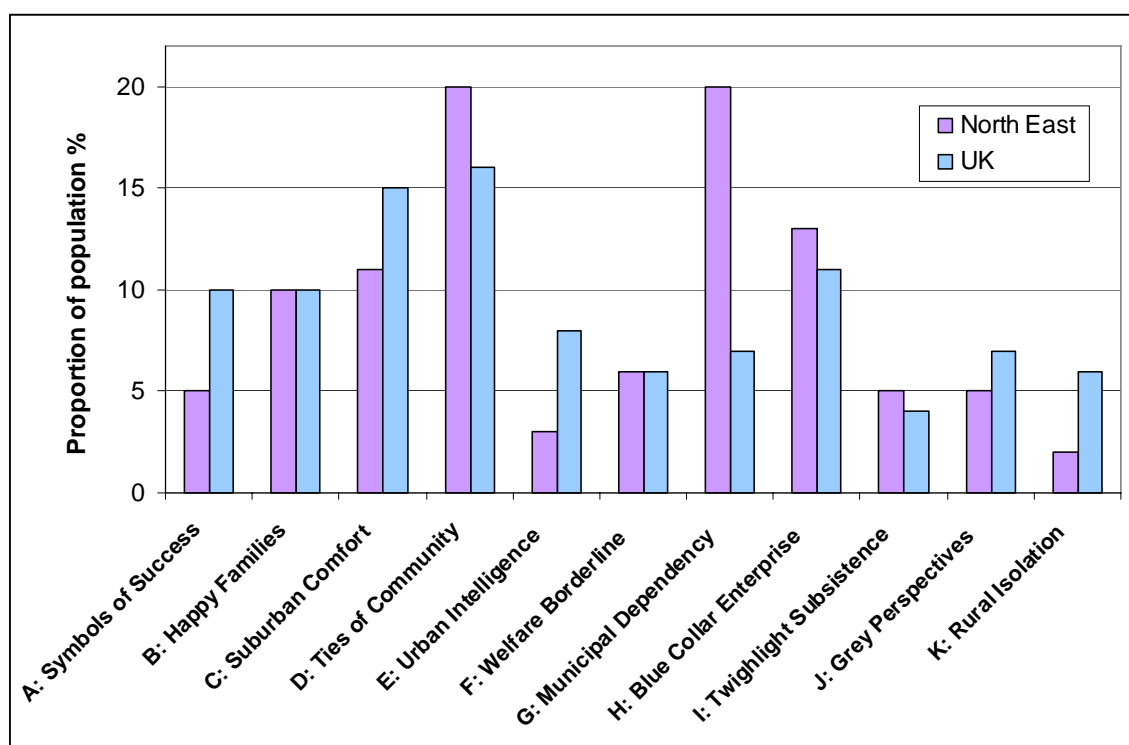


Figure 8 – Mosaic Group composition of the North East and the UK

Municipal Dependency (G) are characterised as a group for which balancing the budget is much more important than long-term financial planning. They lack the funds to buy their own homes and are reliant on local authority housing which is typically far from city centres. The main problem they face is poor accessibility, with many services and facilities beyond walking distance they are often reliant on buses for mobility. These factors come together restrict the choices

¹⁶ For a description of the Mosaic UK classification, including a profile for each Mosaic Group see the accompanying technical report and Appendix B

households in this group can make¹⁷.

Ties of Community (D) is a group comprised of people whose lives are mostly played out within the confines of close knit communities. Living mostly in older houses in inner city neighborhoods or in small industrial towns, most of these people own their own homes, drive their own cars and hold down jobs. Community norms rather than individual material ambitions shape the pattern of most residents' consumption¹⁸.

Other Mosaic groups appear in much smaller proportions in the North East compared to the UK as a whole. The difference is particularly marked for households classed as Urban Intelligence (E) and Symbols of Success (A), groups which are characterised as markers of economically successful areas. Symbols of success are people with rewarding careers who live in sought after locations, affording luxuries and premium quality products. Urban Intelligence are people who are young, single and mostly well educated, they are cosmopolitan in tastes and liberal in attitude.

Appendix B maps the distribution of each Mosaic group by local authority for 2006. At a sub regional level the maps show Northumberland has higher proportions of groups A (symbols of success), J (Grey Perspectives) and K (rural isolation) than any other area. Ties of Community (D) make up the largest proportion of the population in Wear Valley, Derwentside, Darlington and Redcar and Cleveland. Urban Intelligence (E) are only found in any great numbers in Newcastle and North Tyneside. Municipal Dependency (G), make up the highest proportions of the population in Sunderland, Easington and South Tyneside.

The distribution of Mosaic groups at a local authority level helps to explain the distribution of consumer emissions across the North East but hides the fact that the within each local authority quite different socio-economic groups can dominate neighboring areas. Figure 9 provides an example the distribution of Ties of the Community by Super Output area. Together with Municipal Dependency this group makes up the largest proportion of the North East population. Their neighborhoods are often characterised by late 19th century housing which was originally within short walking difference of local factories. Today, this group has a younger than average population; many are married or cohabiting and bringing up young children¹⁹.

¹⁷ Description adapted directly from Experian's Mosaic UK consumer classification guide.

¹⁸ Description adapted directly from Experian's Mosaic UK consumer classification guide

¹⁹ Description adapted directly from Experian's Mosaic UK consumer classification guide.

SOAs with the highest proportion of Ties of the Community 2006

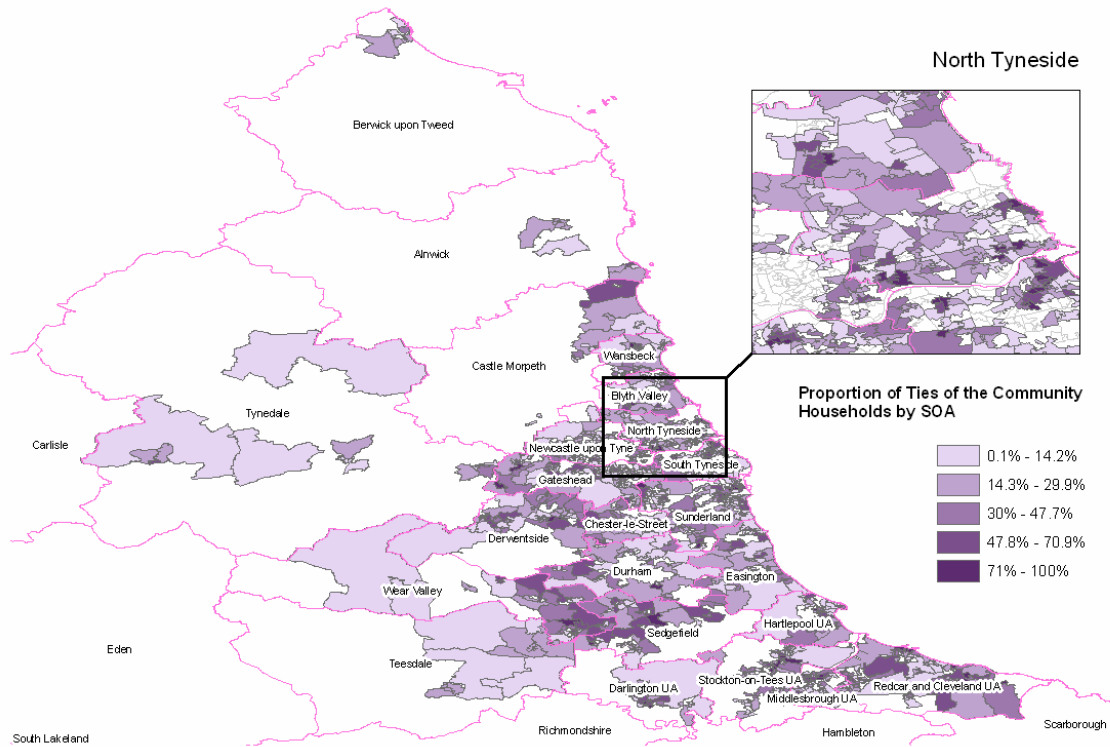


Figure 9: Proportion of Mosaic Group Ties of Community by Super Output Area. 2006²⁰

Figure 10 shows how each of the economic scenarios generated for the North East translate into changes in the number of households by Mosaic group. Growth rates across Mosaic groups are reasonably uniform in scenario 1 resulting in minor changes to the socio-economic composition of the North East by 2026.

The effect of the higher economic growth scenarios is to move the Mosaic composition of the North East in 2026 part way towards that found for the UK as a whole today. This reflects the fact that the scenarios 2 and 3 assume that by 2026 the region’s working-age population will be higher than that in the first scenario by 50,000 and 90,000 respectively.

The growth rates of individual Mosaic groups in Scenario 3 are particularly marked. The growth in households classified as Symbols of success (A) is three times as great in Scenario 3 as in Scenario 1 by 2026. Similarly the growth rate in households classified as Urban Intelligence (E) in Scenario 3 is almost double that displayed in Scenario 2 by 2026.

Although growth rates for groups A and E are high in Scenario 3 they start from a low baseline meaning that they still make up just 13% of the North East population by 2026. In comparison

²⁰ Note that Super Output areas are created so that each area has an equal population size, this means the larger the area, the lower the population density.

Mosaic groups G and D make up 31% of households by 2026 for the same Scenario (see table 1). This is less balanced than the distribution of groups shown for the UK today. Assuming no large-scale changes at a national level this indicates that the North East will continue to possess socio-economic characteristics that differentiate it from the rest of the UK even under the higher regional economic growth scenarios.

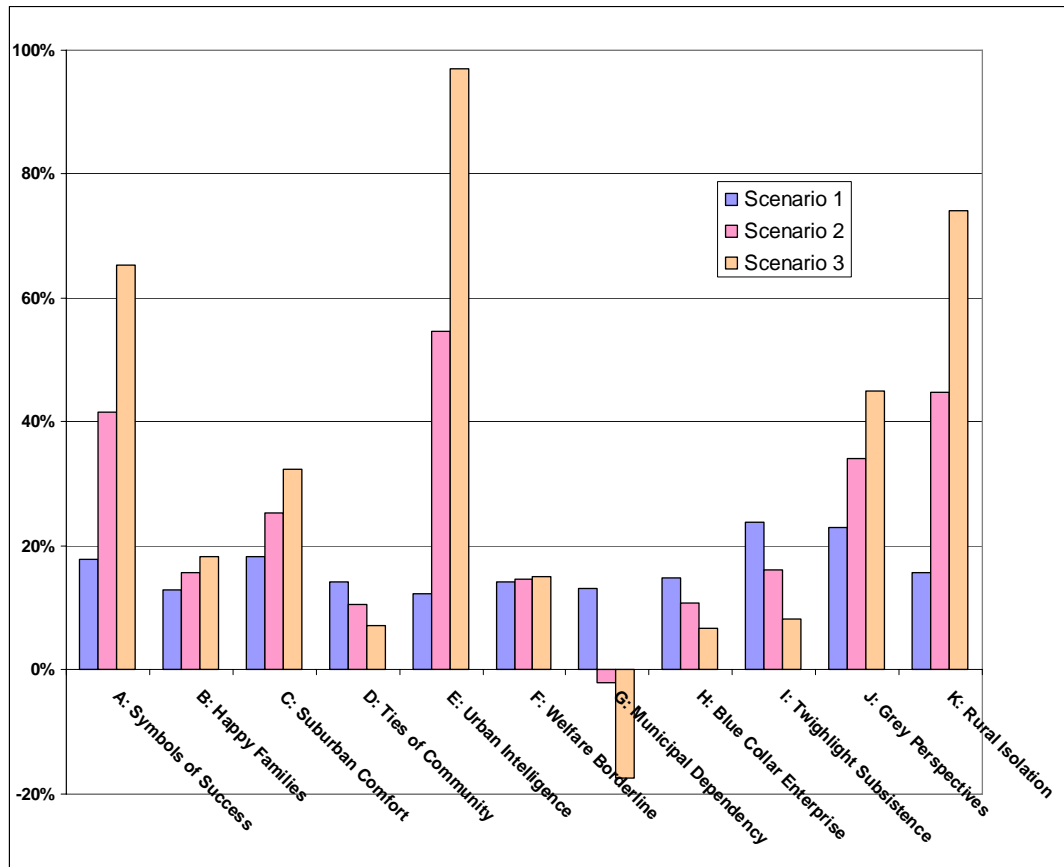


Figure 10: percentage change in Mosaic households in the North East by economic scenario 2006 – 2026

Mosaic Group ordered by size in 2006	Total households	Change in households 2006 - 2016			Change in households 2006 - 2026		
	2006	2016-1	2016-2	2016-3	2026-1	2026-2	2026-3
G: Municipal Dependency	219,163	15,814	1,829	-12,156	28,849	-4,625	-38,098
D: Ties of Community	215,650	17,529	14,341	11,152	30,669	23,037	15,405
H: Blue Collar Enterprise	142,922	11,876	9,419	6,963	21,379	15,499	9,619
C: Suburban Comfort	123,337	12,376	16,007	19,638	22,519	31,209	39,899
B: Happy Families	105,059	8,265	9,467	10,670	13,562	16,440	19,318
F: Welfare Borderline	70,886	5,299	5,427	5,554	10,136	10,441	10,745
J: Grey Perspectives	60,430	7,224	9,992	12,760	13,956	20,582	27,207
I: Twilight Subsistence	57,649	6,836	4,961	3,087	13,741	9,254	4,766
A: Symbols of Success	52,304	5,280	10,468	15,656	9,318	21,735	34,153
E: Urban Intelligence	30,316	2,552	7,914	13,275	3,727	16,559	29,392
K: Rural Isolation	26,390	2,416	5,643	8,871	4,129	11,854	19,579

Table 1: Actual change in Mosaic households in the North East by economic scenario 2006, 2016, 2026

3.5 Changes in household consumption in the North East

Expenditure patterns in the North East closely match those for the UK as a whole. Figure 11 shows that transport takes up the largest proportion of household expenditure followed by recreation and culture in 2006. Housing, fuel and power and food purchases account for just over 20% of expenditure.

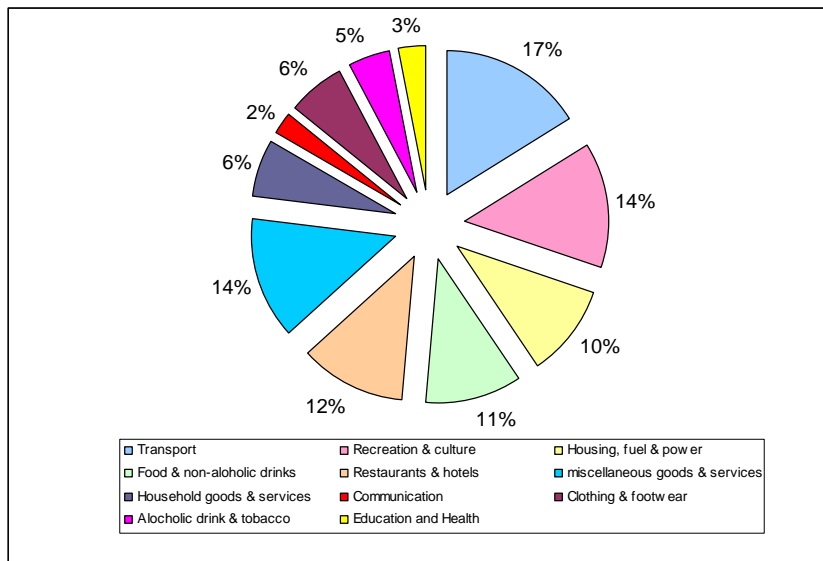


Figure 11: breakdown of total expenditure North East households in 2006²¹

As for any region, these average figures mask disparities in both the volume and patterns of expenditure displayed across Mosaic groups in the North East. Household expenditure in 69% of households is lower than the regional mean reflecting the large proportion of households classified as Municipal Dependency (G). Expenditure in this Mosaic segment is typically 50% lower than that displayed by Symbols of Success households (A), and 40% lower than the Urban Intelligence households (E).

