1 Introduction

1.1 Seeking to guide the economy towards the 'high road'

Skills and performance

There has been a long-standing debate about the links between skills and economic performance. In recent years this has focused upon the different trajectories economies can follow, with particular emphasis on the contrast between the 'high-road to economic success', involving heavy investment in skills and other non-physical capital as opposed to the low road characterised by the vicious circle of the low-skill equilibrium.

1.2 Should we attempt to project future skills needs?

The meaning of the 'optimal skills mix'

The Leitch Review was asked:

- to examine the nature of long-term skills needs of business and the economy
- to examine the optimal mix of skills for the UK in order to maximise economic growth and productivity
- to consider the policy implications of this

This study aims to contribute quantified estimates to inform the Review. We begin with a discussion of what is meant by the 'optimal skills mix'.

Arguments from theory

Over the next two decades, changes in technology, and in the competitive position of other economies, will change the earning power of labour at different skill levels.

Global competition is undermining the earning power of low-skill workers

At the macroeconomic level, competition from low-cost economies will undermine the earning power of lower-skill occupations. This will directly affect producers of tradable goods and services, but there will be an indirect impact on producers of non-tradables too, because in the long-run these affect the cost base of producers of tradables. It could be argued, too, that this kind of competition is increasingly affecting higher-skill occupations, but the effect here is probably more to reduce a little the scarcity premium for these occupations; no one draws the conclusion that policy should encourage UK residents to shift out of these occupations. Technological change, and its rate of diffusion, is to some extent a response to these changes in the global economy, as it provides a way of raising labour productivity in high-cost economies.

A minimal-intervention strategy…

This is a well-known story, but it does not yield much insight for skills policy other than the simple conclusion that higher skills are better. It does not indicate which skills to encourage; one response to this is to be sceptical about the ability of government to 'pick winners' in the area of skills, and to limit policy to the roles of (a) encouraging people to be aware of and respond to market signals, and (b) giving them as much flexibility as possible through their formal education.

… and its limitations

But this places great faith in the capacity of individuals and firms to respond to these signals, and the evidence of the nature of present skills deficiencies does not engender confidence on this point. It assumes that the only market failures to be addressed are (a) imperfect information, and (b) the fact that the state dominates the provision of formal education. But if the skills problem arises, at least partly, because employers adopt strategies that are short-sighted with respect to product and skills development,

the weaknesses that policy needs to address go beyond what would normally be understood by 'imperfect information'.

Can we project skills needs by comparing the cost and return to investment in skills?

Nor does this simple macroeconomic story indicate the desirable ('optimal') rate of investment in skills. The traditional neoclassical view of growth treats investment in skills like any other kind of capital formation, and assumes that it is subject to diminishing returns. Hence, in principle a comparison could be made, for each skill type, between the (social) cost of investment and the (social) return, with the conclusion that investment should proceed until the return falls to match the cost. This would be the 'optimal' skills mix. This suggests, at least as a starting point, a comparison between the cost and return for each skill type at the present time, to indicate the ways in which the economy is presently deviating from the optimal skills mix.

But this assumes that employers are adopting optimal strategies, so that skills shortages are reflected in relative wages. Also, a focus on existing differentials gives no weight to future changes in technology and the pattern of trade in the global economy which the Review is trying to anticipate. A further complication is raised by the possibility of endogenous growth effects, in which case the assumption of diminishing returns may no longer apply.

We conclude that it is helpful to develop quantified projections of skills investment

In this study, therefore, we focus not on the task of calculating the social costs and return to investment in skills on present evidence, which is itself the subject of a substantial literature, but on the way in which quantified views on long-run trends in skills requirements can be developed.

1.3 Developing quantified views on long-run trends in skills requirements

Consider the following possible methods.

Gather qualitative information

One method would be to gather information from Sector Skills Councils (SSCs) about their assessments of recent trends and possible futures. This information would typically be qualitative, and often very specific, but would provide well-grounded 'bottom-up' information. Such assessments often suffer from excessive influence from very recent trends, but the same could be said of other methods.

We do not pursue this approach. Rather, we focus on quantitative methods, intended to complement a qualitative assessment, to give some idea of scale and a means of aggregating to allow summary lessons to be drawn.

Extrapolate occupational trends

One quantitative method of projecting trends would be as follows: identify the rate of growth in employment in different occupations over the past decade and extrapolate this into the future; then derive skill implications from the occupational trends. This assumes that the rate of change in the future will be similar to that observed in the past, but note that this includes implicitly the impact that skill shortages or inadequate demand have had on past trends: past trends might have been different if they were not constrained by labour availability or by the willingness of employers to adapt their strategies in ways that implied a greater demand for skilled labour.

How might a 'higher skill' future be constructed in this simple model? If the skills problem was entirely one of insufficient supply, and if the labour market worked primarily through relative wage signals, one could develop projections with stronger growth in occupations where pay differentials against the average have increased (on

the assumption that such pay differentials reflect shortages rather than a higher cost of acquiring the necessary skills; strictly the evidence here ought to cover this possibility as well). However, if the skills problem is at least partly one of weak aspirations and adaptation by employers, the occupations that 'ought' to see stronger growth in the future would not necessarily currently show signs of scarcity.

A drawback of this method of projecting trends in occupations is that it is not located within a broader context of changes in the wider economy. It would not be possible to demonstrate how the projected trends relate to a wider story (related, say, to globalisation, or technological change, and changes in industrial structure) to account for the projected changes in occupations. Nor would there be accompanying information on trends in particular sectors, which might facilitate comparison with information available from SSCs. Also, the analysis would not, on its own, yield implications for productivity growth.

Develop projections within a complete, structural economic model (MDM)

The approach that we have adopted for the SSDA in *Working Futures*[2] seeks to provide this fuller explanation. Trends in output and employment by industry are constructed within a full national accounting framework, so that each industry's performance can be explained in terms, for example, of trends in exports and imports (globalisation and competitiveness), in household tastes and preferences, and in technological change (growing or declining demand for a given product in final or intermediate demand). Employment in each industry depends on the past relationship with output growth and average earnings (which together determine labour productivity). Occupations are then projected on the basis of trends in each occupation in each industry. If the trends in employment by industry exactly matched the long-term historical average, the resulting projections for occupations would not differ from the simpler method which just extrapolates trends in occupations from the historical evidence alone. But there is an accompanying framework within which to understand what is driving at least part of the occupational shift (ie industrial structure, and the trends that are driving that), and there is a structure within which to effect other scenarios and see the implications for employment and occupations.

How investment in skills would affect economic performance if wage signals matter most

How might this broader structure be used to project a 'higher skill' future than in the 'business as usual' case already presented in *Working Futures*? The driver, in this case, is not that globalisation or technological change proceed more rapidly than under business as usual, but rather that UK firms demand, and UK residents acquire, skills to a greater degree than under business as usual. Again, if the skills problem was entirely one of insufficient supply, and if the labour market worked primarily through relative wage signals, a high skill future would involve a larger supply of workers at higher skill levels (with a depressing effect, relative to the business as usual case, on average earnings in the affected occupations), and a lower supply of workers at lower skill levels. Firms (and industries) which use higher skill levels more intensively would be able to expand more quickly because they would not be constrained to the same extent by skill shortages and because skilled labour is cheaper. At the lower end, the opposite effect would be seen.

[2] Wilson et al, (2005) *Working Futures 2004-2014*, SSDA Wath on Dearne.

…but the primary driver for improved long-term economic performance is unlikely to be lower unit labour costs

Cambridge Econometrics' structural model, MDM, includes equations for exports and imports by sector in which costs and prices affect competitiveness; in principle, therefore, one could make an assessment of the impact of an improved supply of skilled labour on the unit costs of the sector and then allow the export and import equations to determine the resulting boost to net trade and hence output of each sector. However, we doubt that the resulting effects would be substantial, because higher-value added activities compete more on quality than on price, and this is reflected in relatively low price elasticities of exports and imports of higher value-added products. In other words, the empirical results from the modelling confirm the views of other analyses of the skills issue that the benefit is not, primarily, one of reducing costs, but rather of improving the quality of the product and moving up-market. The observed prices for exports may well increase, rather than fall, and yet exports could still increase in real terms. However, data limitations prevent us from quantifying an explicit link between the level of skills and these improvements in quality and economic performance, either at the level of the macroeconomy and, all the more, at the level of particular sectors.

Since, therefore, we cannot rely on existing estimated relationships in the model to predict the impact of a higher (or lower) rate of investment in skills, a less mechanistic approach to developing the scenarios is required. Instead, we use the model to provide a framework within which to design alternative futures, in which assumptions about the rate of investment in skills and their relationship with economic performance at the sectoral level are introduced. This procedure is described in more detail in Chapter 2.

2 Methodology

This chapter sets out the methodology adopted in the study to produce the alternative skills scenarios. It begins with a brief discussion of the meaning of the term skill in the context of the present project. This is followed by a summary of the economic model used for the study, MDM, and the way in which it has been applied.

2.1 The meaning of skill

The meaning and measurement of skill

The discussion has tended to use the term skill rather loosely. This is not the place to develop a typology of skills but there is a need in detailed analysis and discussion to be clear about the particular type or class of skills being addressed.[3] The main ways that skills are usually measured are in terms of occupation or qualification. Both have the merit of being relatively straightforward to measure and readily understood.

More recently there has been much greater emphasis on what are termed (variously) key, core and generic skills. These include things like:

- literacy and numeracy;
- general management skills;
- communication and customer handling skills;
- information handling skills;
- teamworking, etc.

These types of skill are frequently emphasised when employers are asked about their skill needs. Unfortunately these terms are nowhere near as well established as occupation and qualification, either in terms of a consensus about what they mean nor on how best to measure them.

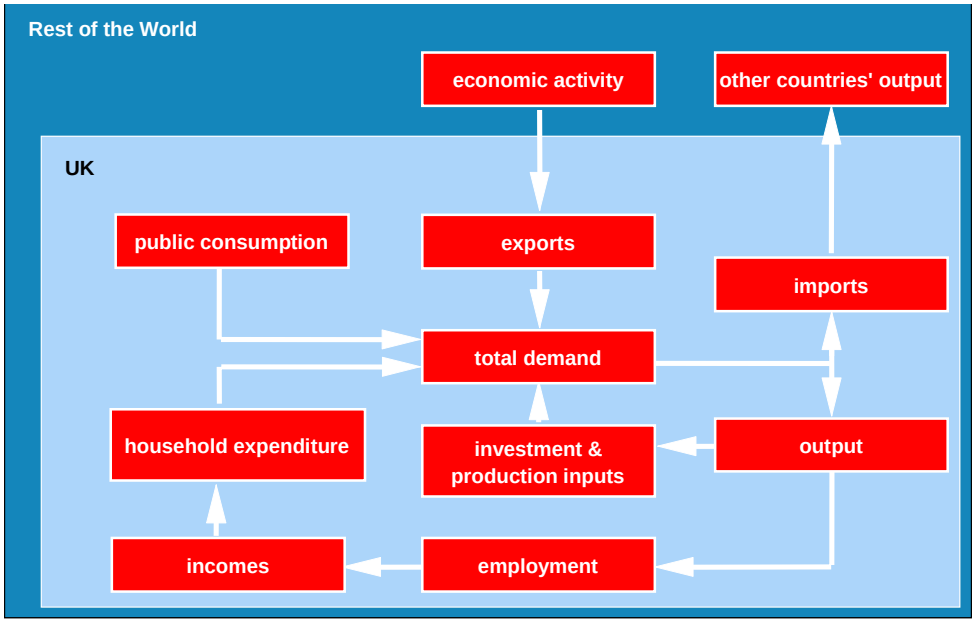
In the present analysis the focus is upon the occupation or qualification structure of employment since this is relatively straightforward to measure. However, much of our thinking about how skills might be linked to productivity and performance, implicitly at least, also relies on these more general and qualitative aspects of skill.

2.2 The Cambridge Multi-Sectoral Dynamic Model (MDM)

MDM is a large-scale economic model with substantial sectoral detail. The model has an essentially Keynesian logic, in which output in each sector is determined by the difference between demand for the sector's products and the level of imports. The sources of demand are the usual components of final demand, disaggregated by product, together with the demand for inputs to production, as shown in Figure 2.1, which also shows the main expenditure loops in the model.

[3] These issue are discussed in more detail in, for example, *Skills In England, 2004* (Wilson *et al.* 2005).

FIGURE 2.1: DETERMINATION OF OUTPUT AND EMPLOYMENT IN MDM



How employment is determined

There are separate equations to determine employment in MDM for each region and sector. The principal drivers of employment are the level of output (in each region and sector) and the level of wages relative to each sector's own price. These equations do not distinguish labour of different quality (skills) because there are insufficient time series data to support this.

Further disaggregation by occupation and qualification

For *Working Futures*, the results for employment by sector are disaggregated by occupation by applying occupational shares which are specific to each sector. These shares are projected forward on the basis of historical trends. The projections of employment by sector and occupation are then used to drive projections for workers of different levels of qualification, using historical data on the skill (qualifications) requirements of each occupation in each sector.

2.3 Adaptations required for the present skills projections

The nature and mechanism of the expected effects

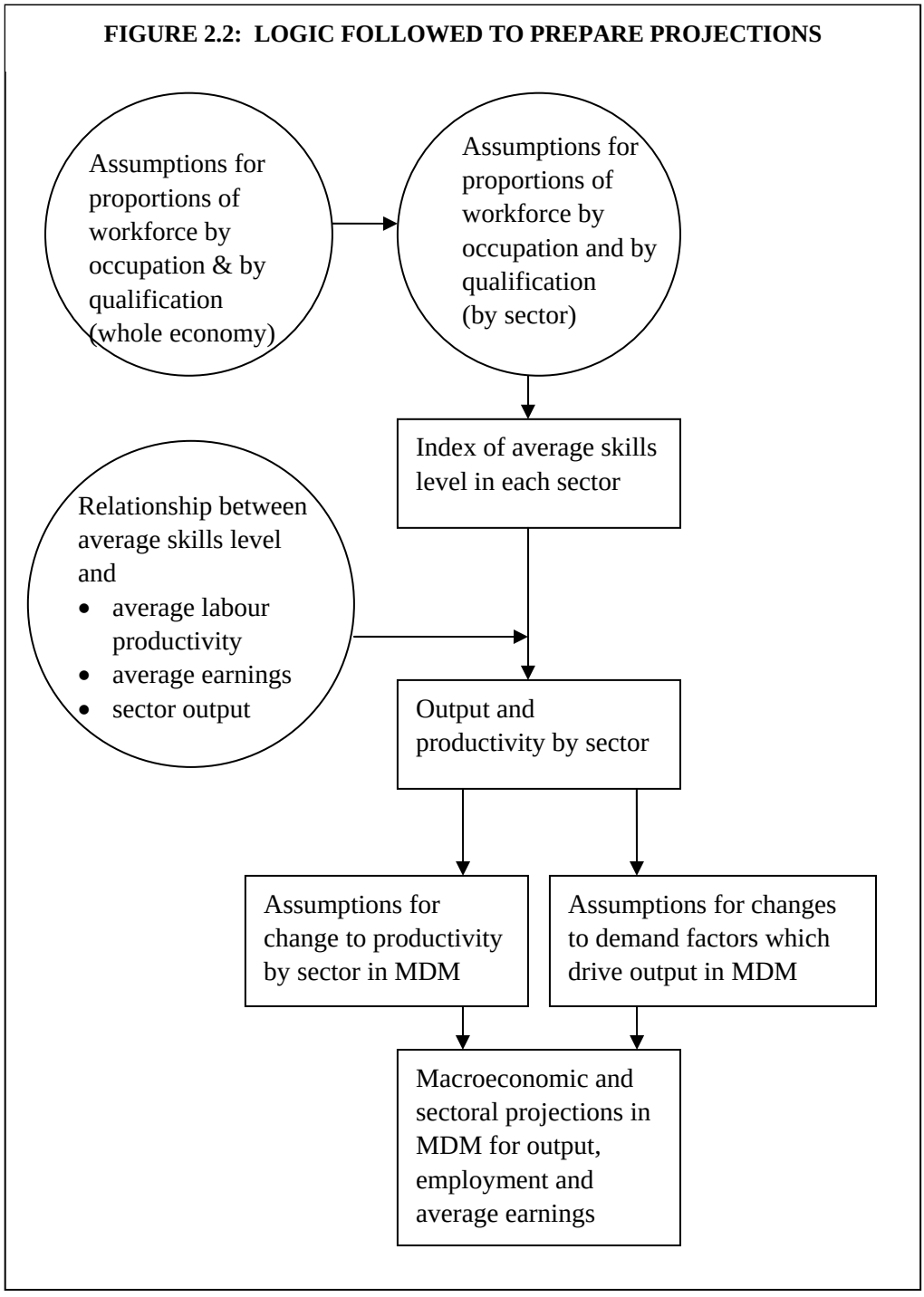
The present exercise requires the following logic of causation. Assumptions are made for changes in the availability of workers with different skills levels. A more highly-skilled labour force results in a higher level of observed labour productivity. As discussed in Chapter 1, in principle there is then an impact on unit labour costs and hence on prices and competitiveness, but in practice the scale of such effects is empirically small, and significant only in commoditised sectors which compete mainly on price.

