The cost of skill underutilisation in the UK

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Executive Summary

Over the past few decades, countries in the OECD have experienced a large and sustained increase in the level of educational attainment, most notably in the tertiary sector but also at other levels. There have also been concerns that many skills produced by this expansion are not fully utilised by the labour market as the demand for those skills have not risen in proportion. Using the Skills Survey data on skill utilisation, this report gives estimates of the cost, in terms of lost economic output, of underutilising the available skills of workers for the UK as a whole. Such an estimate has not been produced previously.

The main analysis looks at individual hourly wages as a measure of worker productivity. It establishes differences in wages for those fully utilised and underutilised in the UK labour market between 1997 and 2012. Given these differences, it estimates how much higher wages (and, by assumption, productivity and output) would have been if everyone who was underutilised entered the sorts of jobs available to their fully utilised counterparts. A range of estimates are given allowing for differences in the effect of underutilisation between sectors and between individuals with different qualifications. This increase is ultimately expressed in terms of a projected increase in national income.

The data shows that based on individual self-reports, around 15% of the UK workforce believe they have more skills than are necessary for their current job, and on average such workers earn approximately 1.5-3.0% less than an otherwise identical individual who reported that they were fully utilised, depending on the particular specification of the model being estimated. This represents a loss of between £12bn and £25bn to UK GDP. Of course, this represents the gain from an unrealistic counterfactual - a more realistic move towards the levels of skill utilisation seen in other European countries like Germany and France would represent a boost of £5-9bn.

A secondary part of the analysis looks at the role of industrial composition of the economy. The sectoral composition of the UK does not itself explain much of the source of total underutilisation. Most European countries have lower levels of underutilisation than the UK, despite an industrial structure that, if replicated in the UK, wouldn't be expected to reduce levels of underutilisation. In particular, the public administration, education and health sector in the UK is relatively large and has better than average levels of skill utilisation, while the manufacturing sector is small and has lower

than average levels of skill utilisation. If the UK were to expand in the latter and shrink the smaller such that its industrial structure started to be closer to places like Germany or Austria then holding everything else equal, skill utilisation would not improve. Instead, it is the level of skill utilisation within a sector that matters most. The report shows workers generally match into sectors where their particular skills, level of experience and qualifications could be best rewarded – the challenge in these sectors is to ensure everyone is best using those skills. One exception appears to be in the lower wage service sector such as hospitality and retail – while there is lower levels of utilisation in this sector, the main difference is that returns to qualification and skills in this sector are lower, even when individuals report full utilisation of those skills. This suggests there are unobserved differences in the skill levels of two identically qualified individuals where one works in the lower wage service sector and the other works elsewhere. The implication of this is that it would not be simple for workers to move from the low wage service sector into other sectors without some retraining or other costs to employers.

The findings presented here give an indication of the size of the total cost of underutilisation. There are a number of caveats which should be borne in mind. Firstly, wages and productivity may not be tightly aligned as labour markets are not perfectly competitive. Secondly, the estimated gain from improvements in utilisation assumes that underutilised workers would be moved into jobs with wages and productivity that are similar to the average of the currently fully utilised groups. However, there may be unobserved differences in productive capability between the fully utilised and underutilised groups. Moreover, there may be diminishing returns to individuals moving into certain skill-appropriate occupations. Finally, these estimates should be seen as one part of a full cost-benefit analysis. Moving towards higher skill employment is not costless, which should be taken into account. Moreover, it does not take into account the cost of producing the current level of skills. Given these costs, it is an open question whether it is preferable (based on cost-benefit analysis) to assume measures to increase skill demand (or accept the existing level of skill demand) and reduce skill supply of the workforce.

1 Introduction

Over the past few decades, countries in the OECD have experienced a large and sustained increase in the level of educational attainment, most notably in the tertiary sector but also at other levels (OECD 2017a; 2017b). There have also been concerns that many skills produced by this expansion are not fully utilised by the labour market as the demand for those skills have not risen in proportion.

Much work has been done in an attempt to establish the extent of the problem (for a summary, see CIPD, 2015). Broadly speaking, there are three approaches found in existing research.[1] Firstly, there are approaches which look to classify jobs using some form of judgement about the skill requirements. For example, in most occupational classifications, the traditional professions (such as lawyers, doctors and accountants) have long been considered to require degree level skills or an equivalent vocational professional qualification. Increasingly it is common to suppose that managerial work and associate professional or technical occupations have a degree requirement – a newly developed cross European indicator provided by Eurostat on overqualification[2] looks at tertiary graduates in occupations that are not managerial, professional or technical for example, and the UK's Higher Education Statistics Agency (HESA) report on those able and unable to access professional managerial and technical occupations in their analysis of graduate labour market outcomes.[3]

Defining underutilisation in this way presents some problems for this paper. Firstly, it focuses only on the graduate/non-graduate distinction, which is too narrow. If graduates are taking jobs for which they are over-skilled, it is likely that this has a knock-on effect on what work is now available for non-graduates and their ability to use their skills. Moreover, even within these broadly defined graduate jobs, it is unlikely that everyone is fully utilised. The majority of managerial, associate professional and technical jobs are held by non-graduates. Recent analysis by Elias and Purcell (2013) and Green and Henseke (2014) has estimated that the skills required by, for example, sales directors or financial analysts are higher and more relevant to graduate skills than property and estate managers or police officers.