Figure 12 shows annual household expenditure profiles by Mosaic group for 2006. Typically, food and housing, fuel and power take up a larger proportion of expenditure for lower income Mosaic groups; 25% for Welfare Borderline households (F), 23% for Municipal Dependency (G), compared to 18% for Happy Families households (B). Spending on transport as a proportion of total expenditure is more uniform and ranges from 19% for Happy Families (B) to 14% for Municipal Dependency (G). In real terms differences in expenditure are greater, Happy Families spend twice as much a year on transport than households classified as Municipal Dependency.

²¹ See Appendix A for a detailed description of each expenditure category

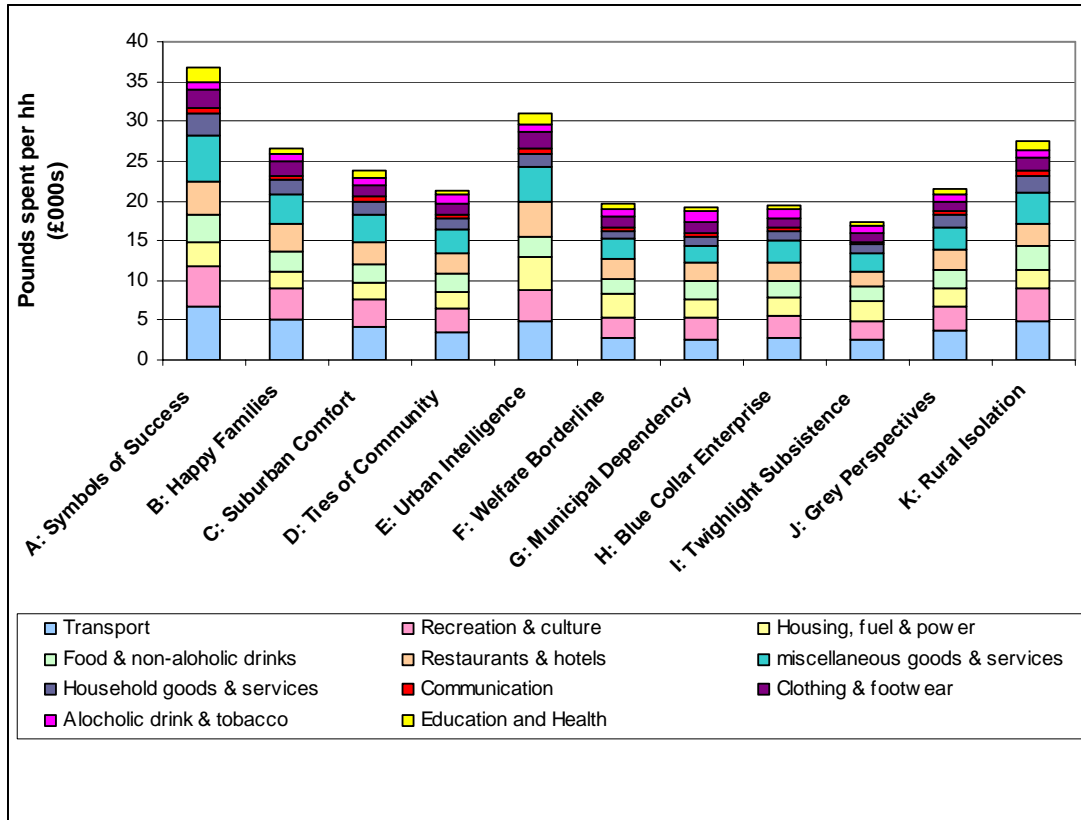


Figure 12: Annual expenditure by Mosaic household in the North East for 2006

Total household expenditure grows at a rate which is in line with or exceeds GVA and income growth in each of the economic scenarios for the North East. For the North East as a whole, total expenditure increases by between 2.4% a year in scenario 1 and 3.6% a year in scenario 3 between 2006 and 2026. Figure 13 shows that annual growth rates are higher for expenditure on energy use, restaurants and hotels and private education and health.

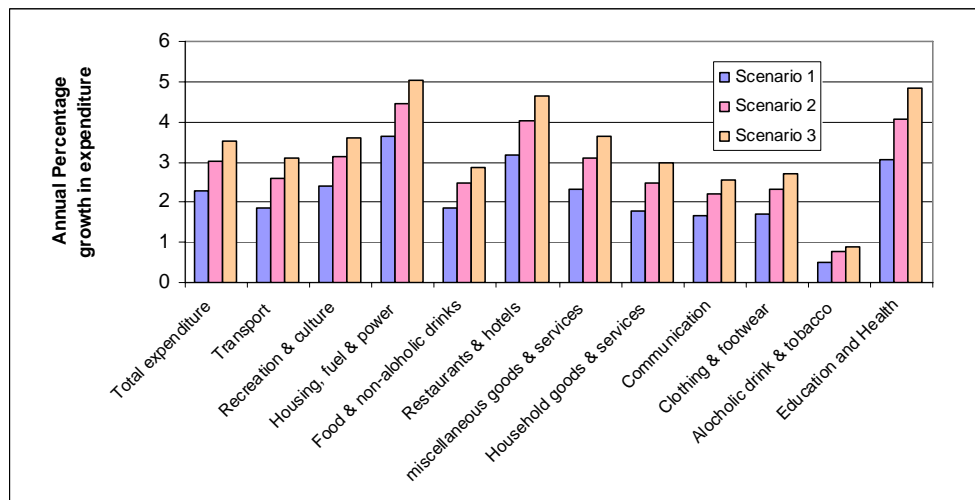


Figure 13: Annual % increase in expenditure by category by North East economic scenario 2006 - 2026

On a household level Mosaic groups increase their annual expenditure by between 1.0% and 1.9% in Scenario 1 and between 1.7% and 2.8% in scenario 3. There is limited change to the patterns of expenditure over time meaning Mosaic household spends money in similar ways in 2006 and 2026.

3.6 Expenditure on domestic goods and imports

All the results displayed so far are outputs from Experian economic and demographic models. As a separate piece of modeling for the study the SEI created projections of the proportion of expenditure in the North East that can be attributed to imports and domestically produced goods respectively. The purpose of this to distinguish between the environmental impacts of goods produced in the rest of the world (ROW) from those produced in the UK²². As Figure 14 shows, the majority of products and services consumed by the North East population are domestically produced but this proportion declined from 86% in 1992 to 78% in 2004. Imports account for the supply of over a quarter of all goods and services consumed in the North East by 2026 under an assumption of continuing trends.

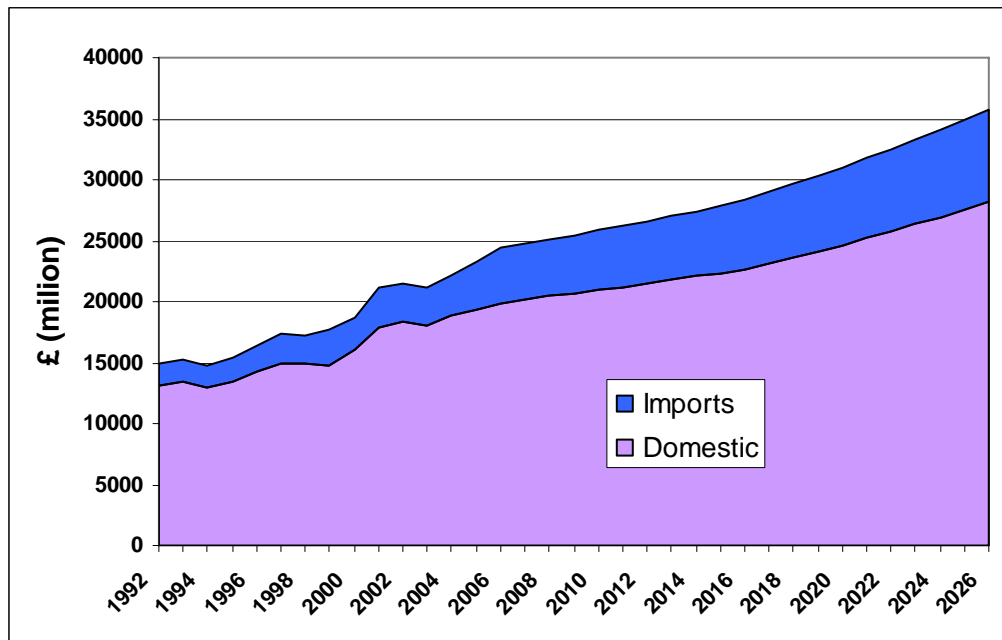


Figure 14: Historical trends and projections in household expenditure met by imports and domestic production

²² Note that products which are imported but ‘finished’ in the UK are classified as domestically produced.

3.7 Trends in Efficiency

Improvements in the efficiency of the economy, both in terms of the rate at which materials and energy are used to produce products, and in the way products are consumed, have the potential to counteract consumer emissions associated with increased consumption. The question is what efficiency improvements are achievable over the next 20 years?

SEI's models show that most product groups purchased in the UK displayed a continuous improvement in their impact per pound spent between 1992 and 2004. These improvements were driven by a number of factors, the most significant of which has been a reduction in the global carbon intensities of industry producing goods consumed in the UK. Almost half the emissions savings associated with improvements in carbon intensities were realised by industry located in the UK, the remainder by industry located in the rest of the world. This reflects the larger proportion of goods consumed by UK residents which are produced or finished in the UK²³.

Within the UK the reduction in carbon intensity of industry has been driven primarily through improvements in the fuel intensity of industrial sectors and secondarily by changes in the fuel mix of the UK economy. Emissions savings associated with a change in the fuel mix were mainly linked to the switch from coal to gas which occurred at the beginning of the 1990s and is commonly referred to as the 'dash for gas'.

These historical trends indicate that improvements in Efficiency (the impact per pound spent) of goods and services consumed in the North East can be brought about by further technological improvements in UK industry. The extent to which this is possible will depend on a number of factors. Firstly, the extent to which increased consumption in the North East is satisfied through increased imports. Historical trends indicate that the proportion of goods consumed in the North East and imported will increase over time. Secondly the extent to which further changes to the UK fuel mix can be implemented. These have leveled out since the 1990s and it is not yet clear what impact the implementation of clean coal technology will have on the carbon intensity of the UK economy. Finally, improvements in technology do not guarantee that products will be used more efficiently. The way people travel in the UK provides a case in point.

Historical trends in SEI's model indicate that the impact per pound spend of transport has increased in the UK between 1992 and 2004. It is possible to identify six well established trends which could account for an increasing impact per pound spent of land transport in the UK²⁴. These are modal shift, increased car size and weight, reduced occupancy, increasing horsepower and acceleration, increased congestion and uptake of air conditioning²⁵. At the same time the

²³ Understanding changes in UK CO₂ emissions 1992-2004. A structural decomposition approach. Research Report. In Press. Submitted to Defra by SEI and the University of Durham.

²⁴ Air travel is excluded from this analysis because its impact per pound spent increased so rapidly that it would have dominated all over results. In the study results the impact per pound spent of air travel is held at 2006 levels in all scenarios. For a short discussion on this see the Technical Report.

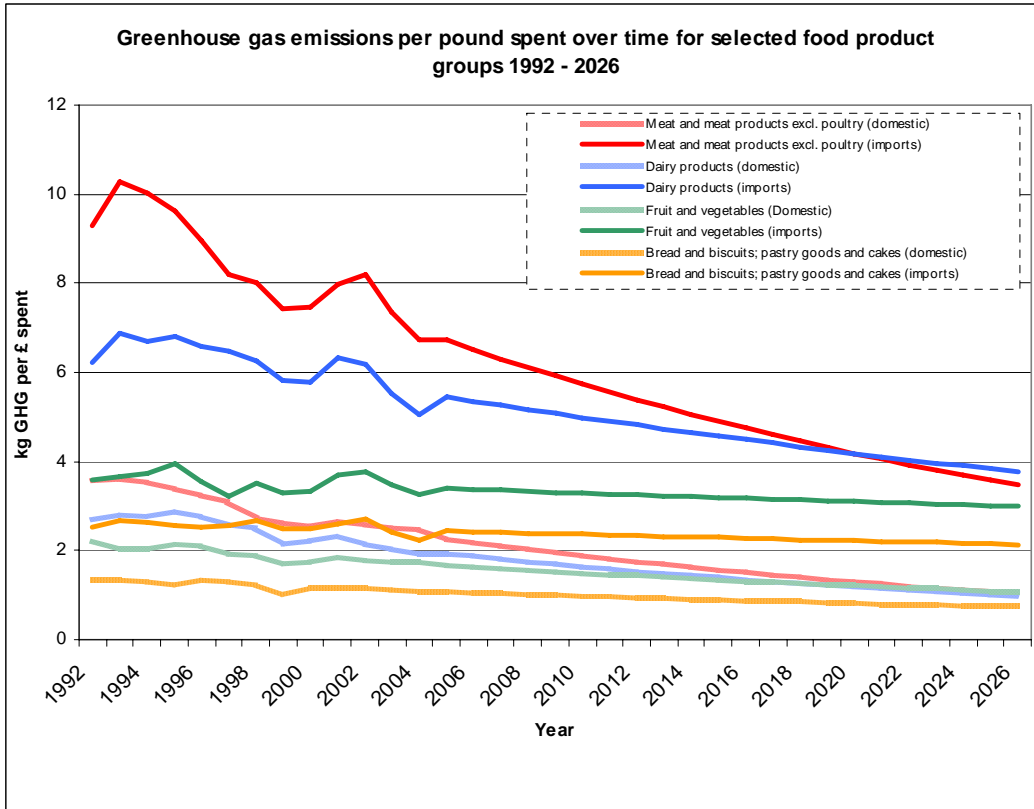
²⁵ With the exception of modal shift these factors are all taken from a discussion of instruments of energy efficiency in Agnolucci, P. Ekins, P. Iacopini, G. Anderson, K. Bows, A. Manders, S. Shackely, S. 2009.

success of cheap flight operators means that people can fly a lot further, and emit more greenhouse gas emissions for every pound spent. These are not strictly technological factors, the model is not showing that transport technology is getting worse (it is not), but the way we choose to travel means that it is costing us less to create more pollution. From an environmental perspective this is a classic example of market failure. Tackling this particular market failure may prove central to whether emissions in the North East can be decoupled from economic growth.