For the economy as a whole, the more important effects of improved skill levels and productivity are (a) a higher level of output, representing the impact of higher skill levels on the quality of products and the capacity to innovate, and (b) a higher level of average earnings.

Sectoral differences

For individual sectors, the story is more complicated because a higher-skill future of this kind is associated with restructuring, as follows. Activities which require low-skill inputs are put under pressure by the rising level of average wages in the economy, and the lower number of low-skilled workers available. If these activities are in highly-traded sectors, so that they are susceptible to global competition from low-cost economies, the result is a reduction in output and an accelerated reduction in employment (typified by some parts of textiles and clothing). If the activities are in sectors where there is little trade, the outcome depends upon the sensitivity of demand to changes in price: if demand is not price sensitive (and, typically, if it is also

FIGURE 2.2: LOGIC FOLLOWED TO PREPARE PROJECTIONS



income-elastic), the activity will be able to pay higher wages and pass this on to customers in higher prices (a possible example being health care, although this is complicated by the dominant role in provision played by the National Health Service); if not, there will be substitution of demand away to other products in response to higher prices and output of the activity will fall (typified, say, by domestic service, at least until recently), or ways will be found to raise productivity through a mixture of capital investment and promotion of self-service (as in retailing).

The process followed in the present study

The process that we have followed in this study is summarised in the diagram in Figure 2.2.

We begin by making assumptions for the proportions of the workforce at different skill levels for the economy as a whole. These represent the inputs to answer the question: what would the economy look like with a different trajectory for skills development in the UK? We then produce similar assumptions by sector which are consistent with the whole-economy total. We apply weights (based for example, on the pay differentials between different qualifications levels) to produce an estimate of the average skill level by sector (or, equivalently, the impact that a shift towards higher qualifications has on the volume of 'constant quality' labour input).

We then develop views on the impact of improved labour quality on each sector's level of labour productivity, average earnings and output. The impact on labour productivity may be assumed to be equal to the change in constant quality labour input that is attributable to higher qualifications (if we accept the usual neoclassical assumptions), or it may be determined by the results of a separate empirical exercise which investigates the evidence for the scale of such effects. A similar procedure is used to relate the labour quality index to average earnings and output growth.

We then make adjustments to the demand drivers in MDM which determine output in the model. For example, in a globalised, low-cost industry such as textiles and clothing, the adjustment comes mainly in the form of higher import penetration (at least partly offset by higher exports, if what is left of the industry succeeds in shifting to higher value-added products), whereas for a globalised high R&D sector the adjustment is made through higher exports. At the same time, adjustments to the model's labour productivity outcomes are needed to represent the assumed impact of skills on productivity. The result is a complete structural representation of how the economy might look for the given skills scenario.

3 Review of Historical Evidence

3.1 Links between skills and performance

This section sets out the theoretical basis and reviews empirical evidence to support the assumptions for the modelling about the impact of improved skills on economic performance.

The more demand-oriented approach to skills now being adopted in government represents a significant change from the supply-side dominated strategies of the past. The review by Porter for the DTI (Porter 2002) and the recent conference organised by the Sector Skills Development Agency as well as a range of other reports and research summarised below highlight the fact that there is an increasing realisation that it is necessary to stimulate employers' demands for skills as well as skills supply, if the economy is to avoid or escape from the so called 'low-skills equilibrium' (Hogarth and Wilson, 2003).

On balance, the evidence available suggests that many UK firms operate in lower quality niches of the market, using lower skill levels, than, for example, their German counterparts. Persuading UK companies to move up-market is unlikely to occur with policies operating solely on the supply side.

The *Working Futures* projections of changing skill needs in the British economy prepared on behalf of the SSDA are based on the use of the CE macroeconomic model. They assume 'business as usual' and a continuation of current policies and patterns of behaviour. As noted in Chapter 5 this therefore implies a considerable and continuing improvement in skill acquisition and deployment. The alternative scenarios developed in this report attempt to compare this with what might be achieved if further improvement could be made on this front. The underlying rationale for this is set out below.

Alternative systems for bringing about the appropriate level of skills development

A variety of systems for workforce development are in operation in different countries. At one extreme, are countries like the US which principally use the market mechanism to equate the demand for skills and supply of skills to meet that demand. At the other extreme, are countries such as Singapore, where the state effectively coordinates both the demand for and the supply of skills. Each system has its advantages and disadvantages.

In a perfectly competitive neoclassical world of full information the market can be relied upon to deliver a optimal solution. Even in a less than perfect world a more market-orientated approach, in which employers signal their excess demand by increasing the amount they pay for skills in relatively short supply, may have considerable advantages such as flexibility. However in the real world of imperfect competition and less than complete information such an approach may fail to recognize the longer-term needs of the economy and society as a whole. It can also be slow to adjust to shortages of skills.

The alternative to the market-led approach is where the State intervenes to co-ordinate supply and demand for skills, as exemplified by Singapore. Intervention there takes place at many levels and, in the case of Singapore at least, has facilitated rapid economic growth. However such systems can be inflexible. They also rely on the correct identification of the appropriate target industries and skills for the future

(optimal skill needs). This is much easier in a small homogenous country, where there is strong centralised control.

The importance of high performance work practices

Economic performance it is not simply about acquiring skills but also optimising their use. This has been assessed in research about the relationship between high performance workplaces, high performance work practices and skills. This body of evidence has been reviewed in the SSDA's *Skills Pay* (Tamkin, et al. 2004). *Skills in England 2003* (Chapter 7) also provided an extensive discussion of the issues relating to organisational effectiveness and investment in skills. Overall, the evidence points to a strong relationship between skill development and the adoption of high performance work practices (HPWs). The variety of skills HPWs invest in depends upon the nature of their business. But the evidence suggests that if skills are to be effectively deployed there needs to be in place a set of complementary human resource practices that allows employees to deploy their skills in the interests of the business.

How skills improve national economic performance

Recent research suggests that skills matter in relation to the national economy in two main ways.[4] First, productivity differences between countries can be at least in part attributable to differences in skill structures. About 20% of the difference in productivity *per* hour worked between the UK and France and Germany has been attributed to the use of more highly skilled workers in the latter countries. Second, and perhaps more importantly (but undoubtedly more difficult to measure), is the impact of skills in affecting the capacity to identify and capture high value-added markets.

Evidence on the rate of return to qualifications shows that there is still a premium for the individual associated with obtaining additional qualifications. What the second factor suggests is that there may be significant external benefits from the acquisition and use of skills beyond their direct benefit to the individual in terms of higher pay.

Identifying precisely what skills to invest in, whether by the individual, the employer or the State is difficult. Evidence that employers (as opposed to individuals) benefit from investing in training and skills has often proved elusive. However recent evidence suggests that many employers report that investment in their employees is essential to the production of their goods or services. Such investment in training and skills attention is often linked to high level work practices and high performance workplaces.

HM Treasury's *Benchmarking UK Productivity Performance* (p.21), outlines five main drivers of productivity:[5]

- **investment**, increasing the stock of physical capital;
- raising **skill** levels to create a more flexible and productive workforce;
- science and **innovation**, to develop new technologies and improve efficiency;
- promoting **enterprise** through measures aimed at removing barriers to entrepreneurship and developing an enterprise culture; and
- improving **competition**, which promotes flexible markets and increases business efficiency and consumer choice.

4 For a review see *Skills in England 2003* and *Skills Pay*.

5 The Performance and Innovation Unit (PIU, 2001) has identified a similar set of drivers. See *In demand: Adult skills in the 21st Century*, and the follow-up report published by the Strategy Unit (2002).

Skills may play a key role in all of the last three drivers as well as the explicit role set in the second driver. Employers may demand higher skills to enable them to meet business objectives more effectively (in the private sector developing new products and new markets, in the public sector, improving efficiency and quality of service provision).

Reviews such as *Skills in England 2003* and the *Skills Pay* report, produced by the SSDA, have emphasised that improving skill supply and skill utilisation alone will not necessarily improve economic performance. But without the necessary skills, investment, innovation, and enterprise – which all lead to improved competitiveness - are unlikely to materialise. Therefore, skill is in a key sense the most important of all the drivers of productivity performance.

Evidence to support the assumptions for the scenarios

As noted in Section 2.3 above, intervention in the model requires some specific assumptions about the impact of changes in labour quality on labour productivity, output and earnings. If the rate of growth in all other factors is held constant, but labour quality increases both output growth and productivity growth are likely to increase. However, it is possible to think of a variety of scenarios in which the relative scale of such effects varies. On the basis of past experience of structural change in the economy, they will certainly differ across sectors. Skill improvements could be translated into productivity gains without much or any increase in output, resulting in a fall in employment. In this case improved quality of labour would raise productive efficiency, but would not affect demand for output through product quality gains. Employment levels are reduced even though, in principle, lower costs might stimulate demand for the sector's output to some degree; in practice, as the UK specialises in higher value-added activities, the size of such price elasticities of demand is often small. In other cases, where the improved quality of labour results in an improved quality of output as well, this is likely to increase the volume demanded and/or increase the price consumers are willing to pay. In such circumstances employment levels may rise. Taking account of interactions across the economy, we could even expect to observe a *decline* in output in some sectors under a higher-skill scenario: as higher skills leads to a rise in the general level of wages in the economy, firms in low value-added activities have to pay more and respond in part by changing the character of jobs to raise productivity, but also by exiting from activities that are no longer viable.

The present study has briefly reviewed the literature linking labour quality/human capital and productivity. The aim was to try and isolate empirical results that provided or could be used to calculate the elasticity of labour productivity with respect to changes in labour quality as measured by skills. Similar elasticities were also required showing the effect of labour quality (skills) on the demand for the sector's output demand and average wages in the sector

While there is much research evidence showing such a linkage between skills and performance as measured by output or productivity growth, the vast majority of it does not allow the calculation of such an elasticity for reasons set out below. The results which did allow such an elasticity to be calculated differed widely with respect to the magnitude of the estimates. The most relevant evidence suggests that the elasticity of productivity with respect to labour quality ranges from 0.6 to 1.7. The present study adopts unity, which is also consistent with a neoclassical worldview.

Exactly the same problems arise in trying to measure the effect of improved qualifications on earnings. However, the measure of labour quality preferred in this study is an earnings-weighted measure, where the different proportions of individuals with different qualification levels are weighted by the relative numbers of individuals holding those qualifications. Thus, by implication the quality measure is effectively an average earnings measure, and a 1% rise in quality results is by definition associated with a 1% rise in earnings. In addition, it can be shown that, when real earnings levels are constant for each qualification level, the index is driven entirely by the rates of change in the proportions holding each qualification level. This, again, is consistent with a neoclassical economic view of the world in which factors are paid their marginal products.

When considering possible impacts on output the available evidence is less helpful, probably because studies typically focus on particular firms or sectors whereas the outturn reflects whole-economy structural changes. Many studies suggest a qualitative link between investment in skills and other aspects of human capital and the quality and specification levels of products and services produced, which supports the principle that investment in skills is associated with a shift in specialisation towards higher value-added activities, but this could be associated either with a recovery in the scale of an underperforming sector or a greater focus on a smaller range of more profitable activities (eg design rather than production).

Empirical evidence on the link between labour quality and performance

There are many studies that provide evidence of relationships between skills and performance, but, as will become apparent, very few of them do so in a way that provides the information needed for the analysis undertaken here. For example, a recent international comparative study of the effects of qualification levels on productivity using econometric techniques on a detailed sectoral panel data set (Jagger, *et al*. 2005), focuses on relative total factor productivity, whereas intervention in the model is via labour productivity.

Other evidence exists linking education and skills with productivity performance. For example, research by the Institute of Fiscal Studies (IFS) suggests that a 5 pp increase in the proportion of workers trained raises value added per worker by 4%. The National Institute of Economic and Social Research (NIESR) matched plant study (extending over two or more decades) provides consistent evidence that UK producers tend to produce lower quality goods and to be less productive. In addition, they suggest that skills gaps are an important contributory factor to these differences in productivity performance, accounting for as much as a fifth of the productivity gap between the UK and Germany.

Another obvious place to look for the evidence linking labour quality to productivity is the growth accounting literature. There are a number of problems with this, however, as demonstrated below. In essence, these are as follows

- most studies do not deal with labour quality
- many of those that include labour quality do so via a measure of quality adjusted person hours, rather than having separate contributions for quality and person hours
- studies that do deal with quality do not report all of the information necessary to construct the required elasticities.

A simplest form of the growth accounting model is,

$$\frac{1}{Y}\frac{dY}{dt} = \frac{wE}{pY}\left(\frac{1}{E}\frac{dE}{dt}\right) + \frac{w_q E_q}{pY}\left(\frac{1}{E_q}\frac{dE_q}{dt}\right) + \frac{rK}{pY}\left(\frac{1}{K}\frac{dK}{dt}\right) + \frac{r_q K_q}{pY}\left(\frac{1}{K_q}\frac{dK_q}{dt}\right) + \frac{1}{A}\frac{dA}{dt}$$

where Y is real value added (a measure of output), E is person hours, K is the physical capital input, E_q is the quality of labour, K_q is the quality of capital. In addition, p is the price per unit of output, w is the wage per person hour, r is the price of physical capital, and w_q and r_q are the premia paid for additional labour quality and capital quality respectively. Finally, A is the residual factor.

The above equation indicates that the rate of growth of output (value added) is a function of the rate of growth of each input weighted by its share of costs or revenues. It also indicates that the rate of growth in physical total factor productivity is a function of the weighted sum of the contributions made by labour and capital quality. In addition, there can be a residual not accounted for by the above factors.

It is possible to illustrate results which include labour quality using the work of Jorgenson and Fraumeni (1992). The empirical estimates are for the US over the period 1948 to 1986, as well as for a number of sub-periods. Their principal results are set out in Table 3.1. The contribution of labour quality to output growth is 0.75 pp and labour quality contributes about 25% of US growth over this period (this compares with 10% in earlier estimates published by Jorgenson, *et al.* (1987).

The problem is that it is very difficult to use this result in terms of the present exercise. It can only really be used if information is available about how much labour quality changed in the US, from which it would then be possible to construct an elasticity of output with respect to labour quality.

Unfortunately, none of the main studies provide estimates of the rate of growth in labour quality to enable the elasticity to be calculated. Two studies offer at least some insights. Jorgenson (2004, p. 31) provides some broad estimates for the G7 economy.

TABLE 3.1: CONTRIBUTIONS TO US ECONOMIC GROWTH

Growth and source of growth	1948-86
Value added growth	2.93
Capital input	3.35
Labour input	2.20
Contribution of labour	1.79
Of which	
Contribution of labour quality	0.75
Contribution of labour volume	1.04
Contribution of capital	0.65
Of which	
Contribution of capital quality	0.10
Contribution of capital volume	0.55
Residual productivity growth	0.50

TABLE 3.2: CONTRIBUTION OF LABOUR QUALITY TO LABOUR PRODUCTIVITY

Year	US	Canada	UK	France	Germany	Italy	Japan
Contribution							
1980-89	0.30	0.40	0.12	0.24	0.26	0.23	0.87
1989-95	0.36	0.55	0.49	0.61	0.33	0.38	0.54
1995-01	0.23	0.18	0.30	0.19	0.23	0.35	0.21
Elasticity							
1980-89	1.70	1.95	1.75	2.29	1.62	1.70	1.71
1989-95	1.69	1.93	1.65	2.41	1.67	1.66	1.70
1995-01	1.65	2.11	1.77	2.37	1.78	1.71	1.71

The contribution of labour quality to labour productivity growth is set out in Table 3.2, along with the associated estimates of the elasticity of labour productivity with respect to labour quality growth. These results suggest high elasticities, broadly consistent across countries. The elasticity of labour productivity with respect to labour quality for the UK is around 1.6-1.8.

A study by Oliner and Sichel (2002), which only reports results for the US shows elasticities much lower than those reported by Jorgenson (see Table 3.3).

Neither source directly defines the method of constructing labour quality. It is not clear, therefore, whether the considerable differences in estimates of the elasticities between the two studies are linked to measurement issues. Thus, the extremely limited literature that allows an estimate of the elasticity of labour productivity with regard to labour quality suggests a value of between 0.6 and 1.7 for the US. The present study adopts a value of unity.

3.2 The scale of increase in skills

Over 1994-2004, the proportion of workers with higher-level qualifications has increased. According to LFS data, the proportion of workers with NQF[6] level 3 or above rose from 39% in 1994 to 49% in 2004. The proportion that did not even have NQF level 1 fell from 18% to 11%.

TABLE 3.3: CONTRIBUTION OF LABOUR QUALITY TO LABOUR PRODUCTIVITY

	1974-1990	1991-1995	1996-2001
Contribution	0.22	0.45	0.25
Rate of growth of labour quality	0.32	0.65	0.38
Elasticity	0.69	0.69	0.66

[6] NQF stands for National Qualification Framework.