Secondly, there are approaches that attempt to estimate some objective skill requirement standard using statistical analysis of labour market data that is observed frequently – in principal, this could deal with one of the main problems of the first set of approaches, which is that definitions of skill requirements tend to be static and updated infrequently, either because in-depth evaluations of task requirements in jobs are expensive and time-consuming, or the survey data underlying the approaches of Elias and Purcell and Green and Henseke come from specific surveys. For example, one commonly used approach is to compare individuals against the mean, median or modal level of education

[1] It should be noted here at the beginning of this paper that the extent of underutilisation and overqualification (and, indeed, underqualification) varies considerably depending on the approach being used, and so it is possible to get a different picture if a different measure were to be used.

[2] http://ec.europa.eu/eurostat/statistics-explained/index.php/Employment_and_labour_demand

[3] https://www.hesa.ac.uk/data-and-analysis/students/graduate-employment

possessed by those doing a particular job during a particular period of time. However, such an approach confuses skill supply with skill demand. As more highly qualified individuals move into a particular occupation, this measure would suggest that fewer people are underutilised even if nothing has changed about the job and consequently many of the new recruits are, in fact, underutilised.

The third approach is to use self-reported survey evidence from individuals about their jobs. There is a considerable amount of work using subjective, self-reported data in the UK, where there are numerous useful data sources and where concerns about the underutilisation of highly qualified individuals, particularly university graduates, is a recurring theme. For example, Dolton and Vignoles (2000) found that around 30-40% of young people graduating in 1980 reported that they did not need their degree to get either their first job after university, or the job they were in six years after graduation. Battu *et al* (2000) find a similar proportion of graduates from two cohorts (1985 and 1990) for whom having a degree was not a requirement of the job they held in 1996. One issue with these sorts of studies is that it is not immediately clear how respondents interpret these sorts of questions – they may be thinking about their skills, but equally they may be saying that given the amount of competition for jobs they face, their degree was necessary to get an interview, regardless of the nature of the job they were applying for. It is possible to need a particular qualification to be hired for a particular job, even if the skills generated by studying for that qualification are ultimately not needed once work starts. Equally, it is possible that someone could get a particular job without one or more of their higher qualifications, but that they find that once they start working, those skills can be put to good use.

Data collected from the UK Skills Surveys[4] distinguish between these two aspects more clearly. In particular, one question is phrased: 'If they were applying today, what qualifications, if any, would someone need to get the type of job you have now?', while a separate question asks respondents about the extent to which they use their skills, experience and abilities in the current job. Green and Zhu (2010) examine this data in the context of the labour market outcomes of UK university graduates. Responses to the former suggest that many highly qualified individuals have increasingly entered jobs where their qualification was not a formal entry requirement –this group is referred to in Table 1 as "overqualified" for their job, in that they possess a qualification that was not needed in order to be recruited. Of these individuals, however, around two-thirds to three quarters of these jobs are not associated with skill underutilisation, whereas around one third are "overskilled" – that is, they self-report that they have more skills than they are able to use in their current employment. For those individuals who did require their qualification to get a particular job, a small proportion is overskilled. Overall, around 13-14% of UK graduates are overskilled – a proportion (but not an absolute number

[4] A descriptor which is used in this report as a catch-all term to include the 1986 Social Change and Economic Life Initiative survey, the 1992 Employment in Britain survey, the 1997, 2001 and 2006 Skills Surveys and the 2012 Skills and Employment Survey.

of individuals) that has remained relatively constant since the early 1990s. These findings are similar to those in Chevalier (2003) and Chevalier and Lindley (2009).

Table 1: Overqualification and overskilling

% of graduates	Male		Female	
	1992	**2006**	**1992**	**2006**
Qualified	78.3	66.8	76.4	68.0
…and overskilled	7.9	5.5	5.0	4.3
Overqualified	21.7	33.2	23.8	32.1
…and overskilled	7.5	9.9	7.2	8.4

Source: Data taken from Green and Zhu (2010). Author's calculations.

This paper uses self-reported skill utilisation measures from the UK Skill Surveys to estimate the cost of underutilising the skills of UK workers in terms of lost economic output. Such an estimate has not been produced previously - existing research has instead examined at how the experience of being in work that does not fully utilise available skills affects an *individual's* wages, employment and other life chances. This is not to say that self-reported measures are perfect, but given the different approaches discussed previously and the available data, this report argues that are the most useful in this context, not least because they allow for the analysis of underutilisation of all workers (not just specific educational groups such as university graduates in certain jobs).