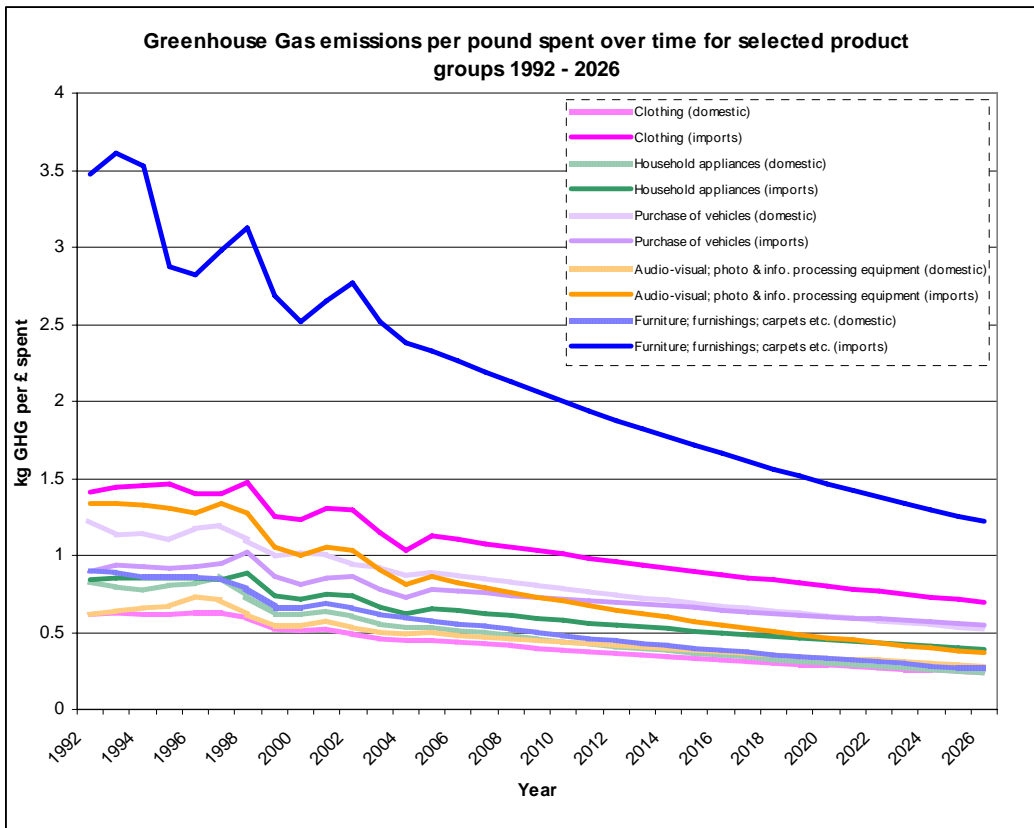
These examples show that the future efficiency of products will depend on the future technological performance of products sourced from the world economy as well as how people will use them. In these circumstances the best assumptions we can make are that historical trends will continue. To provide an example of what this means for specific product groups figures 15 and 16 provide projection of the impact per pound spent of selected product groups consumed in the North East of England.

Figure 15 shows that on average the impact per pound spent declined by 25% for imports and domestically produced food purchased in the UK between 1992 and 2004. This is equivalent to an improvement or around 2.1% a year. Figure 16 shows that on average the impact per pound spent reduced by 29% on average for selected durable items purchased in the UK between 1992 and 2004. This is equivalent to an improvement or around 2.4% a year. These rates of improvement are equal to or greater than increases in population and expenditure for all three economic scenarios.

Different scenarios for achieving radical reduction in carbon emissions: a decomposition analysis.
Ecological Economics, 68 (6). pp. 1652-166



Figures 15 & 16: Historical trends and projections of impact per pound spend of selected product groups



4. The Environmental impacts of consumption

The purpose of this chapter is to quantify the environmental impact associated with each of the economic growth scenarios and assess whether advances in Efficiency offset increases in Consumption and Population. All results are provided using consumer emissions measured in greenhouse gases.

4.1 Future prospects: consumer emissions in the North East

If historical technological trends continue, consumer emissions are set to grow by 9% between 2006 and 2026 under the lower rates of economic growth displayed in scenario 1. They increase by 15% in scenario 2 and by 19% in Scenario 3 over the same period.

All future scenarios demonstrate an increased annual growth rate in consumer emissions from 0.42% a year over the period 1992 – 2004 to between 0.44% (scenario 1) and 0.94% (scenario 3) a year from 2006 to 2026. The rate of growth in consumer emissions displayed in Scenario 3 matches that seen in the South East over the previous decade.

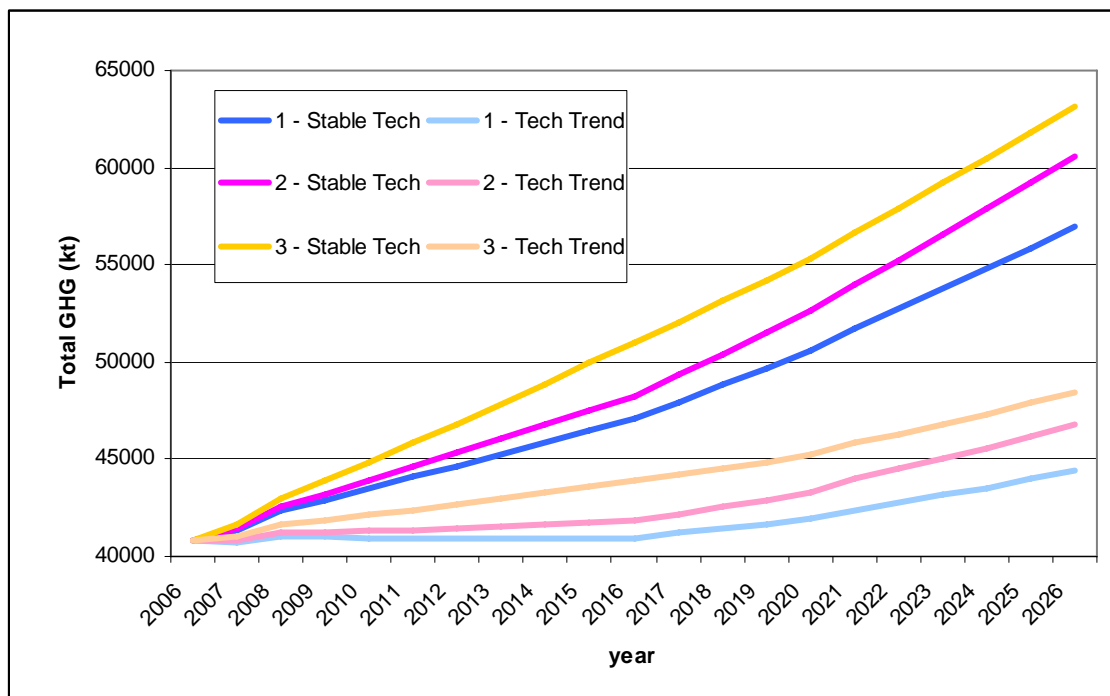


Figure 17: Greenhouse Gas emissions in the North East by economic scenario under alternative technological conditions

The rate at which consumer emissions increase is influenced considerably by improvements in the Efficiency in which products are produced and consumed. This is illustrated by the

introduction of a stability scenario in which the impact per pound spent on products is held at 2006 levels. In the absence of improvements in the impact per pound spent on products, consumer emissions increase by between 40% and 55% between 2006 and 2026. This translates into annual rates of growth of between 1.98% and 2.74% which is beyond anything seen in the UK over the last decade.

	Baseline	efficiency improves		2006 efficiency	
	2006	2016	2026	2016	2026
Scenario 1	40.1	41.0	44.4	47.1	56.9
Scenario 2		41.9	45.6	48.2	61.2
Scenario 3		43.9	48.5	52.0	63.2

Table 2: Total consumer emissions in 2006, 2016 & 2026 by scenario compared for continuing trends and for efficiency levels held at 2006 levels. All figures in Million tonnes.

	Efficiency improves		2006 efficiency	
	2006 - 2016	2016 - 2026	2006 - 2016	2016 - 2026
Scenario 1	0.0	0.8	1.5	2.0
Scenario 2	0.3	1.2	1.8	2.5
Scenario 3	0.8	1	2.4	2.3

Table 3: Annual percentage growth in total consumer emissions in 2006 - 2016 & 2016 - 2026 by scenario compared for continuing trends and for efficiency levels held at 2006 levels. All figures in %

The pattern of growth in consumer emissions is similar on a per capita basis to the trends in total emissions. Assuming that technological trends continue the North East's per capita Greenhouse gas emissions match the current average for the UK (16.3t/cap) by 2026 in all scenarios. Scenarios 2 and 3 overtake the current South East average (17.1t/cap) in 2026 and 2021 respectively. In Scenario 3 the GHG per capita of an average North East resident reaches 17.7tonnes by 2026. The average per capita emissions would be 5tonnes higher by 2026 in all scenarios in the absence of technological improvements.

Figure 18 shows consumer emissions under continuing trends set against GVA for each economic scenario. Under these conditions relative decoupling can be seen between the standard measure of economic progress and consumer emissions in the North East of England.

It is important here to distinguish between relative and actual decoupling. In this context relative decoupling means that greenhouse gas emissions associated with household expenditure increase at a slower rate than GVA in the North East. Consumer emissions do however still increase, there is no reduction in absolute terms. These results indicate that relying on the continued change of efficiency factors in line with historical rates will not bring about decreases in consumer emissions in the North East of England.

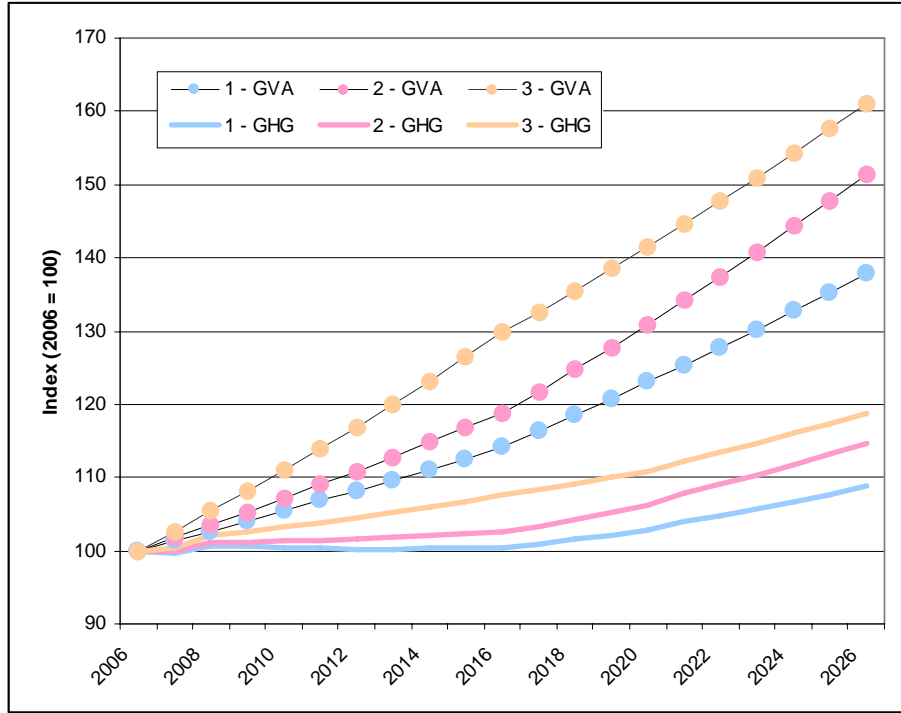


Figure 18: Greenhouse Gas emissions in the North East by economic scenario under alternative technological conditions

4.3 Consumer emissions and household expenditure

The increase in proportion of products imported and consumed by the North East population considerably increases the proportion of consumer emissions associated with imports into the UK. By 2026 imports account for over a quarter of all goods and services consumed in the North East. Figure 19 shows that this translates into a share of 49% of total emissions by 2026 in the highest economic growth scenario (scenario 3). This is an increase in emissions associated with imports of 18% between 2006 and 2026

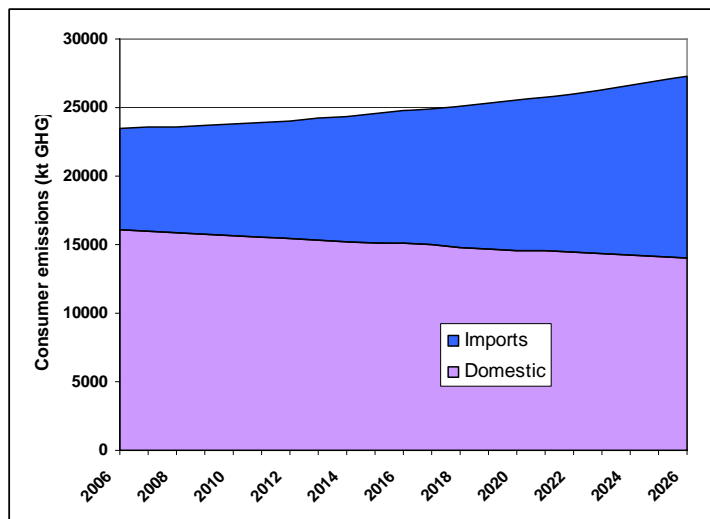


Figure 19: breakdown of North East consumer emissions associated with domestic production and imports

The household emissions profile of the North East is clearly dominated by housing, fuel and power and transport. As expenditure categories these take up 27% of a typical household budget but they account for 53% of a typical household’s consumer emissions. Figure 20 shows that the remaining proportion of consumer emissions is accounted for by household expenditure that is rarely considered in the context of climate change; recreation accounts for 10% of expenditure and 8% of emissions, eating out and cooking at home accounts for 23% of household expenditure and 21% of emissions.

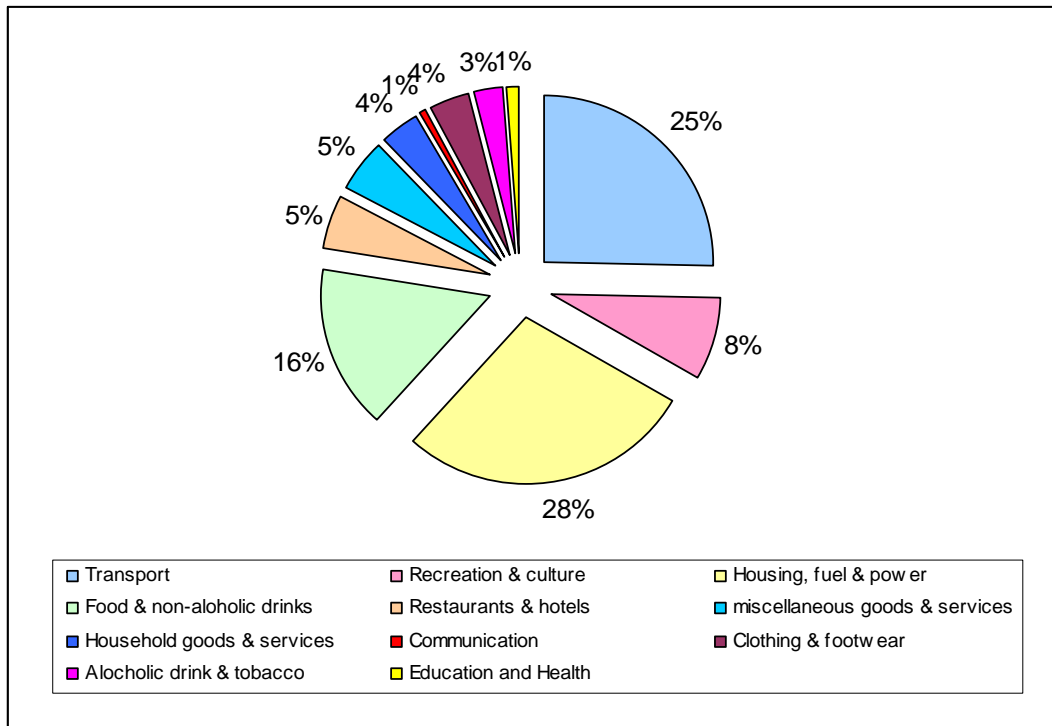


Figure 20: breakdown of consumer emissions in the North East of England in 2006

In each of the three economic scenarios transport and energy use continues to take up the largest proportion of consumer emissions from households. Although expenditure on housing, fuel and power rises faster than any other category in the scenarios, the proportion of emissions it accounts for actually falls marginally. In contrast emissions from transport rise based on a combination of increased expenditure and an increase in the impact of transport per pound spent. In Figure 21 housing, fuel and power and transport account for 64% of consumer emissions from households by 2026 in scenario 3.