Constructing a skills index summary measure

We can construct a single 'skills index' by weighting together the number of workers having different qualifications. We have explored three alternatives for the weights to be used. If we use years of schooling, this tends to give only modest differences in 'skill level' between different levels of qualification, because everyone has 11 years of compulsory education. At the other extreme, if we use simply NQF numbers (0-5), this gives very strong differences in skill level between different levels of qualification (for instance, someone who has not attained NQF level 1 is treated as having zero skills).

A third method adopts the usual neoclassical assumptions in order to determine the relative productivity of people holding different levels of qualification, by using relative earnings as weights, and this is the measure used in the results presented in this report. The index is constructed as

$$Q_t = \sum_{i-0}^{5} w_{it} \, E_i$$

where Q_t is the value of index in year t, w_{it} is the proportion of individuals with that qualification level in year t and E_i is their level of earnings. If, as assumed here, the level of earnings for each qualification level is given, then the rate of change in average earnings is the same as the rate of change in the quality index, and is driven wholly by the change in the qualification mix:

$$\frac{1}{Q_t}\frac{dQ}{dt} = \sum_{i-0}^{5} \frac{w_{it} \, E_i}{Q_t} \frac{1}{w_{it}} \frac{dw_{it}}{dt}$$

In practice, changes in earnings may take place for other reasons, for example, as increased numbers of individuals with higher qualifications compete with one another in the labour market. The productivity of individuals at a given level of qualifications might also vary across sector. However, a general measure for all sectors seems a reasonable starting point. The index is based on fixed weights taken from the LFS for 2004. The index can therefore be interpreted as an average pay measure in 2004 prices. The weights used are shown in Table 3.4.

Applying these weights to the data for 1994-2004, the skills index increases by nearly 9% over the decade. Put another way, if we accept the usual neoclassical assumptions, output per worker was 9% higher in 2004 than it would have been if there had been no improvement in labour quality.

Changing patterns of skills requirements

The patterns of employment by occupation and by qualification have changed dramatically in the UK over the past few decades. Chart 3.1 illustrates trends by occupation. Higher level occupations such as managers and professionals have seen large increases in employment while less skilled occupations have seen declines.

The reasons for the changes in occupational employment structure observed over the last two decades are complex. A major factor is structural change in the economy which affects the industrial mix of employment. The changing fortunes of different sectors, as represented by the macroeconomic model and discussed above are a key driver of occupational change. The other main factors, such as technological and organisational change, are represented by changing occupational mix within sectors.

TABLE 3.4: EARNINGS WEIGHTS USED IN CONSTRUCTING THE SKILLS INDEX

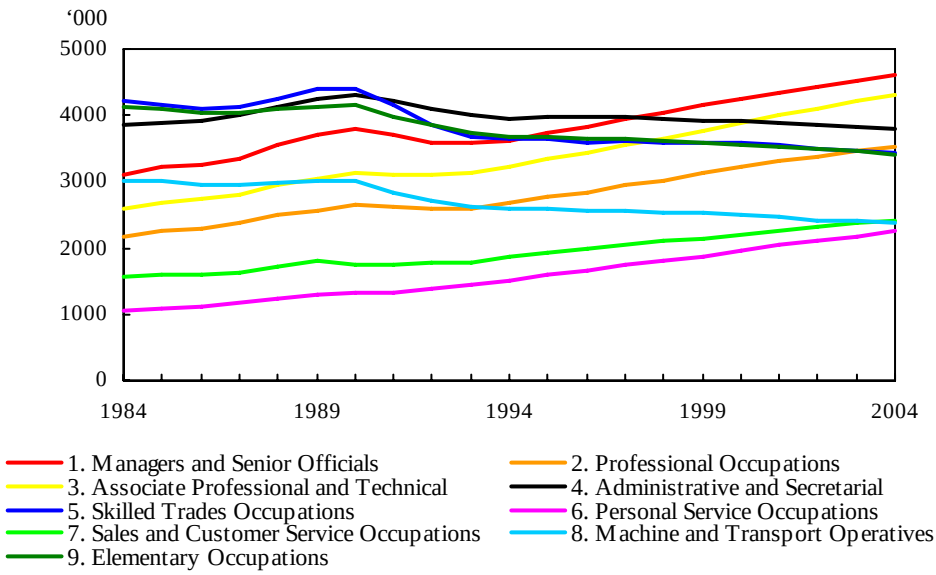
	weight average weekly pay (£)
NQF 5 , Higher degree	629
NQF 4 , First degree & equivalent	548
NQF 4 , HE below degree level	393
NQF 4 , HNC BTEC & RSA higher etc	461
NQF 4 , Nursing and teaching	363
NQF 3 , A level & equivalent	341
NQF 3 , GNQF advanced	361
NQF 3 , ONC BTEC national etc	292
NQF 2 , GCSE(grades A-C)	284
NQF 2 , GNQF intermediate	318
NQF 2 , BTEC 1st diploma etc	264
NQF 1 , GCSE (below grade C)	274
NQF 1 , GNQF foundation	228
NQF 1 , BTEC 1st certificate etc	236
No Qualification	226

Source(s) : LFS 2004.
Ref : (uk-ind QualOccTSInd00).

The key features of recent historical change have been:

- rising employment levels and shares for higher level, white-collar groups such as
  - managers & senior officials
  - professional
  - associate professional & technical occupations
- rapid increases for leisure related and other personal service occupations
- growth and then decline in employment for administrative, clerical & secretarial occupations
- declining employment levels and shares for most blue collar/manual occupations

CHART 3.1: OCCUPATIONAL PROFILES, 1984-2004



Source(s) : IER estimates, *Working Futures 2004-2014*.

CHART 3.2: CHANGING QUALIFICATIONS OF THOSE IN EMPLOYMENT, 1994-2004

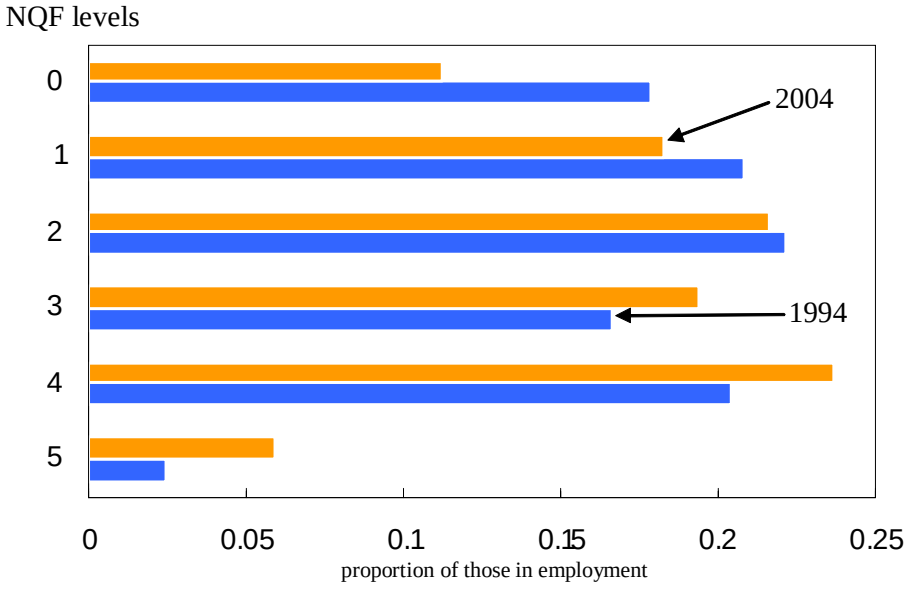


TABLE 3.5: GROWTH IN SKILLS INDICES BY SECTOR AND GENDER, 1994-2004

% pa

	NQF levels			years of schooling			earnings weights		
	males	fem	total	males	fem	total	males	fem	total
1 Agriculture	1.9	2.4	2.0	0.4	0.6	0.4	0.5	0.9	0.6
2 Mining & quarrying, utilities	1.0	1.4	1.1	0.4	0.4	0.4	0.6	0.6	0.6
3 Food, drink & tobacco	1.4	2.5	1.8	0.4	0.6	0.5	0.7	0.9	0.8
4 Textiles & clothing	2.1	4.8	3.6	0.5	0.9	0.7	0.8	1.1	1.0
5 Wood, paper, printing & publishing	1.5	1.9	1.6	0.5	0.5	0.5	0.8	1.0	0.9
6 Chemicals, & NMMP	1.1	3.8	1.8	0.4	1.1	0.5	0.5	1.7	0.8
7 Metals & metal goods	1.2	4.8	1.7	0.3	1.0	0.4	0.5	1.6	0.6
8 Engineering	0.7	2.9	1.2	0.3	0.6	0.4	0.5	1.0	0.6
9 Transport equipment	1.5	3.2	1.7	0.5	0.8	0.5	0.8	1.3	0.9
10 Manufacturing nes & recycling	0.8	2.5	1.2	0.2	0.5	0.3	0.2	0.7	0.3
11 Construction	0.4	2.5	0.6	0.1	0.6	0.2	0.3	1.0	0.3
12 Sale & maintenance of motor vehicles	0.7	1.5	0.9	0.2	0.3	0.2	0.2	0.5	0.3
13 Wholesale distribution	1.0	2.3	1.4	0.3	0.6	0.4	0.5	1.0	0.7
14 Other retail distribution	1.2	2.8	2.1	0.3	0.6	0.5	0.5	0.8	0.7
15 Hotels & catering	0.8	2.4	1.8	0.2	0.5	0.4	0.4	0.7	0.6
16 Transport	0.3	1.8	0.6	0.1	0.5	0.2	0.3	0.7	0.4
17 Communications	1.8	3.2	2.2	0.5	0.8	0.6	0.9	1.1	0.9
18 Banking & insurance	1.4	1.8	1.6	0.6	0.5	0.6	1.1	1.0	1.1
19 Professional services	0.8	1.9	1.2	0.3	0.6	0.4	0.4	1.0	0.6
20 Computing services	0.5	1.5	0.8	0.3	0.6	0.4	0.6	1.2	0.7
21 Other business services	0.4	2.0	1.1	0.2	0.6	0.4	0.2	1.1	0.6
22 Public administration & defence	1.3	2.0	1.6	0.5	0.7	0.6	0.9	1.2	1.0
23 Education	0.7	1.1	0.9	0.4	0.5	0.4	0.5	0.8	0.7
24 Health & social work	0.6	1.8	1.6	0.2	0.5	0.5	0.4	1.0	0.9
25 Miscellaneous services	1.2	2.5	1.9	0.4	0.7	0.6	0.6	1.0	0.8
All industries	1.1	2.4	1.6	0.4	0.7	0.5	0.6	1.1	0.8

Source(s) : IER estimates based on Labour Force Survey.

The three weighting methods described above have been used to construct skills indices for each of the 25 sectors. Table 3.5 shows the historical annual growth rates for all three indices. The increases between 1994 and 2004 are least for males, using the school-year weighted measure and most for females using the NQF level-weighted indicator. The increases over the whole decade for all three measures, across all industries, for males and females combined (in the assumptions developed for incorporation into MDM gender is ignored), are:

- NQF weights =18%
- years of schooling weights =5%
- earnings weighted =9%

The results obviously vary by sector, with some showing little or no increase and in a few cases declines. These tend to be sectors where qualification profiles are already highly qualified such as Computing Services and Education.

3.3 Macroeconomic trends

Table 3.6 summarises trends over the decade 1994-2004 in the growth of value added, in various measures of labour input, and in labour productivity (the ratio of value added to a measure of labour input).

Strong growth in employment and an increase in the employment rate

In real terms (CVM, or 'chained volume measure'), gross value added grew at 2.8% pa, a rate somewhat faster than the long-term average for the UK. Because of the continued growth of part-time working and double-jobbing, the number of workforce jobs increased more rapidly the number of hours worked. Consequently, value added per job grew more slowly than value added per hour worked, which increased at 2.1% pa. At the same time (not shown in the table), the employment rate increased (by 3½ pp) and the unemployment rate fell (by 5 pp), illustrating the fact that over the decade the proportion of the labour force in work increased. This increase in the employment rate combined with an increase in the population of working age to be the main factor driving the increase in hours worked.

TABLE 3.6: TRENDS IN UK PRODUCTIVITY, AND RELATED INDICATORS, 1994-2004

	2004	Trend growth (1)1994 - 2004
		% pa
Value added		
Gross value added (economy-wide), nominal (£bn)	1030	5.4
Gross value added (economy-wide), CVM (2001), (£bn)	1030	2.8
Labour input		
Workforce jobs ('000)	30305	1.2
Workforce jobs with simple adjustment to FTE ('000) (2)	26747	1.1
"Productivity jobs" (ONS series LNNM)		1.0
"Productivity hours" (ONS series LZVA)		0.7
Labour productivity		
Value added (CVM) per workforce job, (£)	31046	1.6
"Output per filled job" (ONS series LNNN)		1.9
"Output per hour worked" (ONS series LSVB)		2.1
Distribution of value added		
Nominal GVA per employee, (£)	38979	4.0
Compensation of employees per employee, (£)	22503	4.2

Note(s): (1) Trend growth is calculated by fitting log(y(t))=a+b*(time) and converting from the exponential growth rate, b, to a conventional growth rate, g, using the formula g=exp(b)-1
(2) Full-time equivalent employees(FTE) are calculated using the equation employees(fte) = full-time employees+(b*part-time employees), where b is 20/35 (ratio of average hours of part-time to full-time workers).

Source(s): ONS, CE.

Indications that growth cannot be sustained at this rate

There are various indications that the rate of growth experienced over 1994-2004 cannot be sustained in the future without an increase in the underlying rate of productivity growth. Firstly, it seems unlikely that reductions in unemployment and increases in the employment rate can be relied on much further to increase labour inputs. Secondly, growth over the past decade has been associated with the development of certain imbalances in the economy which, on past experience, are not likely to grow much further (and some correction is already under way). Household spending grew much more rapidly than GDP growth (by about 0.8 pp in real terms), and more rapidly than household incomes, with the result that the household saving ratio fell from 9.3% in 1994 to 4.4% in 2004. Growth since 2000 has been supported by government spending and a resulting increase in net borrowing. Over 1994-2004 exports have grown at about 5% pa while imports have grown at about 7% pa, in real terms, although the gap in growth rates in current prices was only 1 pp as the UK enjoyed a substantial improvement in the terms of trade, especially in the latter part of the 1990s. We conclude that the baseline macroeconomic projection should have a somewhat lower rate of growth than that experienced in the decade 1994-2004, and that it should incorporate some correction of the macroeconomic imbalances (higher household and government saving, lower balance of payments current account deficit).

3.4 Sectoral trends

Table 3.7 presents trend growth rates for industry sectors over 1994-2004.

Continued shift in structure away from primary and manufacturing activities

Over the decade, the weakest growth rates in value added have generally been in primary and manufacturing sectors. In manufacturing, only chemicals (led by pharmaceuticals), transport equipment (led by aerospace), and miscellaneous manufacturing achieved growth rates greater than 1% pa. In contrast, all the service sectors apart from public administration & defence had growth rates of more than 1% pa (public sector growth rates were depressed by tight spending controls during much of the 1990s). Within the services, the fastest growth rates were in computing services, financial services and the various business services, and transport.

Reasons for weak growth in manufacturing sectors: global specialisation; changes in tastes and technology; higher distribution margins

Analysis of the ONS's Supply and Use Tables sheds some light on the factors responsible for these differences in growth rates[7]. In some sectors, weak growth (or decline) has been primarily due to the impact of global specialisation and the replacement of UK production by imports. This is most clearly the case for textiles, clothing and footwear, but it is also true for some parts of food and drink, ceramics, metal goods, household appliances, computers, motor vehicles, and furniture. In others, weak growth has been due to weak demand, reflecting the impact of changing tastes or technology, for example in some parts of food (oils and fats, sugar, dairy products) and of mechanical engineering. There are some cases where distributors are capturing a larger share of the value of the product (sports goods, food and drink, cosmetics), so that the growth in demand faced by the producer is weaker than the growth in demand expressed by the consumer.

Knowledge-based manufacturing industries performed better

Sectors within manufacturing that have seen a relatively strong performance are typically those with a larger 'knowledge' content (aerospace, pharmaceuticals), but these are also experiencing the impact of globalisation with strong growth in trade in both directions. This reflects economies of specialisation in particular sub-sectors or models, but also the effects of comparative advantage within these sectors (for example, specialisation in R&D and production of branded drugs in pharmaceuticals, while generics are increasingly imported).

Global specialisation has boosted demand for business services as inputs to production

The most important factor driving strong growth in services is greater use of various business services as inputs to production. This reflects changes in technology (growing dependence on IT technology, and hence on the related services), in the knowledge content of final products (growing use of technical consultancy, management consultancy, market research and advertising), and in business organisation (specialisation of firms in the provision of certain services which can be contracted out). For most services, the vast bulk of production is for the domestic market rather than exports, but they provide indirect support for exports to the firms to which they sell. Even so, exports have been an important driver of demand for contract R&D and (of course) international financial services.

[7] The supply and use tables identify the various sources of supply and demand for each product. They are expressed in current prices, and so do not allow us to distinguish separately the effect of price and volume changes.

TABLE 3.7: GROWTH IN VALUE ADDED, EMPLOYMENT AND LABOUR PRODUCTIVITY BY SECTOR, 1994-2004

	2004						Trend growth (1)1994 - 2004		
	Value added (2)		Workforce jobs		Value added per workforce job		Value added (2)	Workforce jobs	Value added per workforce job
	£bn	%	'000	%	£'000	Industry average=100	% pa	% pa	% pa
Agriculture	9.6	1.0	426.3	1.4	22502.5	68.4	0.6	-3.2	3.9
Mining & quarrying, utilities	36.8	3.7	183.2	0.6	200962.5	610.7	0.5	-2.6	3.2
Food, drink & tobacco	23.5	2.4	457.6	1.5	51399.3	156.2	0.2	-0.5	0.7
Textiles & clothing	5.7	0.6	183.1	0.6	30996.5	94.2	-5.8	-9.1	3.6
Wood, paper, printing & publishing	23.5	2.4	566.0	1.9	41456.6	126.0	0.1	-1.0	1.0
Chemicals, & NMMP	34.2	3.4	599.4	2.0	56986.3	173.2	2.2	-1.5	3.7
Metals & metal goods	16.2	1.6	469.9	1.6	34437.7	104.6	-1.3	-2.8	1.6
Engineering	30.8	3.1	681.1	2.2	45274.5	137.6	1.0	-2.6	3.7
Transport equipment	20.1	2.0	361.9	1.2	55597.9	168.9	3.2	-0.2	3.5
Manufacturing nes & recycling	8.0	0.8	233.2	0.8	34249.4	104.1	0.4	0.7	-0.3
Construction	65.6	6.6	2090.1	6.9	31401.3	95.4	2.0	1.6	0.4
Wholesale distribution nes	71.5	7.2	1910.1	6.3	37426.5	113.7	2.6	0.1	2.4
Other retail distribution	60.9	6.1	3144.5	10.4	19369.6	58.9	4.5	1.6	2.8
Hotels & catering	36.0	3.6	1961.8	6.5	18361.3	55.8	2.7	2.0	0.7
Transport	46.2	4.6	1286.2	4.2	35918.9	109.1	6.5	1.7	4.8
Communications	34.7	3.5	526.9	1.7	65939.4	200.4	3.4	2.5	0.9
Banking & insurance	66.4	6.7	1161.7	3.8	57137.9	173.6	7.2	1.0	6.2
Professional services	105.7	10.6	2236.3	7.4	47284.0	143.7	4.6	2.2	2.3
Computing services	29.6	3.0	550.3	1.8	53739.8	163.3	11.6	9.2	2.2
Other business services	35.6	3.6	1996.9	6.6	17810.5	54.1	6.1	4.4	1.6
Public administration & defence	52.2	5.2	1741.4	5.7	29949.4	91.0	0.8	0.3	0.6
Education	56.8	5.7	2442.7	8.1	23238.8	70.6	1.2	1.9	-0.7
Health & social work	75.3	7.6	3223.6	10.6	23369.7	71.0	3.5	1.5	1.9
Miscellaneous services	52.5	5.3	1870.9	6.2	28036.1	85.2	3.3	2.5	0.8
Whole Economy	997.3	100.0	30305.2	100.0	32909.2	100.0	3.0	1.2	1.8

Note(s): (1) Trend growth is calculated by fitting log(y(t))=a+b*(time) and converting from the exponential growth rate, b, to a conventional growth rate, g, using the formula g=exp(b)-1

(2) Value added excludes ownership of dwellings and adjustment for financial services

Source(s): ONS, CE.

Some consumer services have particularly benefited from household income growth

At the same time, some sectors have benefited from growth in household spending on certain services, notably hotels & catering, air transport and insurance, while retailing has benefited from the general growth in retail spending and the ability of retailers to capture a larger margin. These trends largely reflect the character of household preferences and the areas of expenditure which have a higher income elasticity.

Trends in public services reflect government spending priorities, in turn driven by long-term pressures

In the short term, growth in public services is driven by the priorities of any particular government's spending plans. In the long term, these plans reflect the pressures of demographic and social change. The present government has greatly increased spending on health, in response to growing demand as household incomes and expectations have increased, as well as the opportunities presented by changing technology and the pressures of an aging population. Spending on public administration and defence was quite tightly contained over the decade, but international and national security concerns have recently increased the pressure to raise spending in this area. The influence of globalisation is also evident in the government's education agenda, responding to the need to provide the next generation of workers with the skills that will allow them access to the higher value added jobs that will be available.

Productivity trends reflect the opportunities offered by technology and the pressure to shift into higher value added activities

The final column of Table 3.7 shows trends in labour productivity, measured as value added per job. Some of the differences across sectors reflect the inherent nature of the work and the opportunities that technology offers. For example, many of the activities in 'Miscellaneous Services' are personal services for which the opportunities for automation are limited, in contrast to most manufacturing activities.[8,9]

However, the incentive to invest in labour-saving technology also depends on the extent of the pressures of globalisation, either directly (a firm competing in global markets needs to cut labour costs and move into higher value added activities) or indirectly (higher wage levels in the domestic economy forces even producers of non-tradeables to find ways to raise productivity or move up-market so as to be able to pay higher wages, unless demand is very income elastic and/or price inelastic). Thus, strong productivity growth can be found in sectors which are under considerable pressure to restructure (agriculture, textiles & clothing), or where technological change has opened up new opportunities (banking & insurance).

Implications for employment growth, and lessons for the potential impact of improved productivity growth

When combined with the trends in growth in value added already described, these result in the pattern of (net) employment growth.

We draw the conclusion, that measures to raise the rate of productivity growth in the economy could have the following effects, depending on the character of the sector:

- improved capacity to produce higher value added products, boosting competitiveness and output

[8] It should be remembered that the measure of workforce jobs is not adjusted for differences in working hours, so that sectors in which part-time work is growing more rapidly have slower growth in productivity per job (the measure shown in Table 3.7) than per hour worked.

[9] Measured productivity growth, in real terms, may also be understated in some services, where changes in quality are not captured well in price indices, so that inflation is overstated and real growth in value added understated.

- faster restructuring away from lower value added activities, reducing the size of the sector left operating in the UK
- improved contribution to the competitiveness of the customer, raising the customer's demand for the inputs and thereby capturing a larger share of the value added generated by the customer's final sale
- improved quality of product to final consumers in the UK, attracting a higher share of final demand
- products/services with a high income elasticity and low price elasticity see demand growth in response to higher incomes, without much improvement in productivity, with the result that employment increases.

4 Assumptions for Baseline and High Skills Scenarios

4.1 Skills assumptions implicit in the baseline projection

This section summarises the skills assumptions which are implicit in the *Working Futures* scenario. This baseline projection was not prepared by making explicit assumptions about skills and how they might influence productivity and output. Rather labour in general, and skills in particular, are treated as a derived demand. But the changes in occupational employment patterns, in combination with the shift expected in qualification profiles within occupations, allow us to extract the changes in skills implied by the baseline projection.

Table 4.1 summarises the changes in the skills index implicit in the *Working Futures* projections. The results are similar to the trends over the historical period up to 2014, but there is then a notable slowing in the pace of improvement. This reflects both moderating trends in occupational shares in higher level occupations as well as slowing rates of improvements in qualification profiles within occupations (especially the fact that the proportion with no formal qualifications is approaching zero.

4.2 High skills scenarios

In the high skills scenarios it is assumed that there is a general improvement in the rate of skill acquisition. This could be the result of changes in occupational structure in favour of more higher level occupations or it could reflect improvement in the skills within occupations, with the average qualification levels increasing. The baseline assumptions regarding occupational change are set out in Chapter 5. Improvements in qualification profiles within occupations are also discussed there.

The remainder of this section summarises the way in which these assumptions have been developed for the high skills scenario in terms of their impact on productivity and performance. This is in two parts:

1 the increment to skills, sector by sector

2 the implications for output, productivity and wages

TABLE 4.1: CHANGES IN THE SKILLS INDEX OVER HISTORY AND IMPLIED IN THE BASELINE PROJECTION

	1994-2004	2004-2014	2014-2020
Skills index			
Increase over whole period (%)	8.8	9.2	2.8
Annual increase (% pa)	0.8	0.9	0.5

Source(s) : IER estimates based on LFS and *Working Futures* data.
Ref : (Leitch Workbook 2.xls).

In an ideal world we would have a fully specified model in which the links between skills and performance were spelled out. We would also be able to assess how well each sector was performing according to some well-established (possibly international) yardstick. By measuring the shortfall in a sector's performance using such criteria and analysing the causes of its inadequacies (especially in terms of investment in skills), estimates of the necessary changes to resolve this position could be established.

In practice, we have neither of these ideal requirements. Instead we have to rely on much less complete information about the scale of each sector's current investment in skills (as measured by the structure of its employment) and upon limited information about the performance of the sector, primarily in terms of basic UK trends in output, productivity and related measures derived from the MDM model.

The skills indices described in Chapter 3 provide insight into the current structure of employment by occupation and qualification within each sector and how these are changing over time. Even at the 25-fold level of aggregation chosen for the sectoral analysis, the sectors are quite heterogeneous. Much of the real story may be obscured by such aggregation. Developing successful product and skill strategies is something that has to be done at the level of individual companies. The aggregate 25-fold sectoral information we are using may reflect such things but much of what needs to happen on the ground will involve changing patterns of behaviour in individual enterprises. The scenarios developed should be interpreted as reflecting the effects of some companies performing more successfully and raising the average levels of indicators of performance, rather than every company in the sector improving.

Two kinds of 'high skill' scenario

We regard it as helpful to distinguish two kinds of future, which would produce similar increases in the UK's aggregate skill level and labour productivity:

1 Catch-up

The main characteristic of the 'catch-up' scenario is that sectors that have performed less well, on criteria to be discussed below, are regarded as offering the greatest scope for improvement. Hence, the catch-up scenario embodies greater investment in skills and a stronger relative improvement in those sectors which are less skill-intensive and which have under-performed in the last decade.

2 Restructuring

The main characteristic of the 'restructuring' scenario is that the sectors that have performed less well are regarded as being most vulnerable to the impact of globalisation and technological change in the future. Hence, the restructuring scenario embodies greater investment in skills in the same sectors that saw the largest increase in the skills index in the last decade.

Incremental investment in skills

In order to develop an alternative scenario to the 'business as usual' scenario mapped out in *Working Futures*, some idea is needed of the increment in skill (qualification/occupation) to be assumed if UK plc follows the 'high road'.

In both the catch-up and restructuring scenarios, it is assumed that, relative to the baseline projection, the annual rate of increase in the skills index (and hence in labour productivity) for the economy as a whole would be accelerated by 25% of the historically-observed change in the earnings weighted skills index. In other words, if the baseline projection had the same rate of growth in skills as was observed over the decade 1994-2004 (about 9% over the decade), both high skills scenarios would see

this rate increased by 25% (ie raising the increase to about 11.25% over a decade). As noted above, the rate of growth of the skills index implicit in the baseline projections is not identical to the historical rate of growth, although it is similar to it in the first decade of the projections. The uplift figure of 25% is rather arbitrary: it was selected on the grounds that it represented a large enough increase to register on macroeconomic indicators, while remaining within the bounds of plausibility for a step increase in skills investment.

In the catch-up scenario, this acceleration in the skills-intensity of the different sectors is weighted towards the sectors with the lowest skills levels. Formally, this is implemented by adding, for each sector, 25% of the historically observed change in the earnings weighted skills index, deflated by the reciprocal of the value of the industry index compared to the all industry average.

In the restructuring scenario, no weighting towards sectors with the lowest skills levels is carried out: each sector is assumed to see a 25% increase in its rate of increase in the skills index.

The values prepared are expressed as annual percentage increments to be applied for each year (cumulatively). The changes to these indicators are then used to inform the scale of the interventions in productivity, output and employment, required in MDM .

Implications for output, productivity and wages

Having decided on the scale of intervention required, the next issue is what impact this is expected to have on the economy. Based on the review of the literature and theoretical consideration of the type of impact we are trying to simulate, as a minimum, the macro simulations require, for each of the 25 industries, the implications for

- productivity (output per job)
- output
- wages

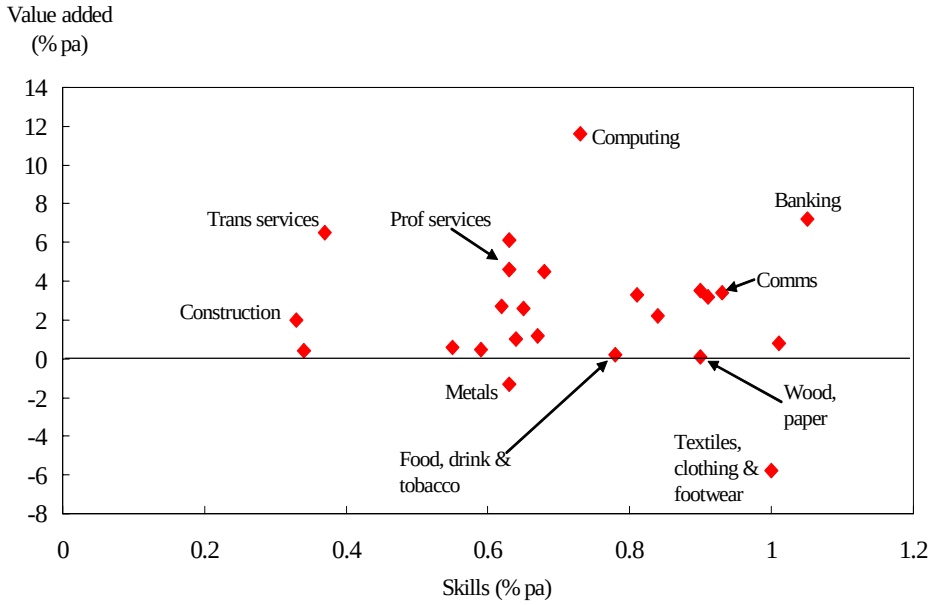
Ideally, these would be based on econometric evidence of the elasticities from a fully specified model. Unfortunately as indicated by the review of the evidence presented in Section 3.1 this does not exist. An attempt was made to develop industry specific parameters using data from MDM and estimating some simple correlations but this failed to produce robust estimates. Although few, if any, studies provide exactly what is needed, (ie sectorally-specific elasticities), the review of the literature does suggest some parameters. The assumptions adopted are set out below. In practice, there may well be lagged impacts between skills, productivity, output and wages but this refinement has not been considered, and is unlikely to make much difference to the long-term trends of interest here.

Assumed impacts on MDM indicators

Productivity We assume that the rate of increase assumed for skill changes in each sector is reflected immediately in the same boost to labour productivity (an elasticity of unity with respect to the skills index).

Output The crucial question, with regard to the sectoral implications of this analysis, is what will be the impact on output (and hence, given that productivity assumptions have already been made, for employment)?

CHART 4.1: GROWTH IN SKILLS INDEX AND IN VALUE ADDED BY SECTOR, 1994-2004



We consider two stylised cases. In the catch-up scenario, we assume that in all sectors, the improvement in productivity is translated one-for-one into higher output (the elasticity of output with respect to productivity is unity). There is, therefore, no change in the sectoral composition of the economy, except insofar as the boost to skills, and hence productivity and output, is not distributed evenly among sectors (in the catch-up scenario we assume a greater increase in skills in the relatively low-skill sectors).

In the restructuring scenario, we adopt varied assumptions across sectors on the relationship between the skills index and output so that 'basic' sectors see the least increases (or greater falls) in output, to reflect sensitivities to globalisation and different elasticities of demand with respect to reductions in price or improvements in quality.

In order to help inform these judgements, Chart 4.1 plots, for each sector, the growth in the skills index and the growth in (CVM) value added over 1994-2004. Certain sectors of interest are labelled in the chart. It is immediately obvious that there is no clear pattern of correlation between the two indicators: rapid increases in skills are not necessarily associated with rapid growth in value added. Some sectors, generally those that involve processing of basic materials, have seen little or no growth in value added (and, in some cases, declines), and global specialisation has been a major factor here. In the assumptions for the restructuring scenario, we set elasticities for the response of output to improvements in skills and labour productivity on the basis of judgements as to which sectors were likely to prove most vulnerable to global competition, and those for which we considered it unlikely that demand would be boosted strongly in response to a more highly-skilled labour force.

Wages We assume that the increase assumed for labour productivity in each sector is reflected immediately in the same boost to real earnings (an elasticity of unity with

respect to the productivity, and hence also to the skills index, given the assumption of unity for the elasticity of productivity to changes in the skills index).

Implementing the changes in MDM

The assumptions for output have been used to determine the scale of the adjustments required to the demand drivers in MDM. At the same time as changing output, adjustments to the model's labour productivity outcomes were made to represent the assumed impact of skills on productivity.

5 Projections to 2020 for Baseline and High skills scenarios

This chapter presents the results of the baseline projections of the extended forecast to 2020. It also presents the results of the two high skills scenarios:

- catch-up scenario
- restructuring scenario

5.1 Baseline projections

The projections provided in *Working Futures* have been extended to provide baseline projections to 2020. The baseline projections represent the 'business as usual' case.