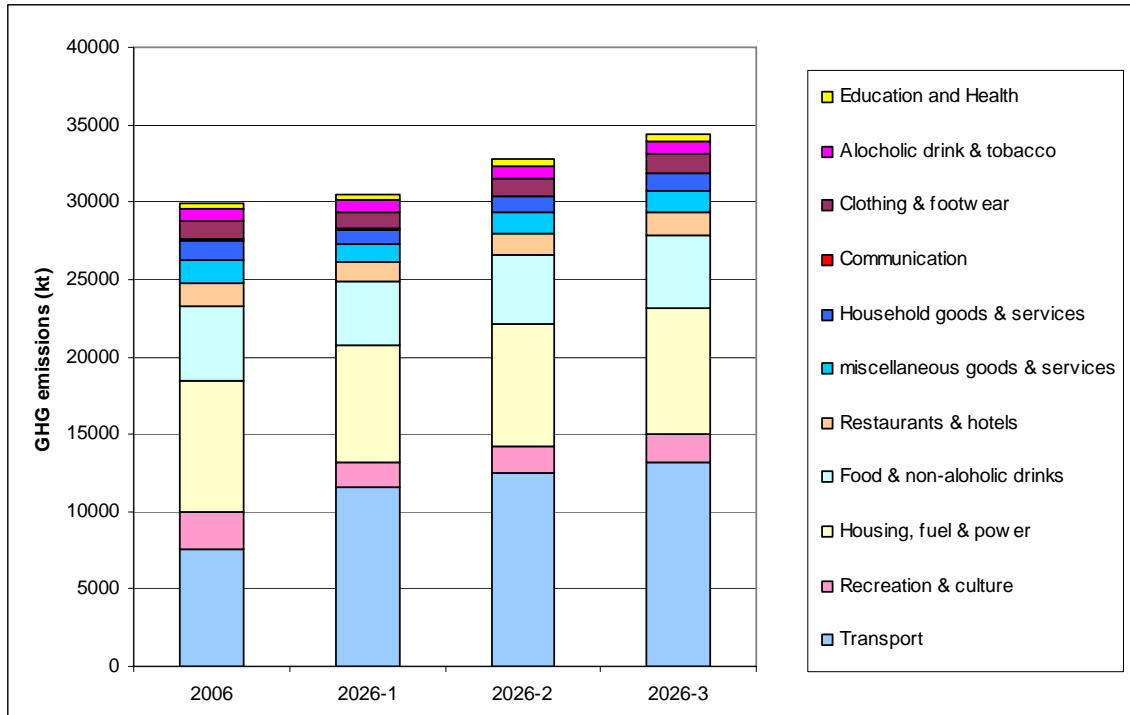


Figure 21: North East Consumer emissions from households in 2006 and in 2026 by economic scenario

Figure 21 also illustrates that change in total emissions from transport accounts for the majority of the increase in total emissions under continuing trends scenarios. This illustrates the importance of the assumptions underpinning the model.

Based on an assumption of continuing trends the impact per pound spent of most product groups declines at a rate which is marginally higher than concurrent increases in household expenditure. The one exception is transport which displays an increasing impact per pound spent over time²⁶. The assumptions on which the model is based must be understood to put these results in context. We cannot accurately predict either the future technological performance of products which are sourced from multiple economies and ever changing supply chains over time or how people will use them. In these circumstances the best assumptions we can make are that historical trends will continue. Although historical trends are not necessarily a good guide for the future they give us an idea of the factors which have an impact over future emissions trajectories and help us to think about the instruments needed to shape them²⁷.

To further illustrate the impact of technological assumptions figure 22 shows the change in total consumer emissions in the North East under the ‘2006’ or ‘static Efficiency’ and ‘continuing

²⁶ Air travel is excluded from this analysis because its impact per pound spent increased so rapidly that it would have dominated all over results. In the study results the impact per pound spent of air travel is held at 2006 levels in all scenarios. For a short discussion on this see the Technical Report.

²⁷ Agnolucci, P. Ekins, P. Iacopini, G. Anderson, K. Bows, A. Manders, S. Shackely, S. 2009. Different scenarios for achieving radical reduction in carbon emissions: a decomposition analysis. *Ecological Economics*, 68 (6). pp. 1652-166.

trends' scenarios for Scenario 3. When the impact per pound spent of consumption is held at 2006 levels, emissions increase by over 2% a year for most expenditure categories. Under the continuing trends scenario reductions in the impact per pound spent of services outweigh increases in expenditure. This is particularly the case for communications and recreational services.

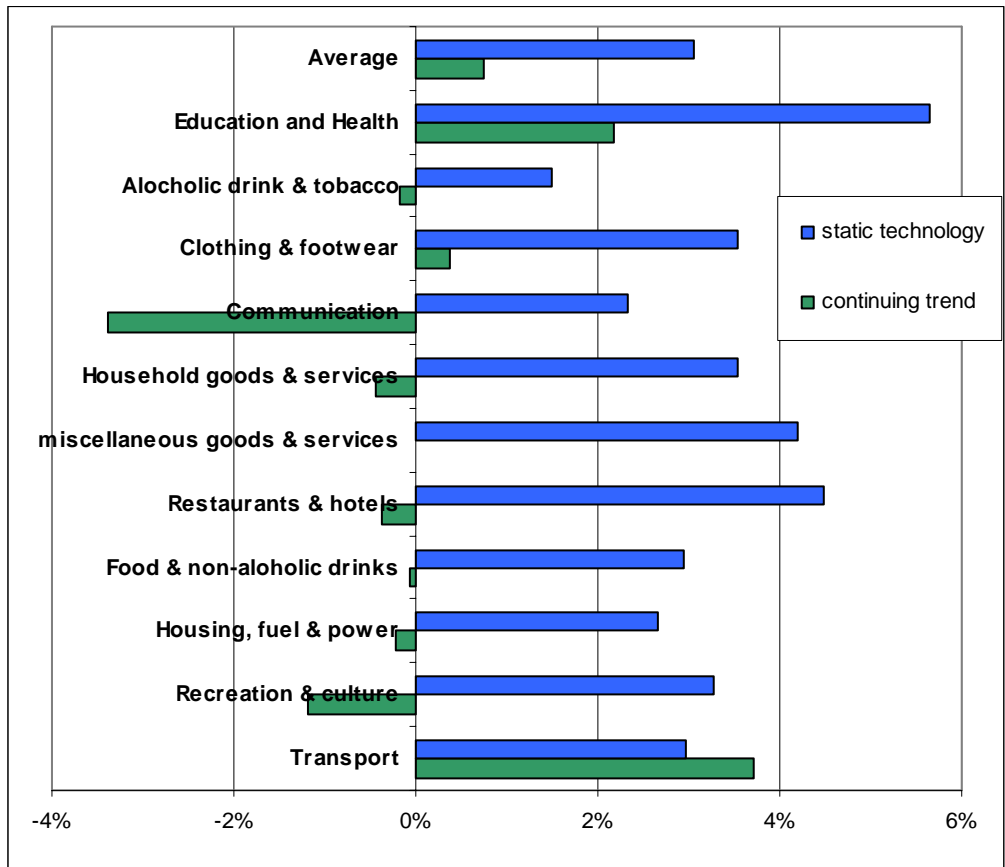


Figure 22: Annual change in consumer emissions for scenario 3 under different assumptions on the role of technology

4.4 Consumer emissions by Mosaic Group

The share of consumer emissions accounted for by each Mosaic group closely reflects their population size within the North East. Figure 23 shows that differences are marginal; whereas groups D and G make up 40% of the population they account for 36% of consumer emissions. This difference is accounted for by the greater share of consumer emissions taken up by groups A (Symbols of Success), B (Happy Families), C Suburban Comfort) and K (Rural Isolation).

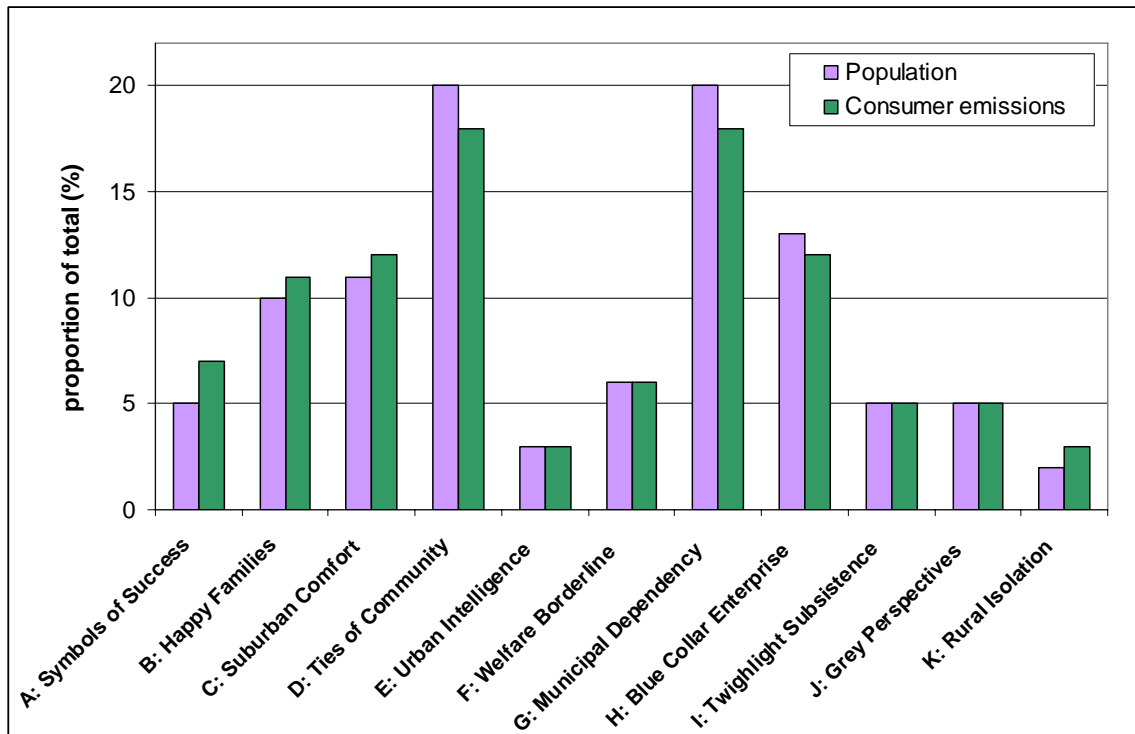


Figure 23: Breakdown of total consumer emissions & population in the North East by Mosaic Group 2006

It is important to distinguish between those Mosaic groups which account for the highest proportion of overall emissions in the North East and those that have high emissions on a per household basis. Figure 24 shows that the consumer emissions of the wealthiest group, Symbols of Success (A), are almost double those of the low income elderly in supported housing (Twilight Subsistence group I). Compared to all other groups, the consumer emissions of group A are between 19% and 41% higher on per household basis.

Figure 24 also illustrates that breakdown of consumer emissions by households is similar across Mosaic groups. Transport, food and energy account combined account for between 67% and 72% of consumer emissions on a household basis. These areas tend to take up a higher proportion of emissions for lower incomes groups mirroring their tighter budgets and less disposable incomes.

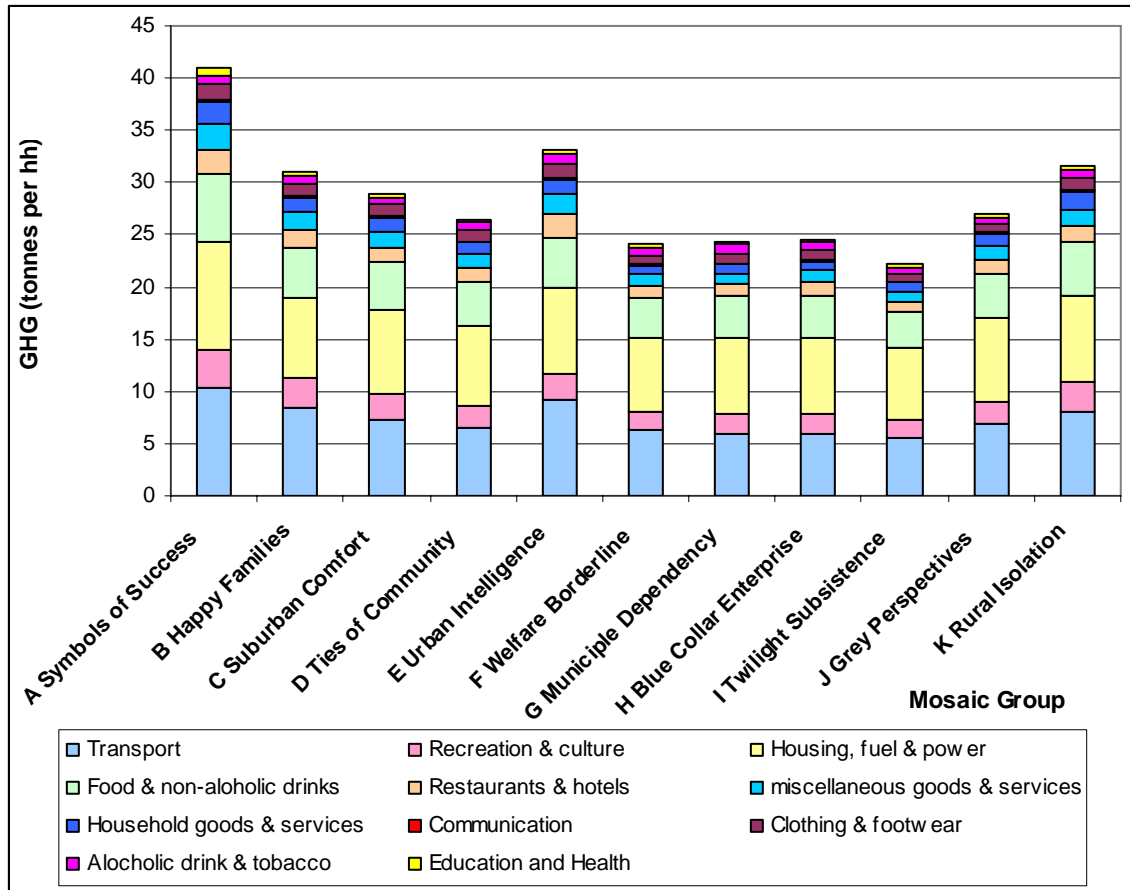


Figure 24: Annual consumer emissions per Mosaic household in the North East for 2006

Figure 25 shows there are only three Mosaic groups in which consumer emissions per household increase substantially in the economic growth scenarios. In the highest economic growth scenario the consumer emissions per household of Urban Intelligence (E) grow by over 30%, they grow by 18% for Rural Isolation (K), and by 10% for Symbols of Success (A) over the same 20 year period. This is driven particularly by higher increases in expenditure on transport by these groups though all groups are responsible for the increase in transport emissions in the North East as a whole.

In the highest economic growth scenarios the rate at which population and expenditure grow for different Mosaic groups starts to make a difference to the proportion of total emissions taken up by each Mosaic group. In Scenario 3 the share of emissions accounted for by the group Municipal Dependency (G) falls from 18% to 12% between 2006 and 2026. Total consumer emissions from wealthier groups A and E combined grow from 10% to 16% over the same period. At the same time the total proportion of emissions associated with Ties of Community (D) remain relatively high at 17% in 2026.