5.1.1 Macroeconomic projections

Table 5.1 below summarises the macroeconomic baseline projections[10].

Beyond 2014, the projections of most variables have settled to a long-term trend rate of change.

TABLE 5.1: BASELINE PROJECTIONS OF MACROECONOMIC INDICATORS

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
				(% pa)				(pp pa)	
GDP at market prices (£2001CVMm)	1066886	1341129	1547210	2.3	2.4	0	0	0.0	0.0
Household expenditure (£2001CVMm)	719415	910264	1053870	2.4	2.5	0	0	0.0	0.0
Exports (£2001CVMm)	279213	422992	551992	4.2	4.5	0	0	0.0	0.0
Imports (£2001CVMm)	330857	501537	652085	4.2	4.5	0	0	0.0	0.0
Claimant unemployment (thousands)	855	1315	1293	4.4	-0.3	0	0	0.0	0.0
GVA at basic prices (£2001CVMm)	939132	1176218	1354506	2.3	2.4	0	0	0.0	0.0
Employment (thousands)	30305	31584	32515	0.4	0.5	0	0	0.0	0.0
GVA per worker (£CVM)	30989	37242	41658	1.9	1.9	0	0	0.0	0.0

Ref : C51FSB-C51FSB.

[10] For ease of comparison, the tables for the baseline projections are presented in exactly the same format as those presented below for the two high skills scenarios, including columns for 'differences from baseline', which are of course, zero for the baseline itself.

TABLE 5.2: BASELINE PROJECTIONS BY SECTOR

						Differences from baseline			
	('000) 2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
Employment			(thousands)		(% pa)		(thousands)		(pp pa)
Primary & Utilities	610	517	472	-1.6	-1.5	0	0	0.0	0.0
Manufacturing	3552	3164	2964	-1.2	-1.1	0	0	0.0	0.0
Construction	2090	1943	1934	-0.7	-0.1	0	0	0.0	0.0
Distrib Trans & Comms	8830	9350	9649	0.6	0.5	0	0	0.0	0.0
Finan Bus & Oth Servs	7816	8742	9537	1.1	1.5	0	0	0.0	0.0
Non-Market Services	7202	7673	7774	0.6	0.2	0	0	0.0	0.0
Total	30305	31584	32515	0.4	0.5	0	0	0.0	0.0
Value added output			(£CVMm)		(% pa)		(£CVMm)		(pp pa)
Primary & Utilities	47421	41797	40470	-1.3	-0.5	0	0	0.0	0.0
Manufacturing	147536	171997	190670	1.5	1.7	0	0	0.0	0.0
Construction	56279	63871	72692	1.3	2.2	0	0	0.0	0.0
Distrib Trans & Comms	231804	299100	347663	2.6	2.5	0	0	0.0	0.0
Finan Bus & Oth Servs	259204	343846	409742	2.9	3.0	0	0	0.0	0.0
Non-Market Services	165251	210794	238121	2.5	2.1	0	0	0.0	0.0
Total	939132	1176218	1354506	2.3	2.4	0	0	0.0	0.0
Productivity			(£CVM per worker)		(% pa)		(£CVM per worker)		(pp pa)
Primary & Utilities	77804	80848	85790	0.4	1.0	0	0	0.0	0.0
Manufacturing	41532	54364	64340	2.7	2.8	0	0	0.0	0.0
Construction	26926	32873	37587	2.0	2.3	0	0	0.0	0.0
Distrib Trans & Comms	26253	31988	36030	2.0	2.0	0	0	0.0	0.0
Finan Bus & Oth Servs	33163	39332	42964	1.7	1.5	0	0	0.0	0.0
Non-Market Services	22946	27472	30629	1.8	1.8	0	0	0.0	0.0
Total	30989	37242	41658	1.9	1.9	0	0	0.0	0.0

Ref : C51FSB-C51FSB.

5.1.2 Sector projections

Table 5.2 summarises the baseline projections by sector for employment, value added output and productivity (measured as value added output per worker).

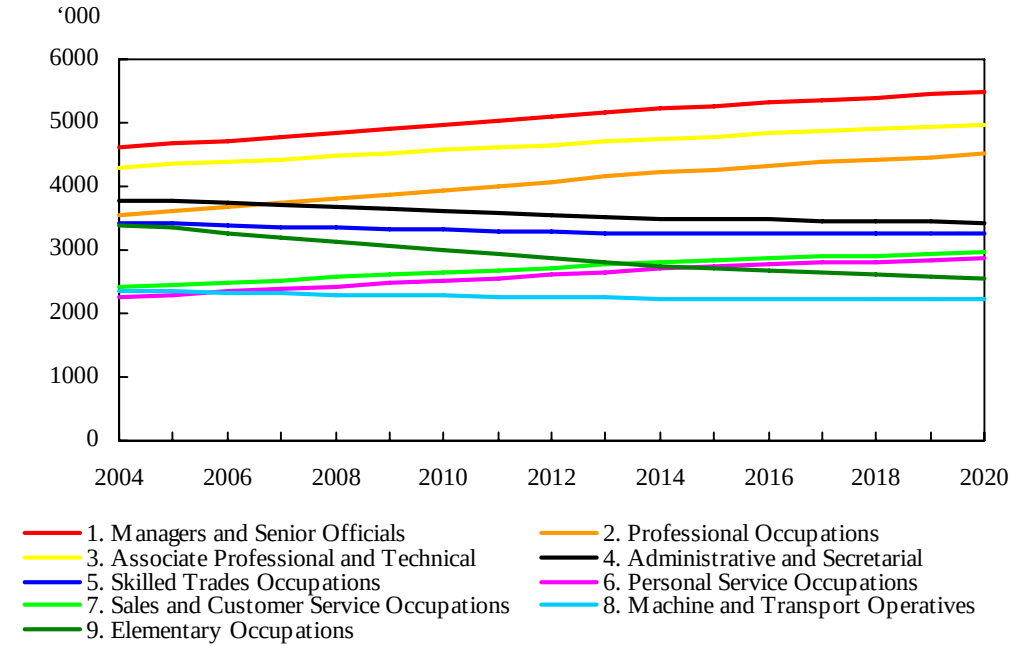
Tables (5.13-5.15) showing the detailed results for the SSDA industries can be found at the end of this chapter.

5.1.3 Occupational projections

The shifting pattern of occupational employment provides a key indicator of changing skill requirements. In the baseline scenario the groups that are expected to show significant increases in employment over the period to 2020 are managers & senior officials, professional occupations, associate professional & technical occupations also personal service occupations and sales & customer service occupations. The first three groups tend to be better qualified than average. These results therefore imply a steady increase in skill requirements as measured by qualifications.

Administrative, clerical & secretarial occupations are expected to see continuing job losses. This reflects a break in trend compared with recent patterns as a result of the continued use of computers and IT systems in most offices. This new trend is expected to continue over the next decade. Declining employment levels are also projected for skilled trades occupations; machine & transport operatives; and elementary occupations. Amongst these declining groups, it is the elementary occupations which are expected to see the largest absolute reduction in numbers. This is the group with the lowest qualification profile.

CHART 5.1: OCCUPATIONAL PROFILES, 2004-2020



Source(s) : CE/IER estimates, MDM01R1 C51F8A Forecast, Leitch Workbook1.xls.

TABLE 5.3: OCCUPATIONAL CATEGORIES SOC 2000 – MAJOR GROUPS

All Industry Sectors

Employment Levels (000s)

	1984	1994	2004	2009	2014	2020
1. Managers and Senior Officials	3,096	3,629	4,609	4,897	5,212	5,499
2. Professional Occupations	2,165	2,674	3,539	3,871	4,225	4,518
3. Associate Professional and Technical	2,593	3,218	4,302	4,521	4,754	4,978
4. Administrative and Secretarial	3,843	3,955	3,790	3,649	3,485	3,433
5. Skilled Trades Occupations	4,211	3,642	3,433	3,328	3,247	3,256
6. Personal Service Occupations	1,054	1,509	2,244	2,473	2,700	2,881
7. Sales and Customer Service Occupations	1,565	1,872	2,412	2,608	2,805	2,972
8. Machine and Transport Operatives	3,018	2,596	2,367	2,293	2,231	2,234
9. Elementary Occupations	4,131	3,680	3,403	3,070	2,729	2,559
Total	25,676	26,775	30,099	30,709	31,389	32,330

Percentage Shares

	1984	1994	2004	2009	2014	2020
1. Managers and Senior Officials	12.1	13.6	15.3	15.9	16.6	17.0
2. Professional Occupations	8.4	10.0	11.8	12.6	13.5	14.0
3. Associate Professional and Technical	10.1	12.0	14.3	14.7	15.1	15.4
4. Administrative and Secretarial	15.0	14.8	12.6	11.9	11.1	10.6
5. Skilled Trades Occupations	16.4	13.6	11.4	10.8	10.3	10.1
6. Personal Service Occupations	4.1	5.6	7.5	8.1	8.6	8.9
7. Sales and Customer Service Occupations	6.1	7.0	8.0	8.5	8.9	9.2
8. Machine and Transport Operatives	11.8	9.7	7.9	7.5	7.1	6.9
9. Elementary Occupations	16.1	13.7	11.3	10.0	8.7	7.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Net Changes	1984-1994	1994-2004	2004-2009	2009-2014	2014-2020	2004-2020
1. Managers and Senior Officials	533	981	287	316	286	889
2. Professional Occupations	509	865	332	354	293	979
3. Associate Professional and Technical	625	1,083	219	233	224	677
4. Administrative and Secretarial	112	-165	-141	-164	-52	-357
5. Skilled Trades Occupations	-569	-210	-105	-81	9	-176
6. Personal Service Occupations	455	735	229	227	181	637
7. Sales and Customer Service Occupations	307	540	196	197	167	560
8. Machine and Transport Operatives	-421	-229	-75	-61	3	-133
9. Elementary Occupations	-451	-277	-333	-342	-170	-845
Total	1,099	3,324	610	680	941	2,231

Source(s) : CE/IER estimates, MDM01R1 C51F8A Forecast, AllUK.xls, (Table 4.1T).
Note(s): : Excludes employment in HM Forces.

TABLE 5.4: SHIFT-SHARE ANALYSIS 1994-2004

	1994		2004				Components of change 1994-2004				
Sub-major group		% of total		% of total	change %	net	scale effect	occupational	effect %	industry-mix effect	%
1. Managers	3,636	13.6	4,607	15.3	26.7	971	477	317	8.7	178	4.9
2. Professionals	2,671	10	3,535	11.7	32.4	865	339	291	10.9	235	8.8
3. Associate Professionals	3,220	12	4,300	14.4	33.6	1,081	398	526	16.3	157	4.9
4. Admin. & clerical	3,952	14.8	3,788	12.6	-4.1	-164	428	-713	-18.0	122	3.1
5. Skilled Trades	3,639	13.6	3,438	11.4	-5.6	-202	514	-409	-11.2	-307	-8.4
6. Personal Service Occs	1,512	5.6	2,246	7.4	48.5	734	162	494	32.7	78	5.2
7. Sales Occs.	1,870	7	2,411	8	28.9	541	207	334	17.9	0	0.0
8. Operatives	2,595	9.7	2,372	7.9	-8.6	-223	354	-214	-8.2	-362	-13.9
9. Elementary occs.	3,681	13.7	3,403	11.3	-7.6	-278	446	-624	-17.0	-100	-2.7
All occupations	26,775	100	30,099	100	12.4	3,324	3,324	0	0	-1	0

Note(s) : The scale effect is the same % for all occupations.
Excludes employment in HM Forces.
Ref : Tab5a.C51RAW template.xls(N196:Y217).

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TABLE 5.5: SHIFT-SHARE ANALYSIS 2004-2020

	2004		2020		Components of change 2004-2020						
Sub-major group		% of total		% of total	change %	net	scale effect	occupational	effect %	industry-mix effect	%
1. Managers	4,610	15.3	5,499	17	19.3	889	330	434	9.4	125	2.7
2. Professionals	3,540	11.7	4,517	14	27.7	980	259	549	15.5	170	4.8
3. Associate Professionals	4,302	14.3	4,979	15.5	15.7	677	322	185	4.3	172	4.0
4. Admin. & clerical	3,790	12.6	3,433	10.6	-9.4	-357	309	-792	-20.9	125	3.3
5. Skilled Trades	3,433	11.4	3,258	10	-5.1	-176	225	-88	-2.6	-312	-9.1
6. Personal Service Occs	2,244	7.4	2,881	8.9	28.4	637	188	392	17.5	57	2.5
7. Sales Occs.	2,412	8	2,972	9.2	23.2	560	193	336	13.9	32	1.3
8. Operatives	2,367	7.9	2,234	7	-5.6	-133	157	-46	-1.9	-245	-10.4
9. Elementary occs.	3,404	11.3	2,559	7.9	-24.8	-845	250	-973	-28.6	-122	-3.6
All occupations	30,099	100	32,330	100.1	7.4	2,231	2,231	0	0	0	0

Note(s) : The scale effect is the same % for all occupations.
Excludes employment in HM Forces.
Source(s) : IER Estimates, Working Futures 2004-2014.
Ref : Tab5a.C51-FSB.xls(N79:Y100).

The effects rarely all point in the same direction. The scale effect is uniformly positive over both the periods 1994-04 and 2004-20 It reflects the overall employment increases realised. The other two effects exhibit differing signs across the various occupational groups, summing across all occupations to zero.

For the forecast period scale and occupational effects are again dominant (see Table 5.5). All else being equal, the scale effect results in an increase of just over 4% in employment levels for each occupation over the 2004-20 period.[13]

The industry mix effect is of even less significance than over the previous decade. In absolute terms it is fairly insignificant, except in a small number of occupations, such as skilled trades and process plant & machine operatives, mainly linked to the fortunes of the manufacturing sector. These findings are consistent with the results for the earlier period 1994 to 2004 in Table 5.4.

This is in marked contrast to earlier decades. During the 1970s and 1980s, industry effects, notably the rapid loss of jobs in the primary and manufacturing sectors and the rapid expansion of employment in services, played a major role in explaining changes in occupational employment patterns. The analysis reported in previous labour market assessments showed large industry effects, both positive and negative. The former tended to benefit white collar, non-manual occupations, in the growing service sectors, while the latter was concentrated on manual, blue collar jobs in industries such as agriculture, mining and many parts of manufacturing.

Although the industry mix is strongly significant in only a few occupations, it makes a marginal contribution to many of the others. It impacts most significantly in positive fashion for health associate professional and managerial occupations. In the case of skilled trades, process, plant & machine operatives and the elementary occupations, it is a negative feature. These latter occupations are linked together by a dependence on final demand in the manufacturing and construction sectors of the economy.

Over the forecast period, the scale effect, which reflects the overall expansion (or decline) in employment levels, is important for all occupations. It is especially notable compared with the other effects for managers & proprietors, administrative & clerical occupations and sales occupations. Additionally, it also exerts a significant positive impact for secretarial & related occupations and the admin/service elementary occupational sub-major group.

The occupational effect is very strongly positive for most professional and associate professional groups and especially in the case of the caring personal service occupations and for customer service occupations. However, the occupational effect exercises a strong negative impact for managers & proprietors in agriculture and services, administrative & clerical occupations, secretarial & related occupations, as well as in the skilled metal & electrical trades, process, plant & machine operatives and in elementary occupations. In all of these sub-major groups, significant changes in organisation and technology within the employing industries are expected to have a marked negative impact on employment levels.

[13] The scale effect is calculated for each gender separately so the percentage does vary slightly between occupations.

TABLE 5.6: REPLACEMENT NEEDS AND TOTAL REQUIREMENTS, BASELINE SCENARIO ('000)

Replacement Demand: Total Period: 2004 - 2020

All sectors

(Results in 000s)	Base year employment	Structural demand	Retire-ments	Occupational mobility	Migration	Replacement demand	Net requirement
Managers and Senior Officials	4,610	889	2,436	0	0	2,436	3,325
Professional Occupations	3,539	978	1,883	0	0	1,883	2,861
Associate Professional and Technical	4,301	677	2,087	0	0	2,087	2,764
Administrative and Secretarial	3,790	-357	2,148	0	0	2,148	1,791
Skilled Trades Occupations	3,432	-176	1,652	0	0	1,652	1,476
Personal Service Occupations	2,243	639	1,265	0	0	1,265	1,904
Sales and Customer Service Occupations	2,412	560	1,187	0	0	1,187	1,747
Machine and Transport Operatives	2,368	-135	1,205	0	0	1,205	1,070
Elementary Occupations	3,404	-845	1,732	0	0	1,732	887
All Occupations	30,099	2,230	15,594	0	0	15,594	17,824

Replacement Demand = Retirements + Occupational Mobility + Migration

Net requirement = Structural Demand + Replacement Demand

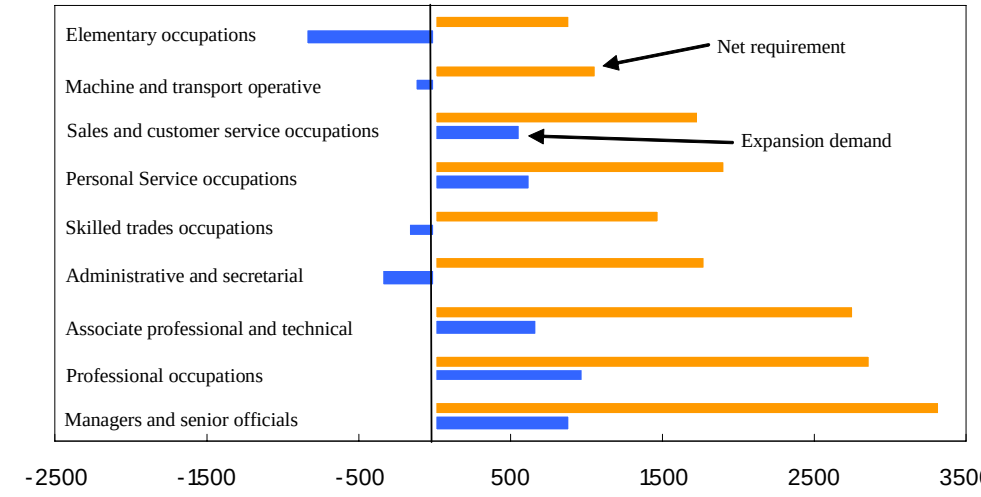
Note(s) : Occupational mobility and migration are assumed zero for simplicity.
: Excludes employment in HM Forces.
Source(s) : IER Estimates, Working Futures 2004-2014.
Ref : IER estimates (RD module.xls, L1:S16).

The key drivers of occupational employment change over the next decade are therefore expected to be related to changing ways of working within industries and the way in which technological change, especially IT, impacts on the need for different skills. This is in contrast to earlier decades when it has been the changing sectoral structure of employment that has been a prime driver.

Replacement Demands

The changing patterns of employment levels by occupation, tell only part of the story. Even where employment is expected to decline there will be a need to replace those leaving the workforce for retirement or other reasons. These replacement needs generally swamp any projected changes in employment levels as the estimates in Table 5.6 make clear. While total employment is expected to grow by 2.3m between 2004 and 2020, replacement needs are almost eight times this figure. A similar pattern emerges for each individual occupation.

CHART 5.2: REPLACEMENT NEEDS AND TOTAL REQUIREMENTS, BENCHMARK SCENARIO ('000)



Note(s) : Occupational mobility and geographical flows are assumed to be zero for simplicity but will also contribute to replacement needs in some cases.
Source(s) : IER estimates based on LFS and Working Futures.
Ref : (RD module.xls, AE36).

5.1.4 Projections of employment by qualification

The projections of qualifications in the baseline scenario are based on an extended version of the stock flow model used in *Working Futures 2004-2014*.[14] This effectively focuses upon the numbers available (i.e. those economically active). The analysis begins by focusing on the total number of people holding formal qualifications at different National Qualification Framework (NQF) levels. The projections are based on a detailed analysis of recent patterns of acquisition of qualifications for different age-gender groups. These patterns are projected to continue to show improvements as observed in recent years, but at a diminishing rate. These results are then combined with information on demographic changes expected by the Government Actuary, in order to obtain implications for the numbers of people holding different qualifications. An analysis of economic activity rates by age, gender and qualification category is superimposed on this in order to obtain the implications for the total numbers economically active holding qualifications in each age gender group.

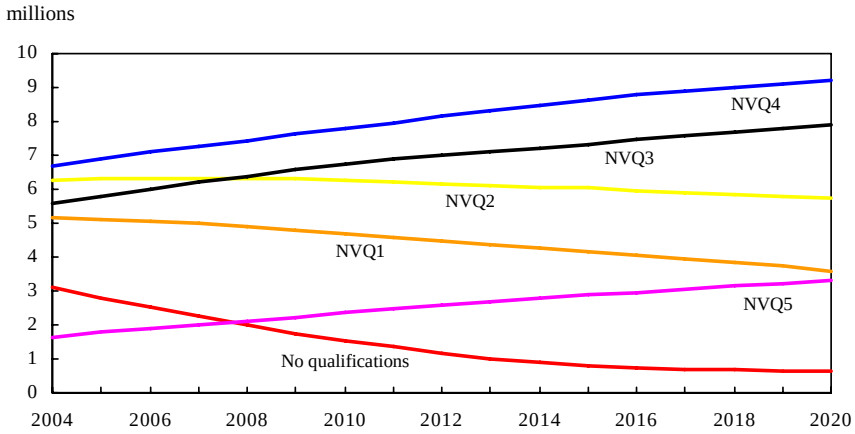
This is then translated into implications for employment using an iterative sorting model which allocates people to jobs (as opposed to unemployment), assuming similar patterns to those observed historically (i.e. better qualified individuals maintain a higher probability of finding a job than those less well qualified). The implications for the 'skills' index for the future are based just on those in employment.

Charts 5.3 and 5.4 illustrate the overall picture. Those with no formal qualifications are projected to continue to see their shares as well as numbers decline, although this trend is expected to flatten out leaving a rump of those unable or unwilling to acquire formal qualifications.

[14] See Bosworth and Wilson (2005).

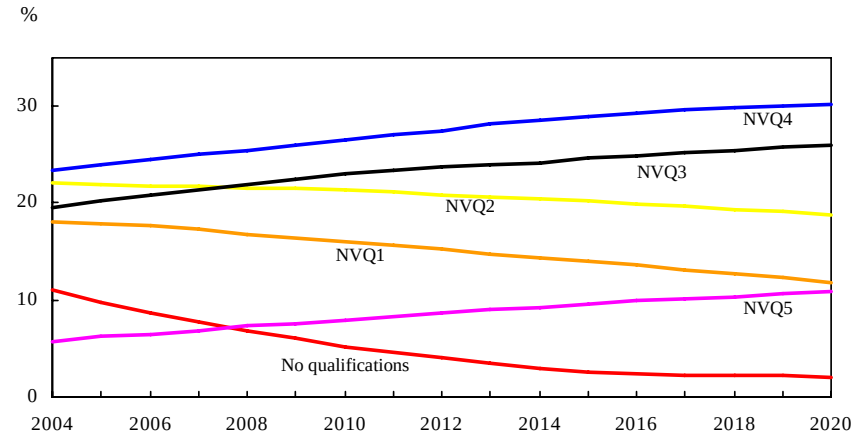
The shares and numbers of those whose highest qualification is at NQF levels 1 or 2 is also expected to fall over the longer term. This reflects the fact that, although many more people will be acquiring qualifications at these levels, they will go on to obtain even higher qualifications. The number qualified at level 3 is projected to rise, as are those with NQF level 4 and 5 qualifications.

CHART 5.3: CHANGING NUMBERS WITH QUALIFICATIONS (ECONOMICALLY ACTIVE)



Note(s) : This is the scenario in *Working Futures* extended; Highest qualification held.
Source(s) : IER estimates based on Stock-flow extended.
Ref : (Forecast mark ii.xls, chart2t)

CHART 5.4: CHANGING SHARES OF THOSE WITH QUALIFICATIONS (ECONOMICALLY ACTIVE)



Note(s) : This is the scenario in *Working Futures* extended; Highest qualification held.
Source(s) : IER estimates based on Stock-flow extended.
Ref : (Forecast mark ii.xls, chart2t%)

TABLE 5.7: PROPORTIONS OF EMPLOYMENT BY HIGHEST QUALIFICATION HELD

		Baseline (*Working Futures 2004-2014* , extended)	
NQF levels	2004	2014	2020
NQF5	6.0	9.5	11.1
NQF4	23.9	29.3	31.0
NQF3	19.7	24.5	26.2
NQF2	22.1	20.2	18.6
NQF1	17.8	13.8	11.3
NQF0	10.5	2.6	1.8
All levels	100	100	100

Even without any further intervention, current patterns of behaviour and existing government policies are expected to result in substantial changes to the kinds of skills available in the workforce. By 2020 fewer than 2% of the workforce will have no formal qualifications at all, while the proportion qualified to post-graduate level is expected to have risen to over 10%. The implications for changing patterns of those in employment are similar. These are summarised in Table 5.7, which focuses upon the shares in employment by NQF level. Graduates and post graduate are projected to take an increasing share of jobs while the proportion of those in employment with qualifications below level 2 is projected to fall to just 10% by 2020.

These changes can be seen as resulting from a combination of changing occupational patterns (in favour of those occupations which tend to employ better qualified people, ie those that have 'higher' qualification profiles), and a general shift ('improvement') of qualifications profiles within all occupations in favour of higher qualified people. In many higher level occupations (especially the professions), the proportion qualified to NQF level 4 (university degree) or above is already close to 100%. The scope for further improvement is therefore limited. The baseline scenario therefore projects only modest further changes here. It is in other occupations, those that have traditionally not been regarded as the province of graduates, that some of the biggest changes are projected. Similarly, there are increased of an analogous nature for lower level occupations, where increasing proportions are expected to posses formal qualifications at NQF levels 2 and 3.

These patterns represent a continuation of recent historical trends. It is difficult to be certain to what extent these developments reflect demand as opposed to supply factors. Successive governments have followed policies aimed at increasing

educational participation and the acquisition of formal qualifications. This has resulted in large increases in supply. Generally speaking, better qualified people tend to find and retain employment more readily that those who are less well qualified. It is therefore no surprise that the qualification profiles of those in employment have risen in virtually all occupations, in line with these supply side developments.

Some have argued that this represents 'qualifications inflation' and that these changes are purely supply driven. According to this line of argument, the workforce may have more abundant credentials but their worth to employers is devalued, and employers drive up entry requirements in order to obtain the best candidates, even in jobs that do not strictly require such formal qualifications. Others point to evidence that there are very real changes in what people have to do in their jobs, which mean that the increase in formal entry requirements is real. They also point to the fact that, up until recently at least, unemployment rates have not increased for the better qualified and nor have rates of return to the acquisition of such qualification shown a decline.[15] On balance the current evidence suggests therefore that demand has probably kept pace with the supply side changes.

In the baseline scenario, the changes projected for 2004-20, continue to be driven by expected supply side developments. The future stocks of those economically active will be largely determined by existing stocks and future inflows (the latter dependent on exogenous demographic factors and likely patterns of educational participation and achievement). As in the past, the better qualified are expected to continue to gain and retain employment in favour of less well qualified people. As a result, the qualification profiles of those in employment are projected to improve in line with these supply side forecasts. Based on past experience, this will be the kind of improving skills profile necessary to support the macroeconomic and sectoral trends in the baseline scenario.

[15] The latest evidence does seem to suggest that this may be changing. Purcell et al (2005) reporting on 1999 graduates five years on, suggest that rates of return are showing signs of falling, although they remain positive and suggest that investment in a degree continues to offer a good return on average.

5.2 Catch-up scenario

In the 'catch-up' scenario we assume:

- relative to the baseline projection, the annual rate of increase in the skills index (and hence in labour productivity) for the economy as a whole is accelerated by 25% of the historically-observed change in the earnings weighted skills index
- this improvement in skills relative to the baseline is larger in sectors with lowest skill levels currently
- that in all sectors, the improvement in productivity is translated one-for-one into higher output (the elasticity of output with respect to productivity is unity)

5.2.1 Macroeconomic projections

Table 5.8 below summarises the macroeconomic projections for the catch-up scenario.

Comparing the results to the baseline projections, productivity (GVA per worker) has been boosted by the target of 0.2pp pa. Both output and employment have been boosted in the catch-up scenario. Overall GDP growth has been boosted by 0.2pp pa.

TABLE 5.8: CATCH-UP SCENARIO PROJECTIONS OF MACROECONOMIC INDICATORS

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
					(% pa)				(pp pa)
GDP at market prices (£2001CVMm)	1066886	1368851	1600805	2.5	2.6	27722	53595	0.2	0.2
Household expenditure (£2001CVMm)	719415	919408	1070859	2.5	2.6	9144	16990	0.1	0.1
Exports (£2001CVMm)	279213	432588	570658	4.5	4.7	9597	18666	0.2	0.2
Imports (£2001CVMm)	330857	502281	653277	4.3	4.5	744	1192	0.0	0.0
Claimant unemployment (thousands)	855	1232	1148	3.7	-1.2	-83	-145	-0.7	-0.9
GVA at basic prices (£2001CVMm)	939132	1202185	1405052	2.5	2.6	25967	50546	0.2	0.3
Employment (thousands)	30305	31747	32798	0.5	0.5	163	283	0.1	0.1
GVA per worker (£CVM)	30989	37868	42840	2.0	2.1	627	1181	0.2	0.2

Ref : C51FS4-C51FSB.

5.2.2 Sector projections

Table 5.9 summarises projections for the catch-up scenario by sector for employment, value added output and productivity (measured as value added output per worker). Tables (5.16-5.18) showing the detailed results for the SSDA industries can be found at the end of this chapter.

The boost to productivity by sector reflects our assumption that there will be a larger acceleration in skills in sectors with the lowest skill levels currently. We have also assumed that for all sectors the improvement in productivity leads to higher output. Subsequently, the boost to output and the second-round effects of higher wages and household spending have boosted employment.

5.3 Restructuring scenario

In the 'restructuring' scenario we assume:

- relative to the baseline projection, the annual rate of increase in the skills index (and hence in labour productivity) for the economy as a whole is accelerated by 25% of the historically-observed change in the earnings weighted skills index (ie the same assumption as in the catch-up scenario)
- the boost to skills is applied to all sectors, in proportion to their own historically-observed change in skills (so the best performers in terms of skills increase in the last decade continue to outperform)
- varied assumptions across sectors on the relationship between the skills index and output so that 'basic' sectors see the least increases (or greater falls) in output, to reflect sensitivities to globalisation and different elasticities of demand with respect to reductions in price or improvements in quality

TABLE 5.9: CATCH-UP SCENARIO PROJECTIONS BY SECTOR

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
Employment			('000)		(% pa)		('000)		(pp pa)
Primary & Utilities	610	523	480	-1.5	-1.4	6	9	0.1	0.1
Manufacturing	3552	3208	3042	-1.0	-0.9	44	78	0.1	0.2
Construction	2090	1953	1954	-0.7	0.0	10	20	0.1	0.1
Distrib Trans & Comms	8830	9361	9658	0.6	0.5	10	9	0.0	0.0
Finan Bus & Oth Servs	7816	8798	9644	1.2	1.5	56	107	0.1	0.1
Non-Market Services	7202	7710	7836	0.7	0.3	37	62	0.0	0.1
Total	30305	31747	32798	0.5	0.5	163	283	0.1	0.1
Value added ouput			(£CVMm)		(% pa)		(£CVMm)		(pp pa)
Primary & Utilities	47421	42402	41524	-1.1	-0.3	605	1053	0.1	0.2
Manufacturing	147536	177630	201651	1.9	2.1	5633	10981	0.3	0.4
Construction	56279	64854	74638	1.4	2.4	982	1946	0.2	0.2
Distrib Trans & Comms	231804	305052	359105	2.8	2.8	5952	11442	0.2	0.2
Finan Bus & Oth Servs	259204	351911	425857	3.1	3.2	8065	16115	0.2	0.3
Non-Market Services	165251	214416	244732	2.6	2.2	3622	6611	0.2	0.2
Total	939132	1202185	1405052	2.5	2.6	25967	50546	0.2	0.3
Productivity			(£CVM per worker)		(% pa)		(£CVM per worker)		(pp pa)
Primary & Utilities	77804	81092	86454	0.4	1.1	244	664	0.0	0.1
Manufacturing	41532	55373	66298	2.9	3.0	1009	1959	0.2	0.2
Construction	26926	33210	38206	2.1	2.4	337	619	0.1	0.1
Distrib Trans & Comms	26253	32589	37182	2.2	2.2	601	1152	0.2	0.2
Finan Bus & Oth Servs	33163	39997	44160	1.9	1.7	666	1196	0.2	0.2
Non-Market Services	22946	27811	31232	1.9	2.0	339	603	0.1	0.1
Total	30989	37868	42840	2.0	2.1	627	1181	0.2	0.2

Ref : C51FS4-C51FSB.

5.3.1 Macroeconomic projections

Table 5.10 below summarises the macroeconomic projections for the restructuring scenario.

Comparing the results to the baseline projections, productivity (GVA per worker) has been boosted by the target of 0.2pp pa, as in the catch-up scenario. However, in this scenario output has been boosted to a lesser extent than in the catch-up scenario, and total employment remains similar to that in the baseline. As in the catch-up scenario, overall GDP growth has been boosted by 0.2pp pa.

5.3.2 Sector projections

Table 5.11 summarises projections for the restructuring scenario by sector for employment, value added output and productivity (measured as value added output per worker). Tables (5.19-5.21) showing the detailed results for the SSDA industries can be found at the end of this chapter.

The boost to productivity by sector reflects our assumption that the acceleration in skills will be the same across all sectors, so the best-performers in the last decade continue to outperform. We have varied our assumptions for the impact on output so that some sectors benefit from a boost to output above the baseline and others (eg 'basic' sectors) suffer a fall in output below that in the baseline.

Overall, employment is marginally lower than in the baseline projections as the productivity gains have been achieved through restructuring.