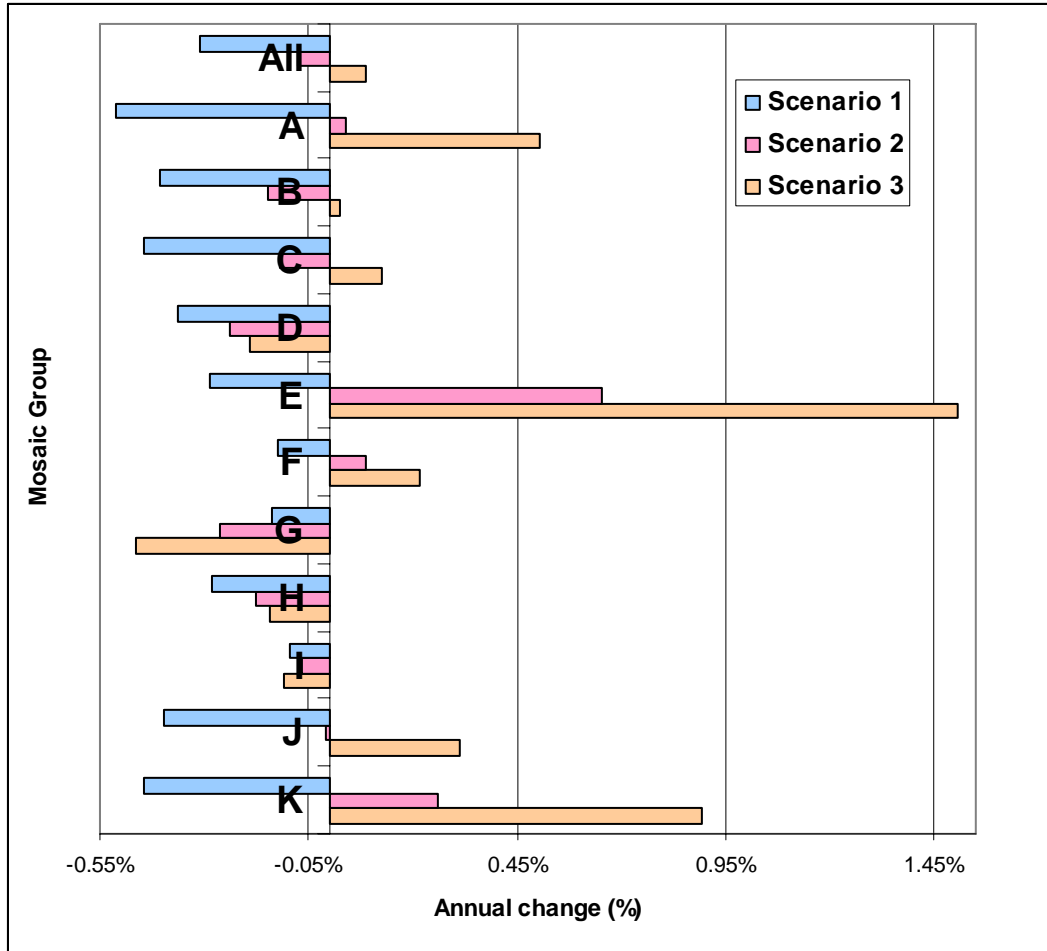


Figure 25. Annual change in consumer emissions per household by Mosaic group under each economic scenario

Mosaic Group ordered by total Consumer emissions in 2006	Total Consumer emissions	Change in consumer emissions 2006 - 2016			Change in consumer emissions 2006 - 2026		
	2006	2016-1	2016-2	2016-3	2026-1	2026-2	2026-3
D: Ties of Community	7.82	-0.09	-0.11	0.07	0.46	0.42	0.24
G: Municipal Dependency	7.49	0.25	-0.30	-0.64	0.75	-0.54	-1.88
H: Blue Collar Enterprise	4.92	0.04	0.01	0.10	0.42	0.34	0.18
C: Suburban Comfort	4.78	-0.07	0.20	0.63	0.37	1.07	1.71
B: Happy Families	4.29	-0.14	0.00	0.28	0.16	0.52	0.81
A: Symbols of Success	2.66	-0.09	0.29	0.80	0.15	1.13	2.18
F: Welfare Borderline	2.41	0.09	0.14	0.26	0.28	0.40	0.48
J: Grey Perspectives	2.23	0.02	0.20	0.46	0.30	0.75	1.20
I: Twilight Subsistence	1.84	0.16	0.10	0.10	0.40	0.27	0.11
E: Urban Intelligence	1.30	0.00	0.34	0.77	0.08	0.98	2.04
K: Rural Isolation	1.09	-0.03	0.17	0.42	0.06	0.57	1.15

Table 4: Actual change in Consumer emissions by Mosaic group in the North East by economic scenario 2006, 2016, 2026. All figures in Millions of tonnes of GHG

5. Conclusions

The study shows a clear relationship between economic growth, increased household expenditure and increased consumer emissions. Total consumer emissions in the North East increase under every economic scenario modeled for this study. The rate at which a growth in emissions occurs in line with economic growth depends both on the rate at which technology improves and the way we choose to use it. The scenarios in this study show it would require technological change on a scale not seen in recent times to cancel out the increase in emissions associated with even low increases in household expenditure. These results are in line with a recent structural decomposition analysis of the national economy that shows the extent to which increases in consumption outweighed technological gains over the last decade²⁸.

The emissions trajectories modeled for the North East economy do not account for the impact of future policy measures but future measures would need to be wide in scope and deep in impact to bring about actual decoupling of economic growth and environmental impacts. From this perspective personal travel clearly needs to be targeted if the region wants to move towards stabilising consumer emissions.

Through the segmentation of household emissions the Mosaic classification point towards the design of climate change mitigation measures which take into account the characteristics of different groups. The ideas below provide examples of how the Mosaic classification can be used to think about the kind of action that could be taken.

Target those most able to bear the costs of action	2006		2026-3	
	Population	Consumer emissions	Population	Consumer emissions
A (Symbols of Success), C (Suburban Comfort), E (Urban Intelligence) and K (Rural Isolation)	10%	13%	25%	33%

The Mosaic segmentation clearly shows that the wealthier a household the higher their consumer emissions are likely to be. In the higher economic growth scenarios emissions from wealthier groups grow at higher rates and start to account for a substantial proportion of the North East's emissions. These groups are also most able to make choices about the way they live and may even be more open to environmental issues. A key challenge is that they may already think they do enough and, though they might not want to admit it, don't want to change their lifestyles further. This may make some households particularly resistant to transport measures that encourage modal shift for example.

One suggestion is to think about measures which can target energy use. These Mosaic groups tend to have high levels of home ownership and higher levels of disposable income. Engagement

²⁸ Understanding changes in UK CO2 emissions 1992-2004. A structural decomposition approach. Research Report. In Press. Submitted to Defra by SEI and the University of Durham.

could focus on incentivising the installment of energy saving or renewable energy measures.

Target those most able to bear the costs of action	2006		2026-3	
	Population	Consumer emissions	Population	Consumer emissions
F (Welfare Borderline), G (Municipal Dependency), I (Twilight Subsistence)	31%	29%	25%	22%

The single group responsible for the highest proportion of emissions in the North East (G), is also one of the groups least able to make choices in their everyday life. Typically they are dependant on local authority housing and public transport services. Access to a wide range of facilities is poor. These are all characteristics which are shared for different reasons by groups F and I. There is a strong argument for targeting those least able to make changes themselves because low carbon interventions can also make a difference to comfort in the home, access to services, planning of meals and financial security. As these groups are all to some extent dependant on state support there are established services that can be built on. Local authorities should consider what measures they can implement that support their wellbeing power. Neighborhood wellbeing officers could support households with everything from financial planning through to energy audits and shopping and meal plans that reduce food waste.

Target those most able to bear the costs of action	2006		2026-3	
	Population	Consumer emissions	Population	Consumer emissions
B (Happy Families), D (Ties of Community), H (Blue Collar Enterprise) and J (Grey Perspectives)	59%	58%	50%	45%

Broadly speaking these groups focus on job security, buying a home, and raising a family. They all exercise a degree of independence and comfort but where they live and work, and how they shop and travel is strongly influenced by regional planning and infrastructure. These are the groups where travel behavior can be feasibly targeted, both through smarter measures and disincentives to car use. That's not to say they would be open to congestion charging or measures which they see as inconvenient. In the context of the current economic climate this is where the principals of a Green New Deal for the economy come in. Nicholas Stern, together with Ottmar Edenhoffer recommends programmes in seven strategic areas that would re-orientate development towards sustainable, low carbon growth²⁹. Those which are applicable at a regional level include subsidizing loans for building retrofits, upgrading and extending public transportation, supporting clean technology markets and incentivising low carbon investments. Many of them involve creating jobs and employment, something which established communities could have a stake in.

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These ideas are included to provide an example of how a segmentation of consumer emissions by Mosaic group even at the broadest level can help to inform the process of policy formation and design. Other household segmentation methodologies can add further value in understanding attitudes to the environment and understanding of climate change issues. This can support communications campaigns as well as informing strategy.

A Green Segments³⁰ area profile of the North East shows that nearly 14% of households are 'Wasteful and Unconvinced', that is they are unwilling to change their lifestyle, although their attitude is fuelled by a lack of education and knowledge of environmental issues. Equally, nearly 6% of households are 'Convinced Consumers', and already willing to change behavior. Like Mosaic, Green Segments is a household level segmentation and illustrates the value of bringing together an evidence base that combines information on:

- I. Agency – the degree of choice households have about the decisions they make in every day life. This extends to affluence and patterns of expenditure
- II. Assets – the nature and condition of resources controlled by households or a community and the condition of infrastructure provided by the state. This could include the energy performance of housing stock or access to and frequency of bus services
- III. Attitudes – the awareness, knowledge and concerns of households regarding the environment and what it means to them
- IV. Action – the levers, methods of engagement and interventions available, and how they fit with existing policies

By bringing this information together it is possible to recognise differences between neighborhoods, taking into account household types, infrastructure and the options available.

At a regional level this report brings together some of this evidence at an aggregated level. It points towards large differences in emissions across households and lifestyles and clearly relates these to incomes and expenditure. Further analysis may be necessary at more detailed spatial levels to provide data at a level which could aid the detail of policy design. An example of how this could be developed at a local level is the partnership between Newcastle City Council, Newcastle University and Science City. They have launched a Carbon Routemap project which, as a first stage, maps carbon emissions from buildings, combining gas and electricity data with the City's planning database. This approach goes some way towards providing the kind of information needed for detailed policy. Making use of standardised approaches of this kind for the North East as a whole would provide a sound evidence base for moving towards a sustainable

³⁰ Green Segments is Experian's classification of attitude to and understanding of the environment and climate change. It segments all households in the UK into 10 groups. A full description of each of these groups together with an area profile for the North East can be found in Appendix C.

economy.

Appendix A: Description of household activities

Each of the 11 aggregated household categories used in this report group a number of activities for which more detailed information is available in the spreadsheets held by NERIP. A short description of the categories is provided below together with an indication of the number of activity categories they aggregate together. The titles for the aggregated categories were chosen to match those used by the Office of National Statistics to summaries Family Spending statistics.

Transport

Household expenditure on operation and maintenance of private vehicles & bus, rail, boat and air transport services (7 categories)

Recreation & culture

Household expenditure on recreational equipment and culture (6 categories)

Housing, fuel and power

Household expenditure on electricity, gas and other fuels together with water supplies and maintenance and repair of dwellings (5 categories)

Food and non alcoholic drinks

Household expenditure on food and non-alcoholic drinks brought home (11 categories)

Restaurants and hotels

Household expenditure on restaurants and hotels (2 categories)

Miscellaneous goods and services

Household expenditure on personal care, valuables and financial services (6 categories)

Household goods and services

Household expenditure on furniture, furnishings, household appliances & utensils and tools and equipment for house and garden (6 categories)

Communication

Postal and telecommunication services (3 categories)

Clothing and footwear

Household expenditure on clothing and footwear (2 Categories)

Alcoholic drink and tobacco

Household expenditure on alcoholic drinks and tobacco (2 Categories)

Education and health: Household expenditure on Medical appliances and equipment, hospital services and private education (4 categories)

Appendix B: Mosaic Group distribution in the North East

Mosaic is Experian's socio-demographic classification. It segments all households in the UK into 61 types aggregated into 11 groups. It provides a comprehensive view of all UK households in terms of their demographics, lifestyles and culture, accurately reflecting the dynamics of British society. This study has used the 11-group scheme and the groups and associated descriptions are listed below.

Group A: Symbols of Success

Symbols of Success contains people whose lives are 'successful' by whatever yardsticks society commonly uses to measure success. These are people who have rewarding careers rather than jobs, who live in sought after locations, who drive the more modern and expensive cars and who indulge in the most exotic leisure pursuits. Most, though not all, appear to enjoy stable household arrangements.

Group B: Happy Families

Happy Families contains people whose focus is on career, home and family. These are mostly younger age groups who are married, or at least in a permanent relationship, and are now raising children in post war family houses, often in areas of the country with rapidly growing populations. The focus of expenditure is on equipment for the home and garden, and the immediate family unit is the principal focus of leisure activities.

Group C: Suburban Comfort

Suburban Comfort comprises people who have successfully established themselves and their families in comfortable homes in mature suburbs. Children are becoming more independent, work is becoming less of a challenge and interest payments on homes and other loans are becoming less burdensome. With more time and money on their hands, people can relax and focus on activities that they find intrinsically rewarding.

Group D: Ties of Community

Ties of Community is comprised of people whose lives are mostly played out within the confines of close knit communities. Living mostly in older houses in inner city neighbourhoods or in small industrial towns, most of these people own their homes, drive their own cars and hold down responsible jobs. Community norms rather than individual material ambitions shape the pattern of most residents' consumption.

Group E: Urban Intelligence

Urban Intelligence mostly contains young and well educated people who are open to new ideas and influences. Young and single, and few encumbered with children, these people tend to be avid explorers of new ideas and fashions, cosmopolitan in their tastes and liberal in their social attitudes. Whilst eager consumers of the media and with a sophisticated understanding of brand values, they like to be treated as individuals, and value authenticity over veneer.

Group F: Welfare Borderline

Welfare Borderline is comprised of many people who are struggling to achieve the material and personal rewards that are assumed to be open to all in an affluent society. Few hold down rewarding or well paying jobs and, as a result, most rely on the council for their accommodation, on public transport to get around and on state benefits to fund even the bare essentials. The lack of stability in many family formations undermines social networks and leads to high levels of anti social behaviour among local children.

Group G: Municipal Dependency

Municipal Dependency mostly contains families on lower incomes who live on large municipal council estates where few of the tenants have exercised their right to buy. Often isolated in the outer suburbs of large provincial cities, Municipal Dependency is characterised as much by low aspirations as by low incomes. Here people watch a lot of television and buy trusted mainstream brands from shops that focus on price rather than range or service.

Group H: Blue Collar Enterprise

Blue Collar Enterprise comprises people who, though not necessarily very well educated, are practical and enterprising in their orientation. Many of these people live in what were once council estates but where tenants have exercised their right to buy. They own their cars, provide a reliable source of labour to local employers and are streetwise consumers. Tastes are mass market rather than individualistic and focus on providing comfort and value to family members.

Group I: Twilight Subsistence

Twilight Subsistence consists of elderly people who are mostly reliant on state benefits, and live in housing designed by local authorities and housing associations. Some live in old people's homes or sheltered accommodation, while others live in small bungalows, set in small enclaves within larger council estates. Most of these people spend money only on the basic necessities of life.

Group J: Grey Perspectives

Grey Perspectives consists mostly of pensioners who own their homes and who have some source of income beyond the basic state pension. Many of these people have, on retirement, moved to the seaside or the countryside to live among people similar to themselves. Today many of these people have quite active lifestyles and are considered in their purchasing decisions.

Group K: Rural Isolation

Rural Isolation contains people whose pattern of living is distinctively rural. They live not just outside major population centres but also deep in the countryside, in small communities which have been little influenced by the influx of urban commuters. These are places where people with different levels of income share attachments to local communities, and where engagement with the community and with the natural environment are more important to most residents than material consumption.