TABLE 5.10: RESTRUCTURING SCENARIO PROJECTIONS OF MACROECONOMIC INDICATORS

						Differences from base			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
				(% pa)				(pp pa)	
GDP at market prices (£2001CVMm)	1066886	1360696	1584349	2.5	2.6	19567	37139	0.1	0.2
Household expenditure (£2001CVMm)	719415	922168	1076007	2.5	2.6	11904	22137	0.1	0.1
Exports (£2001CVMm)	279213	428674	562935	4.4	4.6	5682	10943	0.1	0.1
Imports (£2001CVMm)	330857	506502	661655	4.4	4.6	4965	9571	0.1	0.1
Claimant unemployment (thousands)	855	1343	1334	4.6	-0.1	28	41	0.2	0.2
GVA at basic prices (£2001CVMm)	939132	1192492	1385491	2.4	2.5	16274	30985	0.1	0.2
Employment (thousands)	30305	31557	32475	0.4	0.5	-27	-40	0.0	0.0
GVA per worker (£CVM)	30989	37788	42663	2.0	2.0	547	1005	0.1	0.2

Ref : C51FS5-C51FSB.

TABLE 5.11: RESTRUCTURING SCENARIO PROJECTIONS BY SECTOR

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
Employment		('000)		(% pa)		('000)		(pp pa)	
Primary & Utilities	610	510	461	-1.8	-1.7	-7	-10	-0.1	-0.1
Manufacturing	3552	3124	2902	-1.3	-1.2	-40	-62	-0.1	-0.1
Construction	2090	1949	1946	-0.7	0.0	6	12	0.0	0.1
Distrib Trans & Comms	8830	9360	9656	0.6	0.5	9	7	0.0	0.0
Finan Bus & Oth Servs	7816	8755	9558	1.1	1.5	13	21	0.0	0.0
Non-Market Services	7202	7665	7767	0.6	0.2	-8	-7	0.0	0.0
Total	30305	31557	32475	0.4	0.5	-27	-40	0.0	0.0
Value added output		(£CVMm)		(% pa)		(£CVMm)		(pp pa)	
Primary & Utilities	47421	41938	40723	-1.2	-0.5	141	253	0.0	0.0
Manufacturing	147536	172843	192207	1.6	1.8	846	1537	0.0	0.1
Construction	56279	64605	74112	1.4	2.3	734	1420	0.1	0.1
Distrib Trans & Comms	231804	303402	355735	2.7	2.7	4302	8072	0.1	0.1
Finan Bus & Oth Servs	259204	349680	421110	3.0	3.1	5834	11368	0.2	0.2
Non-Market Services	165251	214353	244708	2.6	2.2	3559	6588	0.2	0.2
Total	939132	1192492	1385491	2.4	2.5	16274	30985	0.1	0.2
Productivity		(£CVM per worker)		(% pa)		(£CVM per worker)		(pp pa)	
Primary & Utilities	77804	82235	88257	0.6	1.2	1387	2467	0.2	0.2
Manufacturing	41532	55330	66234	2.9	3.0	966	1895	0.2	0.2
Construction	26926	33143	38082	2.1	2.3	270	495	0.1	0.1
Distrib Trans & Comms	26253	32416	36840	2.1	2.2	427	810	0.1	0.2
Finan Bus & Oth Servs	33163	39941	44061	1.9	1.6	610	1097	0.2	0.2
Non-Market Services	22946	27965	31506	2.0	2.0	493	877	0.2	0.2
Total	30989	37788	42663	2.0	2.0	547	1005	0.1	0.2

Ref : C51FS5-C51FSB.

5.3.3 Occupations and skills in the high skills scenarios

The high skills scenarios are predicated on employers being able to increase the average skills levels in their employed workforces as set out in previous sections. This assumes that suitably qualified people are available. However the scenarios are not simply about boosting supply. Rather their focus is upon changing demand.

The high skills scenarios involve a step change in the deployment of skills across the economy. This has been articulated as a 25% improvement in the rate of growth of the skills index developed in Chapter 3, compared with performance actually observed over the period 1994-2004. The skills index is measured in terms of what (on average) employers are prepared to pay to employ people who hold different levels of formal qualifications.[16]

Such an improvement could be achieved by employers changing their employment structures in favour of particular occupations (which typically require higher levels of formal qualifications). Equally the same improvement could be achieved by increasing the proportion of people qualified at higher levels within occupations. There are an infinite number of possible combinations here. Both the 'catch-up' and 'restructuring' scenarios assume a fairly even split between changing occupational structures and changing qualification profiles within occupations.

Equally, there is an infinite range of possibilities in terms of how the qualification improvements contribute to the increases assumed in the skills index. It could be concentrated at higher levels, with a shift in favour of post-graduate qualifications, or it could be the raising up of those at the bottom from a position of having no or poor formal qualifications to becoming better qualified. Various attempts have been made to assess where the deficiencies are currently most severe (see, for example the discussion in the LSC's *Skills In England* reports). There is however no clear consensus on this. Current patterns of change also constrain future possibilities. For example, the proportion of those with no formal qualifications at all is already expected to fall to very low levels by 2020, leaving little room for further improvement. Our preferred selection from the various alternatives we have considered are shown in the final columns of Table 5.13.

16 Formal qualifications are as noted earlier only one measure of skill. While the discussion here focuses upon qualifications and occupations (because they are relatively straightforward to measure), it should be recognised that other dimensions, as discussed in Section 2.1, may be equally important in achieving the kind of high skills scenarios envisaged here.

TABLE 5.12: OCCUPATIONAL EMPLOYMENT IN THE HIGH SKILLS SCENARIOS

All Industry Sectors		Catch-up	Restruct-uring
Employment Levels (000s)			
	2004	2020	2020
1. Managers and Senior Officials	4,609	6,049	6,046
2. Professional occupations	3,539	5,425	5,452
3. Associate Professional and Technical	4,302	5,576	5,556
4. Administrative and Secretarial	3,790	2,842	2,739
5. Skilled Trades Occupations	3,433	3,292	3,206
6. Personal Service Occupations	2,244	2,706	2,728
7. Sales and Customer Service Occupations	2,412	2,761	2,783
8. Machine and Transport Operatives	2,367	1,923	1,862
9. Elementary Occupations	3,403	2,040	1,919
Total	30,099	32,613	32,290
Percentage Shares			
	2004	2020	2020
1. Managers and Senior Officials	15.3	18.5	18.7
2. Professional occupations	11.8	16.6	16.9
3. Associate Professional and Technical	14.3	17.1	17.2
4. Administrative and Secretarial	12.6	8.7	8.5
5. Skilled Trades Occupations	11.4	10.1	9.9
6. Personal Service Occupations	7.5	8.3	8.4
7. Sales and Customer Service Occupations	8.0	8.5	8.6
8. Machine and Transport Operatives	7.9	5.9	5.8
9. Elementary Occupations	11.3	6.3	5.9
Total	100.0	100.0	100.0
Net Changes			
	Catch-up 2004-20		Restructuring 2004-20
	%	‘000	**%** ‘000
1. Managers and Senior Officials	31.2	1,439	31.2 1,436
2. Professional occupations	53.3	1,886	54.1 1,913
3. Associate Professional and Technical	29.6	1,274	29.1 1,254
4. Administrative and Secretarial	-25.0	-948	-27.7 -1,051
5. Skilled Trades Occupations	-4.1	-141	-6.6 -227
6. Personal Service Occupations	20.6	462	21.6 484
7. Sales and Customer Service Occupations	14.4	349	15.4 370
8. Machine and Transport Operatives	-18.8	-445	-21.3 -505
9. Elementary Occupations	-40.1	-1,363	-43.6 -1,484
Total	8.4	2,514	7.3 2,191

Source(s) : IER estimates.
Note(s): : Excludes employment in HM Forces.
Ref : AllUk.c51 FS4.accel-1 (table 5.12 Leitch).

TABLE 5.13: PROPORTIONS OF EMPLOYMENT BY HIGHEST QUALIFICATION HELD

	Baseline (*Working Futures*, extended)			High skills scenarios	
				Catch-up	Structural
Ref:			FSB	FS4	FS5
NQF levels	2004	2014	2020	2020	2020
NQF5	6.0	9.5	11.1	12.6	12.7
NQF4	23.9	29.3	31.0	33.0	33.2
NQF3	19.7	24.5	26.2	27.2	27.1
NQF2	22.1	20.2	18.6	16.6	16.5
NQF1	17.8	13.8	11.3	9.3	9.2
NQF0	10.5	2.6	1.8	1.3	1.3
All levels	100	100	100	100	100.0

Note(s) : These are highest qualifications held. Shares at NQF levels 1 and 2 fall despite more people acquiring such qualifications because even more of them are projected to go onto obtain even higher qualifications.
Source(s): IER estimates based on LFS and other data.

For the reasons already discussed they should be regarded as indicative of the kinds of skills that might be required to facilitate the kind of high skills vision sketched out above. They indicate greater emphasis on skills at all levels above NQF 2, but especially at NQF 4 and 5. The detailed decisions about what skills are required must be made by employers. The SSDA and the Sector Skills Councils clearly have a crucial role to play in articulating the voice of employers but also in helping to persuade them of the advantages of moving in this direction.

The conclusions from this analysis are that, although the two scenarios have rather different implications for the sectoral distribution of value added and employment, the implications for employment by occupation and qualifications are not markedly different. To put it another way, the results have not proved very sensitive to different sectoral outcomes for the same given boost to skills and productivity.

How a high skills scenario might come about

The State has a critical role in facilitating further improvements in educational attainment. But by itself, boosting supply will not be enough. Indeed unless changes are also made on the demand side, attempts to boost the supply of skills simply risks depressing the rate of return to higher level qualifications. Achieving the kind of high skills scenario set out here requires that employers buy in to this vision by investing in employing more highly skilled people. The State may be able to help this by demonstration, promotion and exhortation. However, some sticks and carrots may be needed as well. This might include raising the minimum wage to force employers to move to ways of working that are high skill rather than low skill. Society as a whole makes (often more implicitly than explicitly) certain choices about the distribution of income and how people are valued. This is reflected in the decisions Governments make about things such as the minimum wage and pay in the public sector generally. Changing these may have profound implications and risks for employment, given the

increasing intensity of international competition. However, other countries have demonstrated that it is possible to make these choices in a manner which does not put jobs at risk in the longer term and which encourages all employers to value their staff more highly and to use them more efficiently. If such plans are set out well in advance, then employers can have time to adjust their plans to reflect the new rules of the game. Obviously some jobs will be put at risk by such policies, but this is an inevitable feature of the high skills scenario which involves restructuring and the loss of old low-skilled employment in favour of new high-skilled jobs.

TABLE 5.13: BASELINE PROJECTIONS OF EMPLOYMENT BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		('000)		(% pa)		('000)		(pp pa)	
1 Agriculture	426	365	335	-1.6	-1.4	0	0	0.0	0.0
2 Mining & quarrying, utilities	183	152	136	-1.8	-1.8	0	0	0.0	0.0
3 Food, drink & tobacco	458	410	383	-1.1	-1.1	0	0	0.0	0.0
4 Textiles & clothing	183	104	90	-5.5	-2.4	0	0	0.0	0.0
5 Wood, paper, printing & publishing	566	525	508	-0.8	-0.5	0	0	0.0	0.0
6 Chemicals, & NMMP	599	527	474	-1.3	-1.7	0	0	0.0	0.0
7 Metals & metal goods	470	416	394	-1.2	-0.9	0	0	0.0	0.0
8 Engineering	681	622	577	-0.9	-1.3	0	0	0.0	0.0
9 Transport equipment	362	318	291	-1.3	-1.4	0	0	0.0	0.0
10 Manufacturing nes & recycling	233	243	248	0.4	0.4	0	0	0.0	0.0
11 Construction	2090	1943	1934	-0.7	-0.1	0	0	0.0	0.0
13 Wholesale distribution	1910	1991	2047	0.4	0.5	0	0	0.0	0.0
14 Other retail distribution	3145	3420	3590	0.8	0.8	0	0	0.0	0.0
15 Hotels & catering	1962	2076	2086	0.6	0.1	0	0	0.0	0.0
16 Transport	1286	1331	1378	0.3	0.6	0	0	0.0	0.0
17 Communications	527	531	548	0.1	0.5	0	0	0.0	0.0
18 Banking & insurance	1162	1161	1136	0.0	-0.4	0	0	0.0	0.0
19 Professional services	2236	2487	2719	1.1	1.5	0	0	0.0	0.0
20 Computing services	550	718	954	2.7	4.8	0	0	0.0	0.0
21 Other business services	1997	2331	2580	1.6	1.7	0	0	0.0	0.0
22 Public administration & defence	1741	1685	1624	-0.3	-0.6	0	0	0.0	0.0
23 Education	2443	2584	2640	0.6	0.4	0	0	0.0	0.0
24 Health & social work	3224	3599	3695	1.1	0.4	0	0	0.0	0.0
25 Miscellaneous services	1871	2046	2148	0.9	0.8	0	0	0.0	0.0
Total	30305	31584	32515	0.4	0.5	0	0	0.0	0.0

Ref : C51FSB-C51FSB.

TABLE 5.14: BASELINE PROJECTIONS OF VALUE ADDED OUTPUT BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		(£CVMm)		(% pa)		(£CVMm)		(pp pa)	
1 Agriculture	9418	10557	11382	1.1	1.3	0	0	0.0	0.0
2 Mining & quarrying, utilities	38003	31240	29088	-1.9	-1.2	0	0	0.0	0.0
3 Food, drink & tobacco	21125	22831	23003	0.8	0.1	0	0	0.0	0.0
4 Textiles & clothing	5029	3206	3091	-4.4	-0.6	0	0	0.0	0.0
5 Wood, paper, printing & publishing	22078	24407	26029	1.0	1.1	0	0	0.0	0.0
6 Chemicals, & NMMP	32350	41124	48006	2.4	2.6	0	0	0.0	0.0
7 Metals & metal goods	14928	16091	16917	0.8	0.8	0	0	0.0	0.0
8 Engineering	28135	35082	40951	2.2	2.6	0	0	0.0	0.0
9 Transport equipment	17235	20906	23340	1.9	1.9	0	0	0.0	0.0
10 Manufacturing nes & recycling	6657	8350	9334	2.3	1.9	0	0	0.0	0.0
11 Construction	56279	63871	72692	1.3	2.2	0	0	0.0	0.0
13 Wholesale distribution	67113	84999	96849	2.4	2.2	0	0	0.0	0.0
14 Other retail distribution	56251	69107	77387	2.1	1.9	0	0	0.0	0.0
15 Hotels & catering	33430	40445	42778	1.9	0.9	0	0	0.0	0.0
16 Transport	45285	53422	58419	1.7	1.5	0	0	0.0	0.0
17 Communications	29725	51128	72230	5.6	5.9	0	0	0.0	0.0
18 Banking & insurance	44817	56212	62008	2.3	1.6	0	0	0.0	0.0
19 Professional services	103992	138433	167155	2.9	3.2	0	0	0.0	0.0
20 Computing services	29009	50689	71155	5.7	5.8	0	0	0.0	0.0
21 Other business services	34501	43652	49891	2.4	2.3	0	0	0.0	0.0
22 Public administration & defence	48750	59710	66238	2.0	1.7	0	0	0.0	0.0
23 Education	52315	64276	71861	2.1	1.9	0	0	0.0	0.0
24 Health & social work	64186	86808	100022	3.1	2.4	0	0	0.0	0.0
25 Miscellaneous services	46885	54860	59533	1.6	1.4	0	0	0.0	0.0
Total	939132	1176218	1354506	2.3	2.4	0	0	0.0	0.0

Ref : C51FSB-C51FSB.

TABLE 5.15: BASELINE PROJECTIONS OF PRODUCTIVITY BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		(£CVM per worker)		(% pa)		(£CVM per worker)		(pp pa)	
1 Agriculture	22094	28955	33947	2.7	2.7	0	0	0.0	0.0
2 Mining & quarrying, utilities	207410	205000	213183	-0.1	0.7	0	0	0.0	0.0
3 Food, drink & tobacco	46161	55633	60076	1.9	1.3	0	0	0.0	0.0
4 Textiles & clothing	27458	30788	34437	1.2	1.9	0	0	0.0	0.0
5 Wood, paper, printing & publishing	39009	46538	51274	1.8	1.6	0	0	0.0	0.0
6 Chemicals, & NMMP	53974	78065	101295	3.8	4.4	0	0	0.0	0.0
7 Metals & metal goods	31767	38701	42991	2.0	1.8	0	0	0.0	0.0
8 Engineering	41306	56403	71038	3.2	3.9	0	0	0.0	0.0
9 Transport equipment	47618	65847	80149	3.3	3.3	0	0	0.0	0.0
10 Manufacturing nes & recycling	28542	34394	37620	1.9	1.5	0	0	0.0	0.0
11 Construction	26926	32873	37587	2.0	2.3	0	0	0.0	0.0
13 Wholesale distribution	35135	42683	47307	2.0	1.7	0	0	0.0	0.0
14 Other retail distribution	17889	20205	21555	1.2	1.1	0	0	0.0	0.0
15 Hotels & catering	17041	19481	20507	1.3	0.9	0	0	0.0	0.0
16 Transport	35208	40132	42400	1.3	0.9	0	0	0.0	0.0
17 Communications	56410	96216	131809	5.5	5.4	0	0	0.0	0.0
18 Banking & insurance	38579	48429	54568	2.3	2.0	0	0	0.0	0.0
19 Professional services	46501	55674	61473	1.8	1.7	0	0	0.0	0.0
20 Computing services	52716	70561	74612	3.0	0.9	0	0	0.0	0.0
21 Other business services	17277	18730	19339	0.8	0.5	0	0	0.0	0.0
22 Public administration & defence	27995	35438	40795	2.4	2.4	0	0	0.0	0.0
23 Education	21417	24877	27215	1.5	1.5	0	0	0.0	0.0
24 Health & social work	19911	24123	27069	1.9	1.9	0	0	0.0	0.0
25 Miscellaneous services	25061	26812	27716	0.7	0.6	0	0	0.0	0.0
Total	30989	37242	41658	1.9	1.9	0	0	0.0	0.0

Ref : C51FSB-C51FSB.