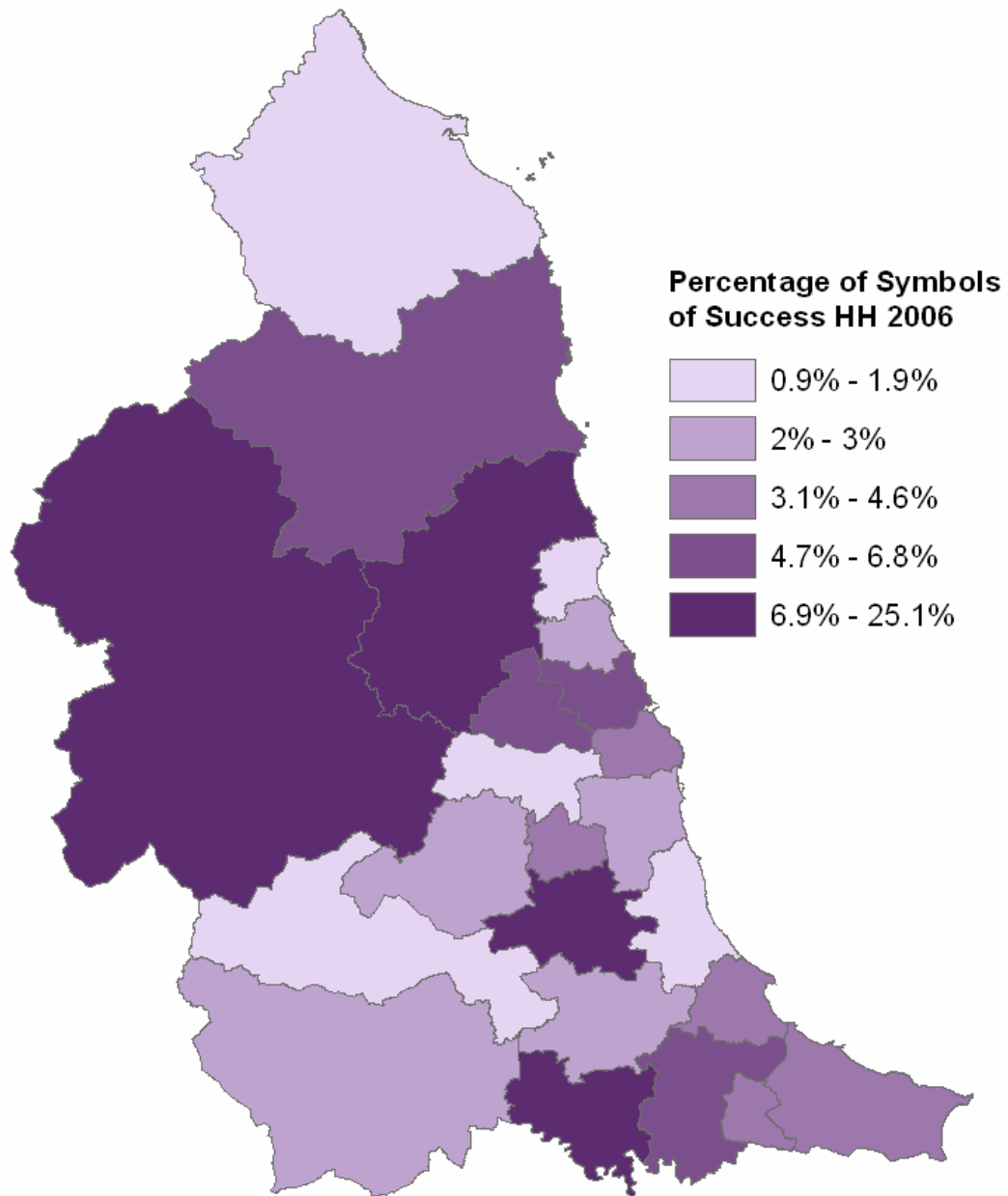
Table A1, below provides the distribution of the numbers of households in the North East within each Mosaic group.

	2006
Households	1,104,104
A: Symbols of Success	52,304
B: Happy Families	105,059
C: Suburban Comfort	123,337
D: Ties of Community	215,650
E: Urban Intelligence	30,316
F: Welfare Borderline	70,886
G: Municipal Dependency	219,163
H: Blue Collar Enterprise	142,922
I: Twilight Subsistence	57,649
J: Grey Perspectives	60,430
K: Rural Isolation	26,390

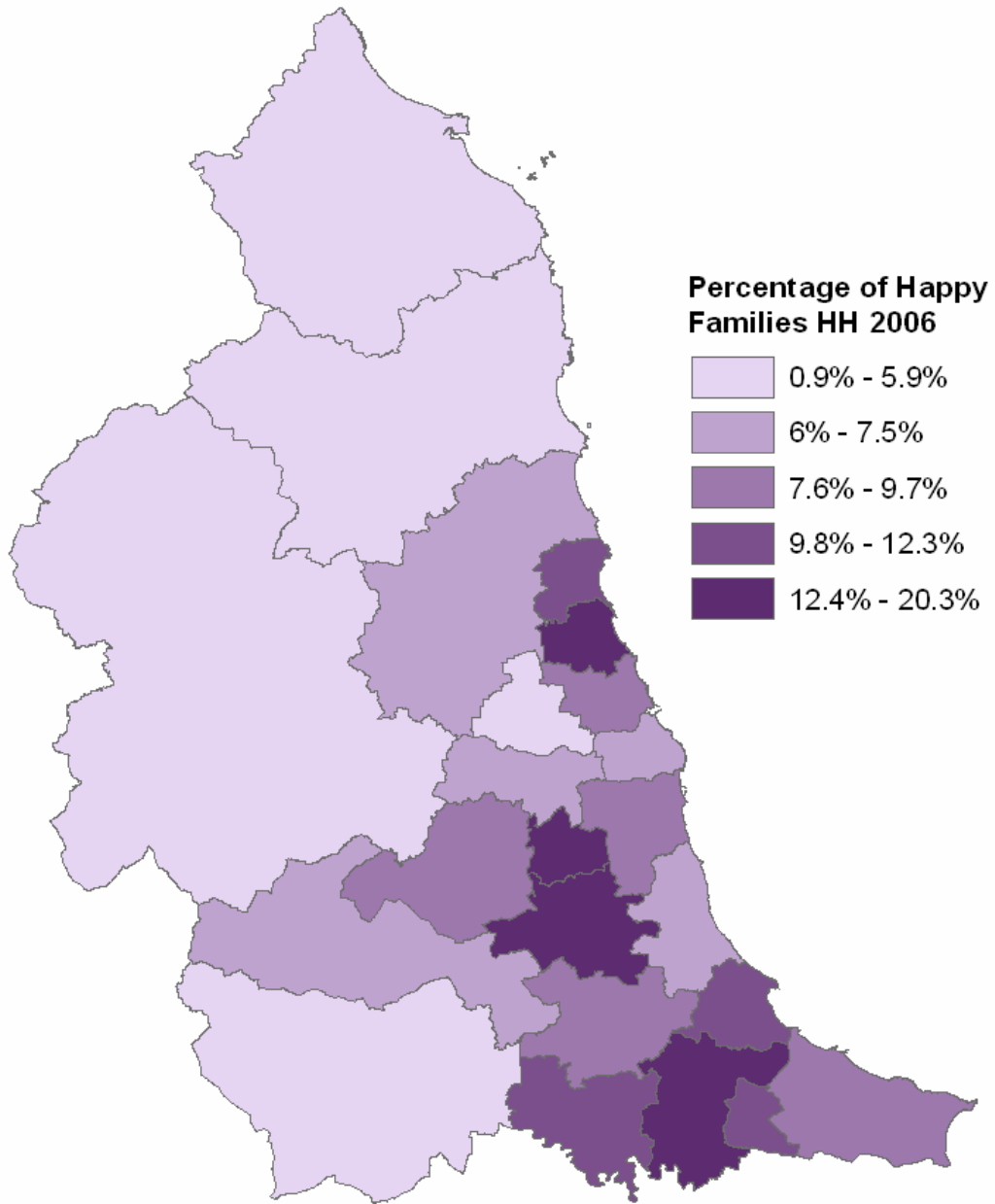
Table A1: Mosaic household in the North East of England 2006

The following maps provide an overview of the concentration of Mosaic groups by local authority area in the North East of England in 2006.

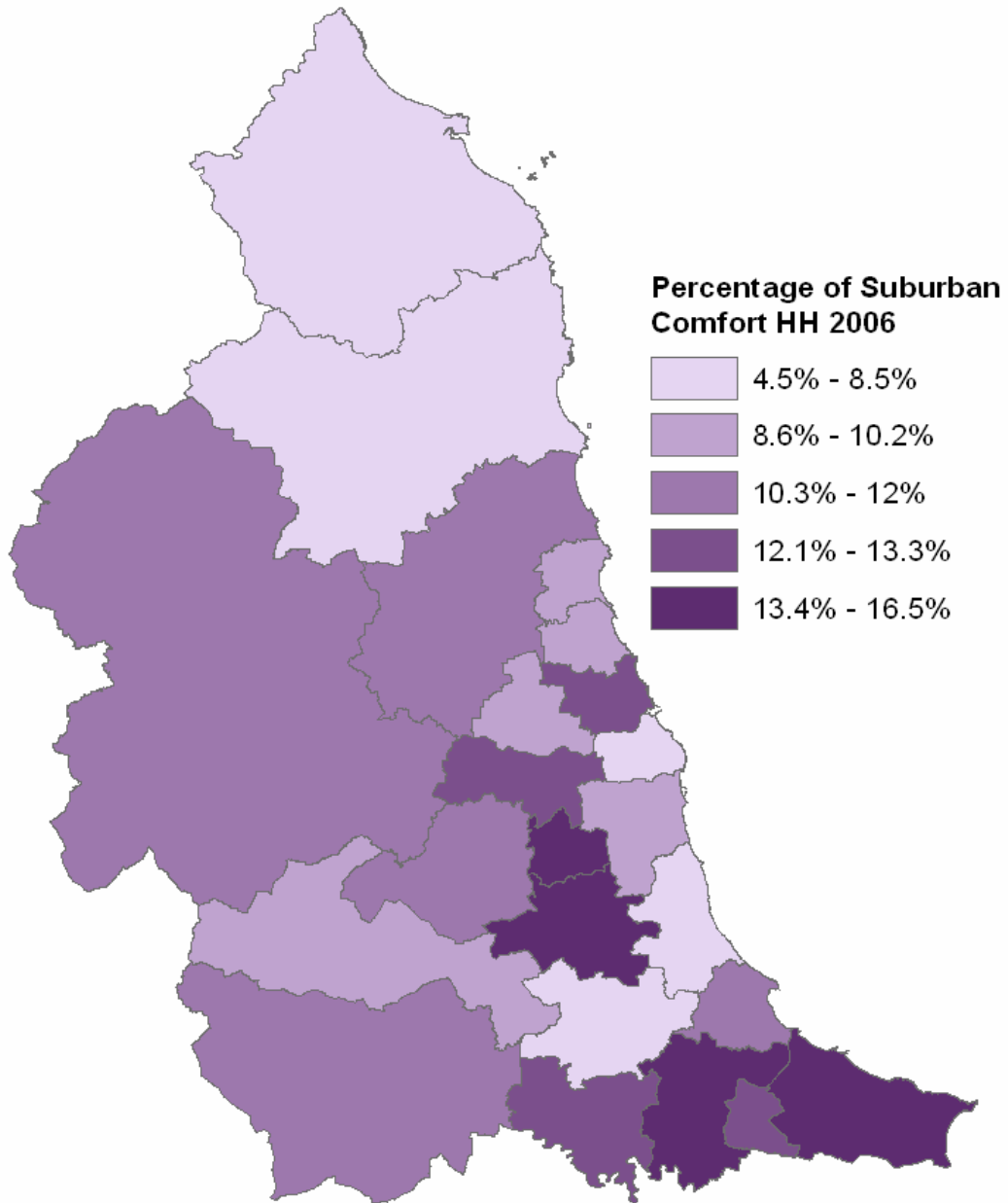
Percentage of Group A: Symbols of Success Households in Each Local Authority in the NE 2006



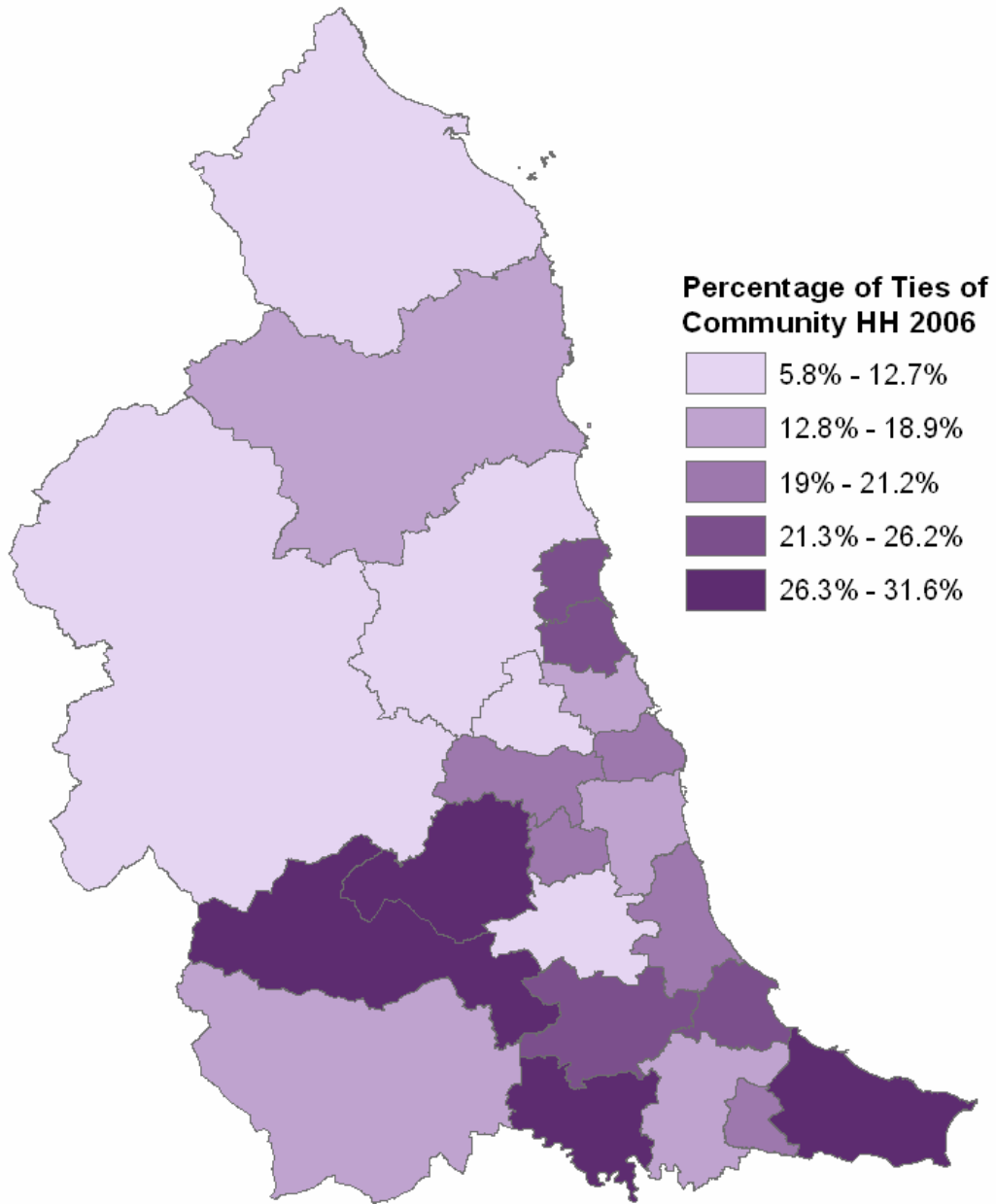
Percentage of Group B: Happy Families Households in Each Local Authority in the NE 2006