TABLE 5.16: CATCH-UP SCENARIO PROJECTIONS OF EMPLOYMENT BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		('000)		(% pa)		('000)		(pp pa)	
1 Agriculture	426	371	344	-1.4	-1.2	6	9	0.2	0.2
2 Mining & quarrying, utilities	183	152	136	-1.8	-1.8	0	0	0.0	0.0
3 Food, drink & tobacco	458	414	389	-1.0	-1.1	4	6	0.1	0.1
4 Textiles & clothing	183	105	93	-5.4	-2.0	1	4	0.1	0.4
5 Wood, paper, printing & publishing	566	533	523	-0.6	-0.3	9	16	0.2	0.2
6 Chemicals, & NMMP	599	532	483	-1.2	-1.6	5	9	0.1	0.2
7 Metals & metal goods	470	419	398	-1.2	-0.8	3	5	0.1	0.1
8 Engineering	681	637	602	-0.7	-0.9	15	26	0.2	0.3
9 Transport equipment	362	322	299	-1.2	-1.2	5	8	0.1	0.2
10 Manufacturing nes & recycling	233	246	254	0.5	0.5	3	6	0.1	0.2
11 Construction	2090	1953	1954	-0.7	0.0	10	20	0.1	0.1
13 Wholesale distribution	1910	2003	2068	0.5	0.5	12	21	0.1	0.1
14 Other retail distribution	3145	3404	3557	0.8	0.7	-16	-34	0.0	-0.1
15 Hotels & catering	1962	2078	2089	0.6	0.1	1	3	0.0	0.0
16 Transport	1286	1344	1400	0.4	0.7	13	22	0.1	0.1
17 Communications	527	532	545	0.1	0.4	1	-3	0.0	-0.1
18 Banking & insurance	1162	1171	1154	0.1	-0.2	10	18	0.1	0.1
19 Professional services	2236	2518	2776	1.2	1.6	31	57	0.1	0.1
20 Computing services	550	732	984	2.9	5.1	13	30	0.2	0.2
21 Other business services	1997	2331	2580	1.6	1.7	0	0	0.0	0.0
22 Public administration & defence	1741	1681	1618	-0.4	-0.6	-4	-6	0.0	0.0
23 Education	2443	2597	2662	0.6	0.4	13	22	0.1	0.1
24 Health & social work	3224	3626	3741	1.2	0.5	28	46	0.1	0.1
25 Miscellaneous services	1871	2048	2150	0.9	0.8	1	2	0.0	0.0
Total	30305	31747	32798	0.5	0.5	163	283	0.1	0.1

Ref : C51FS4-C51FSB.

TABLE 5.17: CATCH-UP SCENARIO PROJECTIONS OF VALUE ADDED OUTPUT BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		(£CVMm)		(% pa)		(£CVMm)		(pp pa)	
1 Agriculture	9418	10864	11908	1.4	1.5	308	526	0.3	0.3
2 Mining & quarrying, utilities	38003	31537	29616	-1.8	-1.0	297	527	0.1	0.1
3 Food, drink & tobacco	21125	23502	24199	1.1	0.5	672	1196	0.3	0.4
4 Textiles & clothing	5029	3304	3315	-4.1	0.1	98	224	0.3	0.7
5 Wood, paper, printing & publishing	22078	25197	27529	1.3	1.5	790	1500	0.3	0.4
6 Chemicals, & NMMP	32350	42258	50222	2.7	2.9	1135	2216	0.3	0.3
7 Metals & metal goods	14928	16648	17989	1.1	1.3	557	1072	0.3	0.5
8 Engineering	28135	36421	43714	2.6	3.1	1340	2763	0.4	0.5
9 Transport equipment	17235	21641	24743	2.3	2.3	736	1403	0.4	0.4
10 Manufacturing nes & recycling	6657	8657	9940	2.7	2.3	307	606	0.4	0.5
11 Construction	56279	64854	74638	1.4	2.4	982	1946	0.2	0.2
13 Wholesale distribution	67113	86812	100339	2.6	2.4	1814	3490	0.2	0.2
14 Other retail distribution	56251	69970	78936	2.2	2.0	863	1549	0.1	0.1
15 Hotels & catering	33430	41307	44248	2.1	1.2	862	1470	0.2	0.2
16 Transport	45285	54661	60713	1.9	1.8	1239	2294	0.2	0.3
17 Communications	29725	52303	74869	5.8	6.2	1175	2639	0.2	0.2
18 Banking & insurance	44817	57830	65040	2.6	2.0	1618	3032	0.3	0.3
19 Professional services	103992	141439	173304	3.1	3.4	3006	6150	0.2	0.3
20 Computing services	29009	52000	74194	6.0	6.1	1311	3039	0.3	0.3
21 Other business services	34501	44576	51670	2.6	2.5	924	1779	0.2	0.2
22 Public administration & defence	48750	60779	68162	2.2	1.9	1070	1924	0.2	0.2
23 Education	52315	65264	73635	2.2	2.0	988	1774	0.2	0.2
24 Health & social work	64186	88373	102935	3.2	2.6	1565	2913	0.2	0.2
25 Miscellaneous services	46885	56067	61648	1.8	1.6	1207	2115	0.2	0.2
Total	939132	1202185	1405052	2.5	2.6	25967	50546	0.2	0.3

Ref : C51FS4-C51FSB.

TABLE 5.18: CATCH-UP SCENARIO PROJECTIONS OF PRODUCTIVITY BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		(£CVM per worker)		(% pa)		(£CVM per worker)		(pp pa)	
1 Agriculture	22094	29310	34606	2.9	2.8	354	659	0.1	0.1
2 Mining & quarrying, utilities	207410	207196	217454	0.0	0.8	2196	4271	0.1	0.2
3 Food, drink & tobacco	46161	56773	62292	2.1	1.6	1140	2216	0.2	0.3
4 Textiles & clothing	27458	31380	35556	1.3	2.1	592	1119	0.2	0.2
5 Wood, paper, printing & publishing	39009	47273	52592	1.9	1.8	735	1319	0.2	0.2
6 Chemicals, & NMMP	53974	79402	103929	3.9	4.6	1336	2634	0.2	0.2
7 Metals & metal goods	31767	39785	45184	2.3	2.1	1083	2194	0.3	0.4
8 Engineering	41306	57155	72585	3.3	4.1	752	1546	0.1	0.1
9 Transport equipment	47618	67192	82730	3.5	3.5	1345	2581	0.2	0.2
10 Manufacturing nes & recycling	28542	35248	39176	2.1	1.8	854	1555	0.3	0.3
11 Construction	26926	33210	38206	2.1	2.4	337	619	0.1	0.1
13 Wholesale distribution	35135	43340	48523	2.1	1.9	657	1216	0.2	0.2
14 Other retail distribution	17889	20556	22195	1.4	1.3	351	640	0.2	0.2
15 Hotels & catering	17041	19882	21185	1.6	1.1	401	678	0.2	0.2
16 Transport	35208	40664	43360	1.5	1.1	533	960	0.1	0.2
17 Communications	56410	98319	137443	5.7	5.7	2103	5634	0.2	0.4
18 Banking & insurance	38579	49401	56369	2.5	2.2	972	1801	0.2	0.2
19 Professional services	46501	56172	62420	1.9	1.8	499	946	0.1	0.1
20 Computing services	52716	71057	75414	3.0	1.0	496	802	0.1	0.1
21 Other business services	17277	19127	20029	1.0	0.8	397	690	0.2	0.2
22 Public administration & defence	27995	36160	42135	2.6	2.6	722	1340	0.2	0.2
23 Education	21417	25131	27661	1.6	1.6	254	446	0.1	0.1
24 Health & social work	19911	24370	27514	2.0	2.0	247	445	0.1	0.1
25 Miscellaneous services	25061	27384	28678	0.9	0.8	572	962	0.2	0.2
Total	30989	37868	42840	2.0	2.1	627	1181	0.2	0.2

Ref: C51FS4-C51FSB.

TABLE 5.19: RESTRUCTURING SCENARIO PROJECTIONS OF EMPLOYMENT BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		('000)		(% pa)		('000)		(pp pa)	
1 Agriculture	426	358	325	-1.7	-1.6	-7	-10	-0.2	-0.2
2 Mining & quarrying, utilities	183	152	136	-1.8	-1.8	0	0	0.0	0.0
3 Food, drink & tobacco	458	402	369	-1.3	-1.4	-9	-14	-0.2	-0.2
4 Textiles & clothing	183	101	84	-5.8	-2.9	-4	-6	-0.3	-0.5
5 Wood, paper, printing & publishing	566	519	500	-0.9	-0.6	-5	-7	-0.1	-0.1
6 Chemicals, & NMMP	599	523	468	-1.4	-1.8	-4	-6	-0.1	-0.1
7 Metals & metal goods	470	408	381	-1.4	-1.1	-8	-13	-0.2	-0.2
8 Engineering	681	618	570	-1.0	-1.4	-4	-7	-0.1	-0.1
9 Transport equipment	362	312	284	-1.5	-1.6	-5	-8	-0.2	-0.2
10 Manufacturing nes & recycling	233	242	246	0.4	0.3	-1	-2	0.0	0.0
11 Construction	2090	1949	1946	-0.7	0.0	6	12	0.0	0.1
13 Wholesale distribution	1910	1985	2035	0.4	0.4	-7	-13	0.0	0.0
14 Other retail distribution	3145	3413	3575	0.8	0.8	-7	-16	0.0	0.0
15 Hotels & catering	1962	2088	2105	0.6	0.1	12	19	0.1	0.1
16 Transport	1286	1339	1391	0.4	0.6	8	13	0.1	0.1
17 Communications	527	535	551	0.1	0.5	3	3	0.1	0.0
18 Banking & insurance	1162	1149	1118	-0.1	-0.5	-12	-19	-0.1	-0.1
19 Professional services	2236	2498	2737	1.1	1.5	12	18	0.0	0.0
20 Computing services	550	724	964	2.8	4.9	6	10	0.1	0.0
21 Other business services	1997	2338	2592	1.6	1.7	7	12	0.0	0.0
22 Public administration & defence	1741	1650	1570	-0.5	-0.8	-35	-54	-0.2	-0.2
23 Education	2443	2595	2660	0.6	0.4	11	19	0.0	0.0
24 Health & social work	3224	3615	3722	1.2	0.5	16	27	0.0	0.0
25 Miscellaneous services	1871	2046	2147	0.9	0.8	0	-1	0.0	0.0
Total	30305	31557	32475	0.4	0.5	-27	-40	0.0	0.0

Ref : C51FS5-C51FSB.

TABLE 5.20: RESTRUCTURING SCENARIO PROJECTIONS OF VALUE ADDED OUTPUT BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
		(£CVMm)		(% pa)		(£CVMm)		(pp pa)	
1 Agriculture	9418	10496	11274	1.1	1.2	-60	-108	-0.1	-0.1
2 Mining & quarrying, utilities	38003	31442	29450	-1.9	-1.1	202	361	0.1	0.1
3 Food, drink & tobacco	21125	22761	22788	0.7	0.0	-70	-215	0.0	-0.1
4 Textiles & clothing	5029	3183	3030	-4.5	-0.8	-23	-61	-0.1	-0.2
5 Wood, paper, printing & publishing	22078	24686	26532	1.1	1.2	279	503	0.1	0.1
6 Chemicals, & NMMP	32350	41504	48792	2.5	2.7	380	786	0.1	0.1
7 Metals & metal goods	14928	16020	16755	0.7	0.8	-71	-161	0.0	-0.1
8 Engineering	28135	35318	41398	2.3	2.7	237	447	0.1	0.1
9 Transport equipment	17235	20958	23456	2.0	1.9	53	116	0.0	0.0
10 Manufacturing nes & recycling	6657	8413	9457	2.4	2.0	63	123	0.1	0.1
11 Construction	56279	64605	74112	1.4	2.3	734	1420	0.1	0.1
13 Wholesale distribution	67113	85804	98316	2.5	2.3	805	1467	0.1	0.1
14 Other retail distribution	56251	69962	78922	2.2	2.0	856	1535	0.1	0.1
15 Hotels & catering	33430	41217	44104	2.1	1.1	772	1326	0.2	0.2
16 Transport	45285	54156	59705	1.8	1.6	734	1286	0.1	0.1
17 Communications	29725	52263	74687	5.8	6.1	1135	2457	0.2	0.2
18 Banking & insurance	44817	56947	63324	2.4	1.8	735	1315	0.1	0.1
19 Professional services	103992	140667	171609	3.1	3.4	2234	4454	0.2	0.2
20 Computing services	29009	51707	73453	6.0	6.0	1018	2299	0.2	0.2
21 Other business services	34501	44346	51193	2.5	2.4	695	1301	0.2	0.2
22 Public administration & defence	48750	59819	66439	2.1	1.8	109	201	0.0	0.0
23 Education	52315	65544	74172	2.3	2.1	1268	2312	0.2	0.2
24 Health & social work	64186	88991	104098	3.3	2.6	2182	4076	0.3	0.3
25 Miscellaneous services	46885	56013	61531	1.8	1.6	1153	1998	0.2	0.2
Total	939132	1192492	1385491	2.4	2.5	16274	30985	0.1	0.2

Ref : C51FS5-C51FSB.

TABLE 5.21: RESTRUCTURING SCENARIO PROJECTIONS OF PRODUCTIVITY BY INDUSTRY

						Differences from baseline			
	2004	2014	2020	2004-2014	2014-2020	2014	2020	2004-2014	2014-2020
	(£CVM per worker)			(% pa)		(£CVM per worker)		(pp pa)	
1 Agriculture	22094	29337	34661	2.9	2.8	382	714	0.1	0.1
2 Mining & quarrying, utilities	207410	206595	216292	0.0	0.8	1595	3109	0.1	0.1
3 Food, drink & tobacco	46161	56694	61762	2.1	1.4	1061	1686	0.2	0.1
4 Textiles & clothing	27458	31640	36016	1.4	2.2	852	1579	0.3	0.3
5 Wood, paper, printing & publishing	39009	47554	53026	2.0	1.8	1016	1753	0.2	0.2
6 Chemicals, & NMMP	53974	79420	104276	3.9	4.6	1355	2981	0.2	0.2
7 Metals & metal goods	31767	39304	43980	2.2	1.9	602	989	0.2	0.1
8 Engineering	41306	57121	72697	3.3	4.1	717	1658	0.1	0.2
9 Transport equipment	47618	67097	82662	3.5	3.5	1250	2513	0.2	0.2
10 Manufacturing nes & recycling	28542	34792	38382	2.0	1.7	398	762	0.1	0.1
11 Construction	26926	33143	38082	2.1	2.3	270	495	0.1	0.1
13 Wholesale distribution	35135	43231	48321	2.1	1.9	548	1013	0.1	0.1
14 Other retail distribution	17889	20497	22079	1.4	1.2	292	524	0.1	0.2
15 Hotels & catering	17041	19742	20950	1.5	1.0	261	443	0.1	0.1
16 Transport	35208	40440	42931	1.4	1.0	308	530	0.1	0.1
17 Communications	56410	97741	135550	5.7	5.6	1525	3741	0.2	0.2
18 Banking & insurance	38579	49579	56657	2.5	2.2	1150	2089	0.2	0.2
19 Professional services	46501	56311	62706	1.9	1.8	637	1233	0.1	0.1
20 Computing services	52716	71377	76226	3.1	1.1	816	1614	0.1	0.2
21 Other business services	17277	18971	19748	0.9	0.7	241	409	0.1	0.1
22 Public administration & defence	27995	36257	42316	2.6	2.6	819	1521	0.2	0.2
23 Education	21417	25259	27887	1.7	1.7	382	672	0.2	0.2
24 Health & social work	19911	24620	27967	2.1	2.1	497	899	0.2	0.2
25 Miscellaneous services	25061	27373	28656	0.9	0.8	561	940	0.2	0.2
Total	30989	37788	42663	2.0	2.0	547	1005	0.1	0.2

Ref : C51FS5-C51FSB.