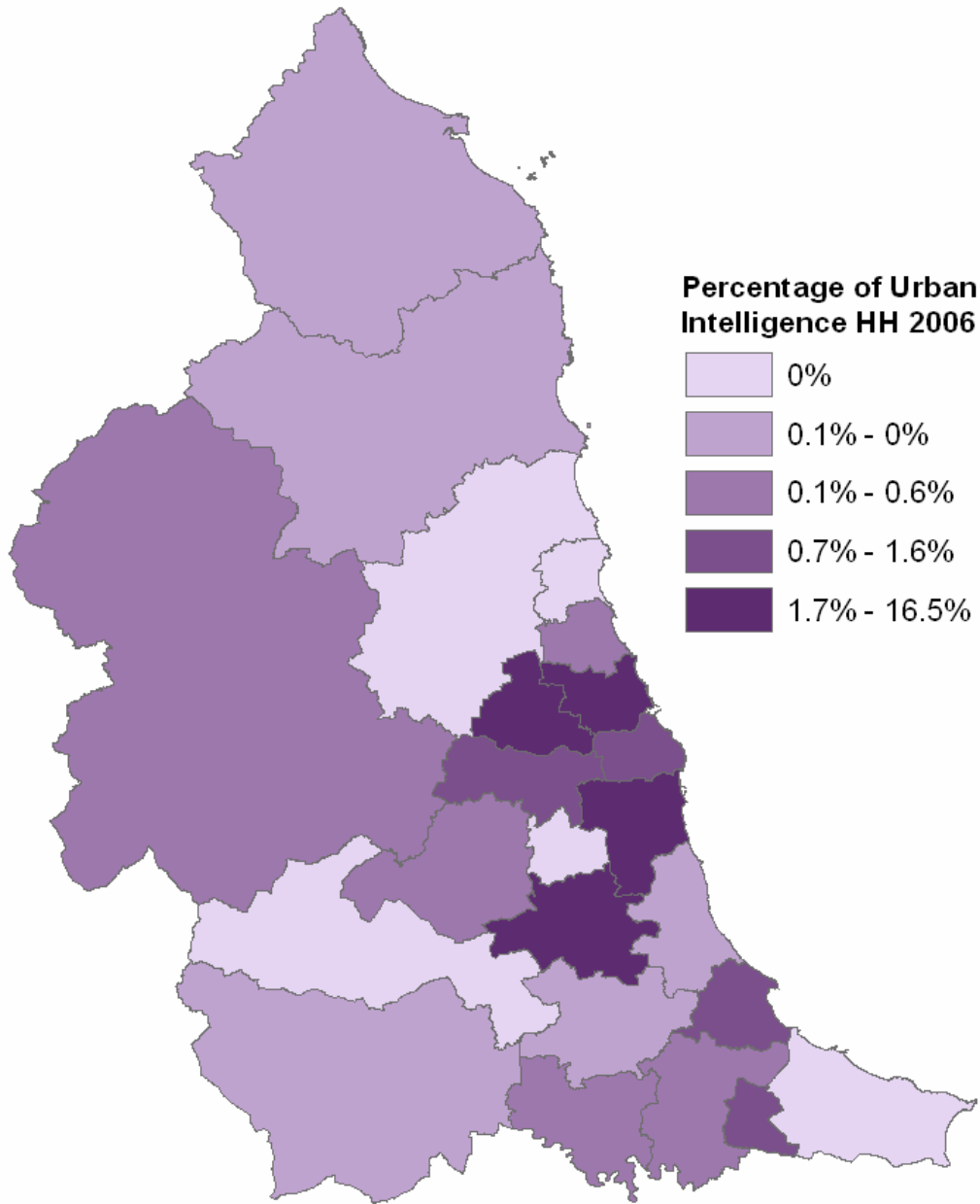
Percentage of Group C: Suburban Comfort Households in Each Local Authority in the NE 2006



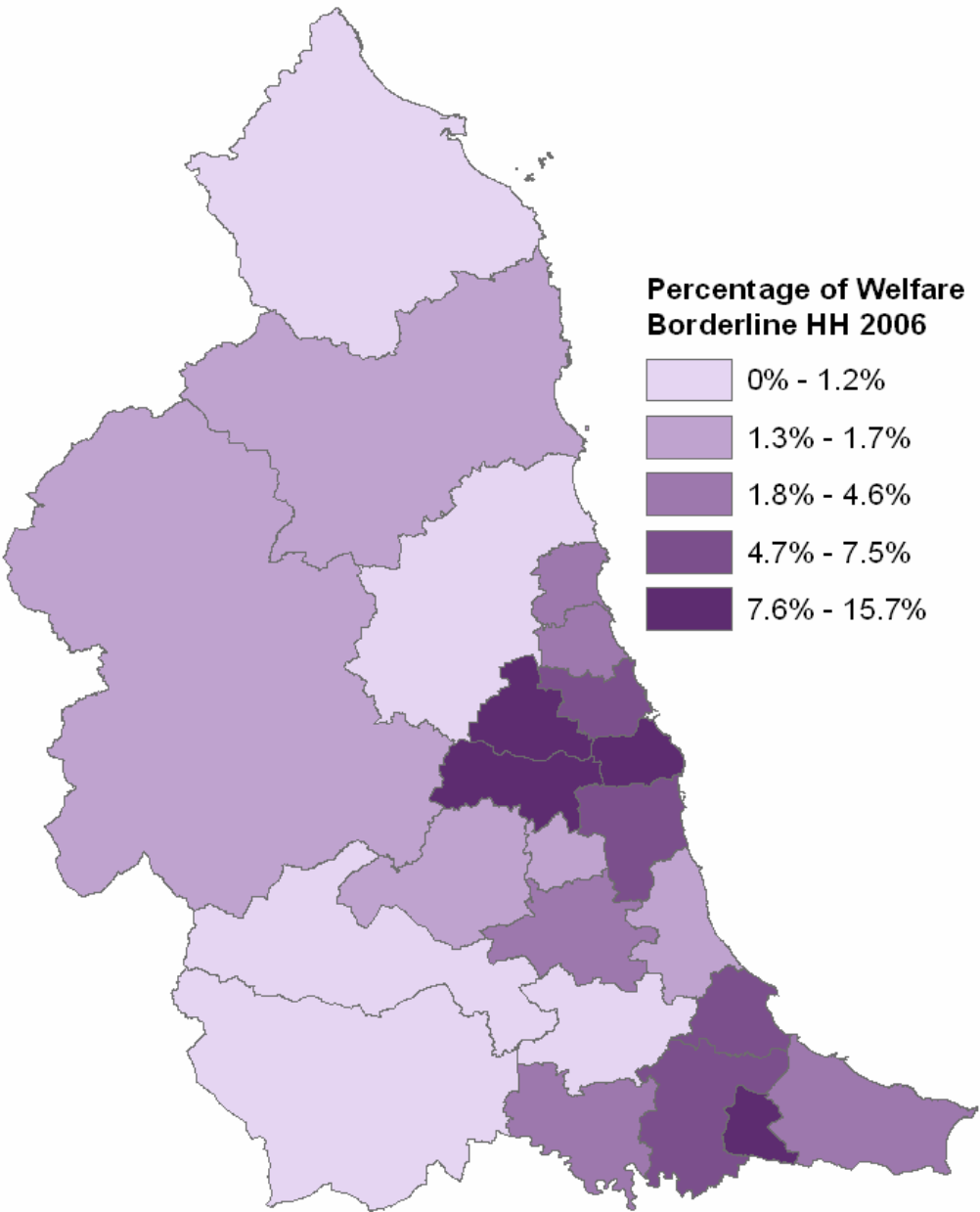
Percentage of Group D: Ties of Community Households
in Each Local Authority in the NE 2006



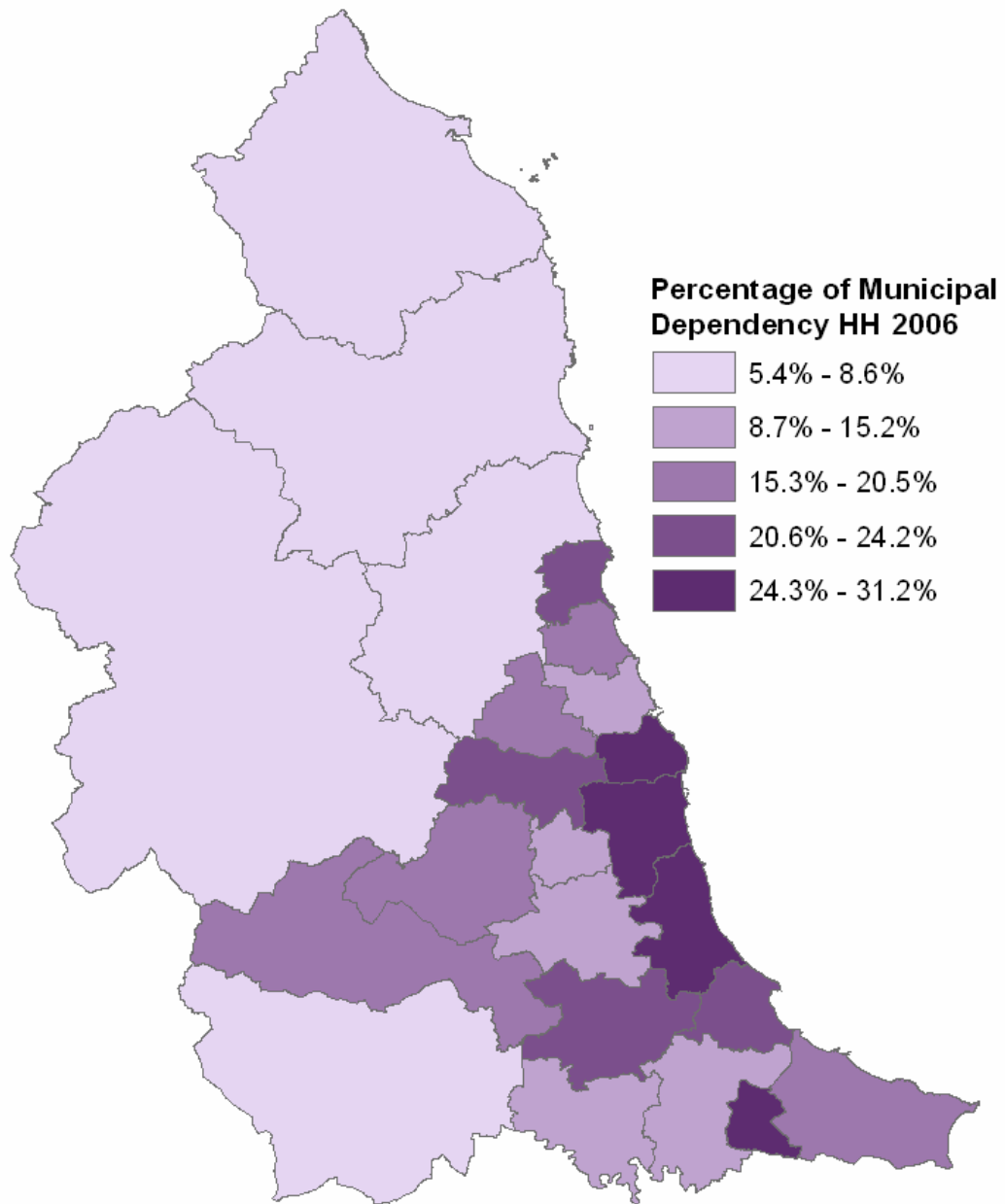
Percentage of Group E: Urban Intelligence Households in Each Local Authority in the NE 2006



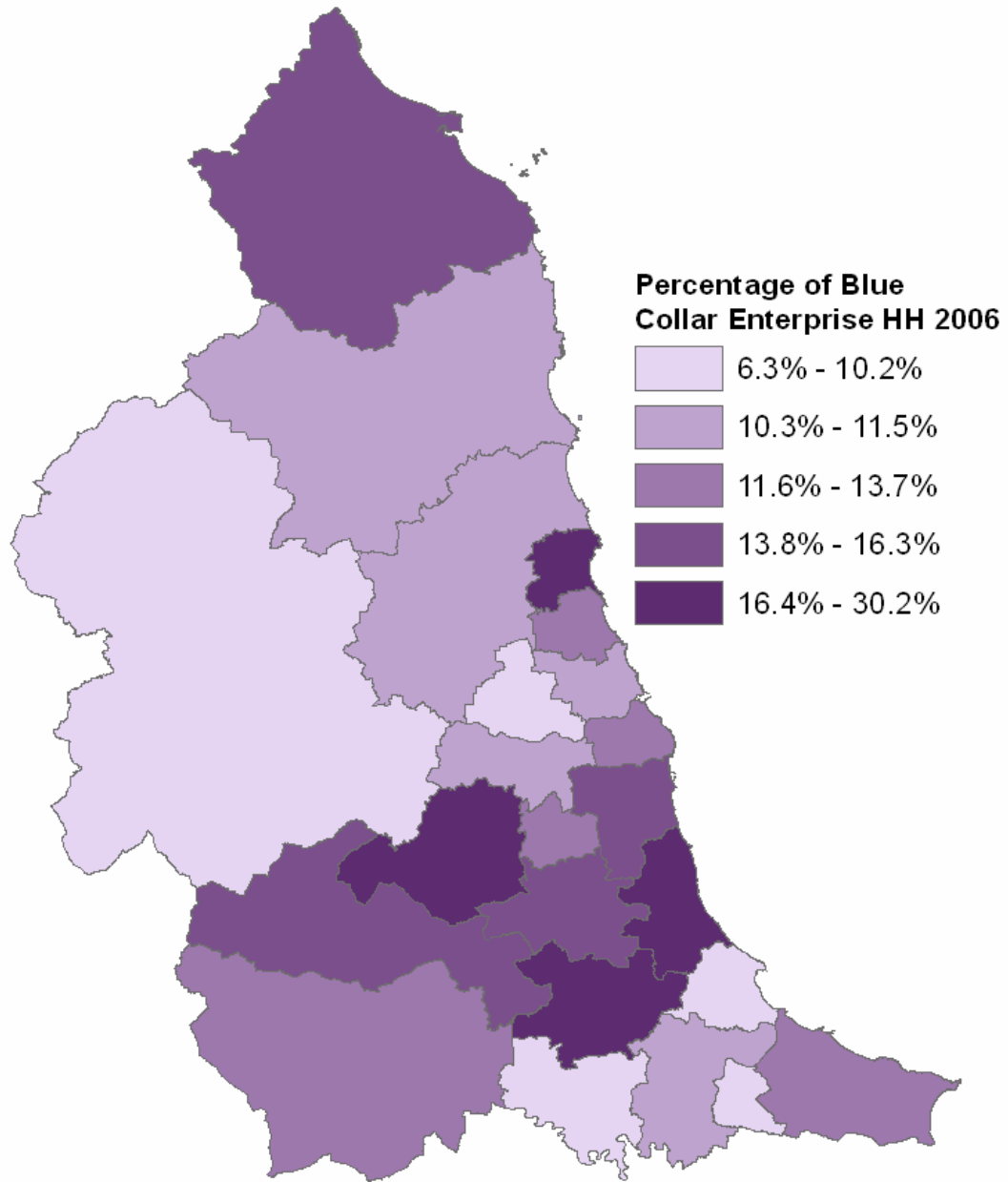
Percentage of Group F: Welfare Borderline Households
in Each Local Authority in the NE 2006



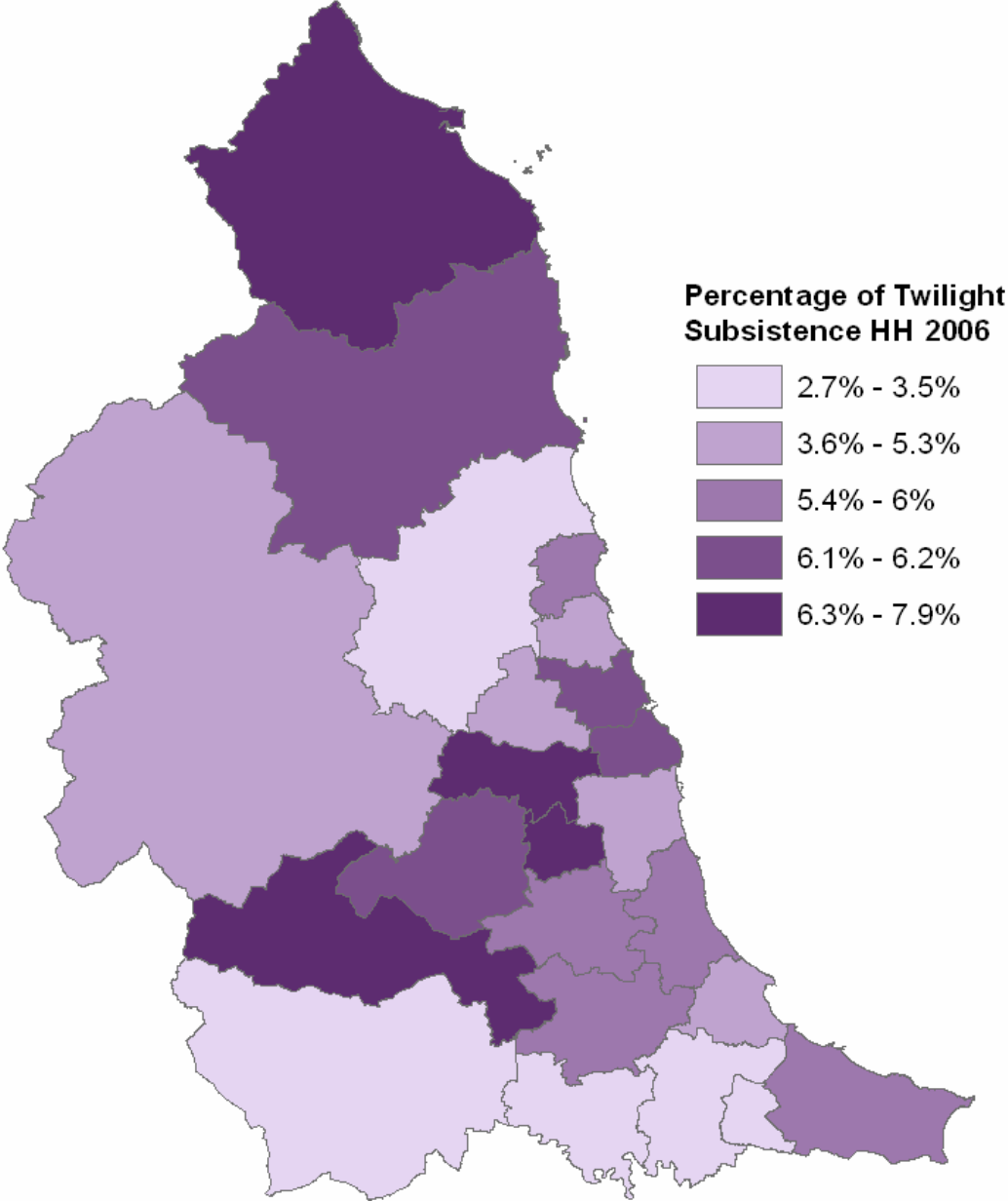
Percentage of Group G: Municipal Dependency Households in Each Local Authority in the NE 2006



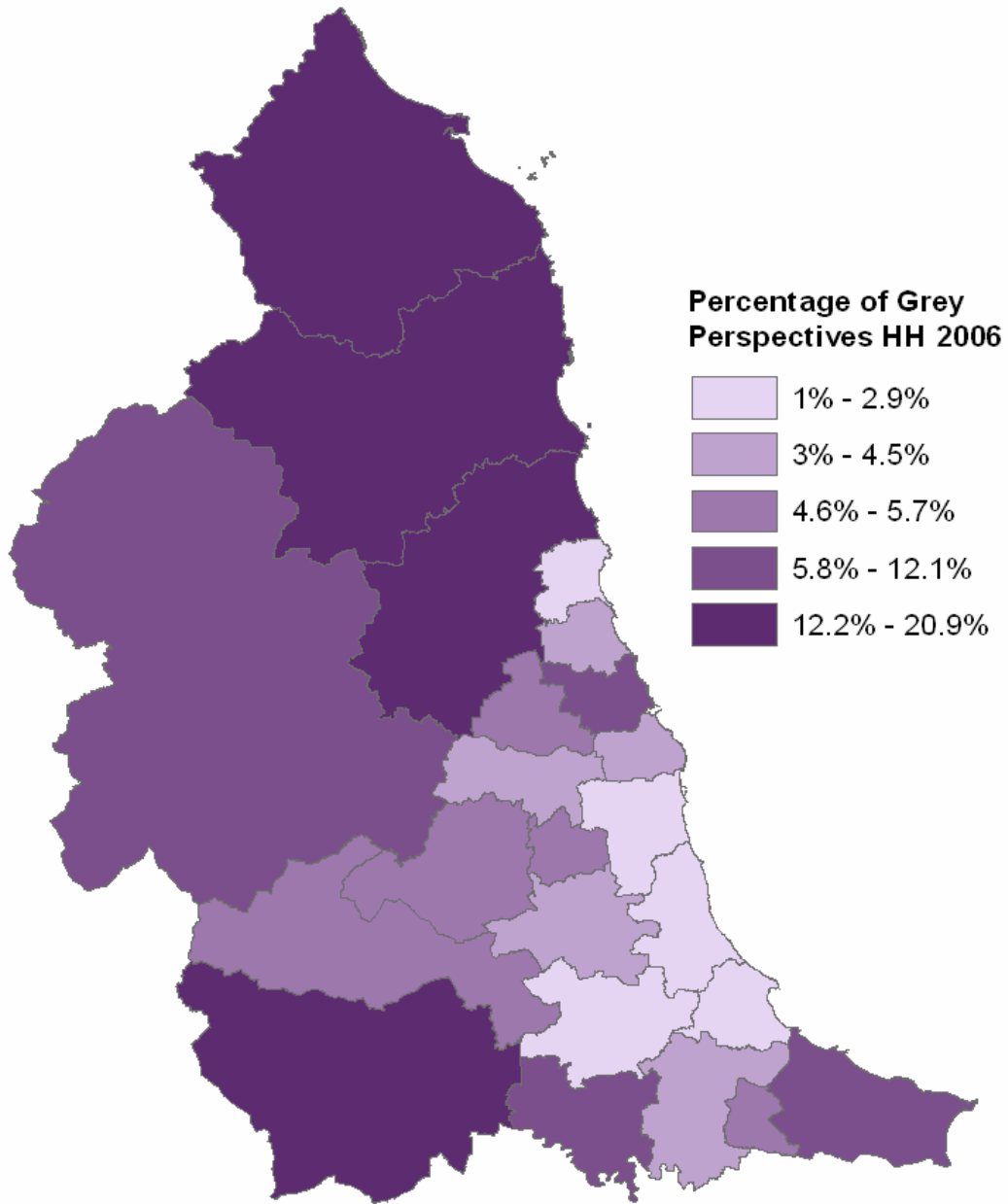
Percentage of Group H: Blue Collar Enterprise Households in Each Local Authority in the NE 2006



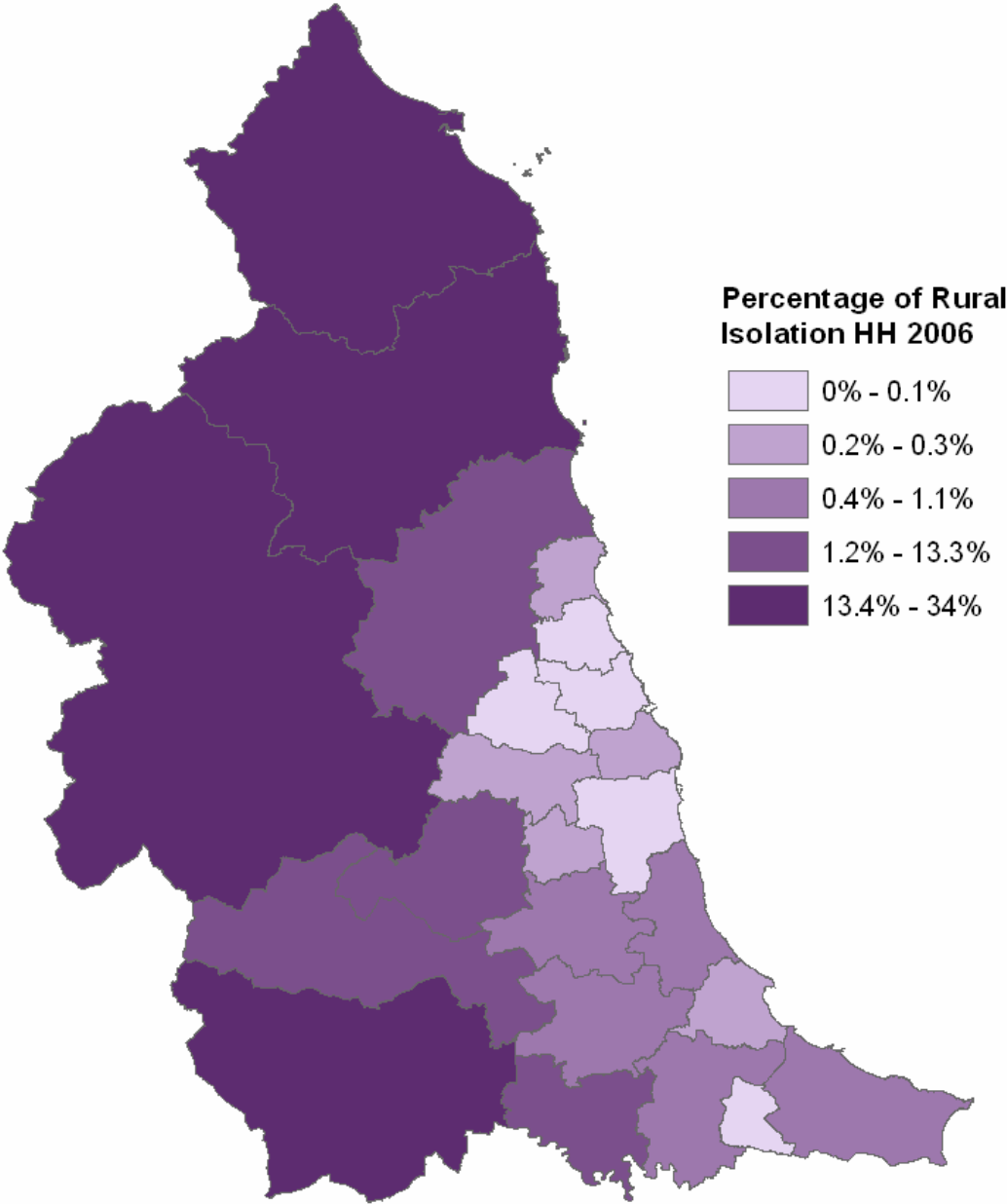
Percentage of Group I: Twilight Subsistence Households
in Each Local Authority in the NE 2006



Percentage of Group J: Grey Perspectives Households in Each Local Authority in the NE 2006



Percentage of Group K: Rural Isolation Households
in Each Local Authority in the NE 2006



Appendix C: Green Segments Area Profile

Green Segments is Experian's classification of attitude to and understanding of the environment and climate change. It segments all households in the UK into 10 groups. Each group can be mapped at individual, household and postcode level

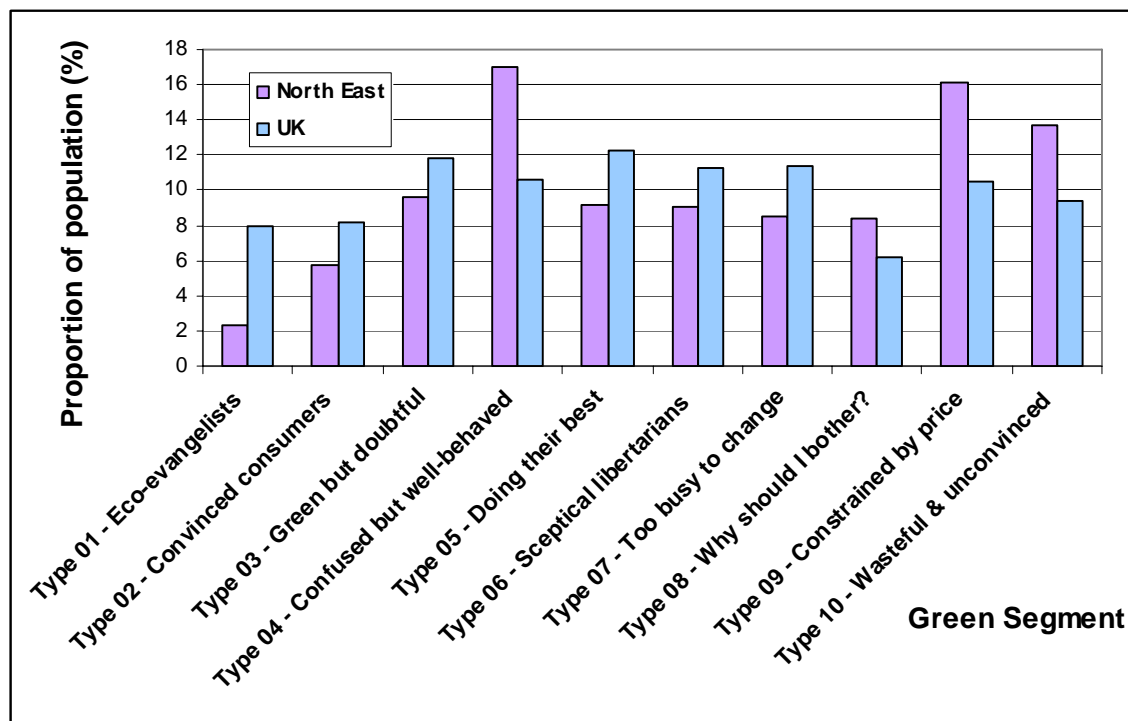


Figure C1: Comparison of make-up of North East and UK population by Green Segments.

2007 estimate for Adults 18+

Green Segment descending by proportion of North East population	North East %	UK %	Index
Type 04 - Confused but well-behaved	16.99	10.61	160
Type 09 - Constrained by price	16.13	10.49	154
Type 10 - Wasteful & unconvinced	13.73	9.41	146
Type 03 - Green but doubtful	9.65	11.87	81
Type 05 - Doing their best	9.14	12.21	75
Type 06 - Sceptical libertarians	9.09	11.26	81
Type 07 - Too busy to change	8.53	11.42	75
Type 08 - Why should I bother?	8.35	6.21	135
Type 02 - Convinced consumers	5.73	8.13	71
Type 01 - Eco-evangelists	2.35	7.97	29

Table C1: Ranking of Green Segments as proportion of North East and UK population.

2007 estimate for Adults 18+