The report is broken down as follows. Section 2 outlines the approach to measuring the costs of underutilisation taken in this report, with a discussion of limitations of the analysis and the caveats that are necessary to bear in mind. Section 3 presents the headline results for the UK as a whole and for different industries. Section 4 concludes.

2 Estimating the costs of underutilised skills

Establishing the cost to the UK of a labour market that does not fully employ all available skills requires comparing it to an appropriate alternative. One approach would be to say that the demand for skills in the UK at a point in time is fixed and that the cost is what has been invested in skills that are not needed. This would include costs to the individual who has completed education and training, such as the financial costs of study and the lost earnings during that time period, as well as the contribution of firms and the state to the funding of education and training.

The analysis here instead takes the supply of skills in the UK as fixed, and considers the costs to be the lost productivity of individuals who find they are underutilised in the workplace. These two aspects of the costs of underutilisation are related. It might, for example, be reasonable to assume that individuals only invest in skills to the extent that the study costs are at least as high as the expected benefits from higher wages they later command. Given data availability on labour market outcomes,

this second approach is more straightforward, while producing estimates of the costs of producing skills across a variety of institutions in the UK is incredibly difficult. Ideally, both would be known, so that a full cost benefit analysis of different scenarios and policy measures could be considered, as it noted later on this report. The approach taken here is more in line with the general drive of UK government policy to move towards a higher skill, higher valued added model for the economy, but it remains an assumption throughout that raising skill demand to meet existing skill supply is the preferred policy solution

To achieve this estimate of the cost of underutilisation, the analysis takes gross real hourly wages as measure of individual worker productivity. Under conditions of perfect competition in the labour market, economic theory states that the prevailing wage should equal the marginal productivity of labour. That is, employers would only be willing to take on an additional worker if what they produce is more than or equal to the cost of taking that individual. The main econometric specification estimated in this report is given in the Appendix. The key variable in the analysis is the effect of (self-reported) skill utilisation. Holding everything else constant, the difference in wages between an individual who is fully utilising their skills and one who is not is taken to capture the lost economic output of the latter individual. This is referred to in this report as the full skill use premium. Aggregating over all underutilised workers then gives an estimate of the additional economic output that would have resulted from full skill utilisation.

There are a number of caveats to the estimates. Firstly, labour markets are not typically perfectly competitive, which means that wages will usually fall below marginal productivity. In this case, the estimated losses from underutilisation will be lower than the true figure. Moreover, in some sectors, market forces are not the only thing driving pay (for example, in education and healthcare, where output and productivity not easy to measure). This approach also assumes that economic activity by individuals and firms does not have a zero-sum element, in which case higher wages for an individual become detached from the overall output of the economy as they imply a lower wage for someone else. All of this considered, wages should be treated as, at best, an approximation for the economic output of an individual to society as a whole.

Secondly the premium on skill utilisation captures the average difference in wage (as a proxy for productivity) between those that fully use their skills and those that do not to some extent. In estimating the gain to the economy from full utilisation, the assumption is that underutilised workers would be moved into jobs with wages and productivity that are similar to the average of the currently fully utilised groups. There are two reasons why this might not be a correct assumption. Firstly, there may be unobserved differences in productive capability between the fully utilised and underutilised groups – for example, those that are in general less able even within a single educational group (like those with undergraduate degrees) might systematically be more likely to be found in less demanding

jobs. Fully utilising the skills of this group would imply moving into lower productivity work than is currently typical of an equivalently qualified fully utilised individual. On the other hand, perhaps the more able are more likely to report being under-utilised – they, after all, have greater abilities that can be underutilised.

Thirdly, the final estimate of the overall gain to the economy of achieving full utilisation supposes that there is no effect anywhere else in the labour market of finding skill-appropriate work for the currently under-utilised.[5] It might be the case that there is diminishing marginal gains from moving a currently underutilised individual into a job that could potentially take full advantage of available skills. For example, suppose that in a low cost service sector firm, the most able and productive engage in managerial tasks and direct teams of individuals engaged in simpler tasks. If a currently under-utilised high skill individual were to move into such a post, their productivity is likely to be far lower (there are now two managers doing the work of one) unless the total workforce expands so that this individual also had a team to manage.

Fourth, the estimated benefits represent a best-case scenario, and not a very likely one. For one reason, full utilisation is probably unattainable. Other countries with a lower rate of skill utilisation than the UK do not have full utilisation. Some lower skilled tasks will continue to be required[6] and some people will opt for jobs which might not fully utilise their skills due to other constraints, such as family responsibilities.[7] At the end of this report, the estimated economic gains from reaching some more plausible goals are given.

Finally, interpreting these figures as the total potential gain to the economy would assume that this reorganisation of work could be enacted without cost. This report shows that differences in the level of underutilisation in the UK is not particularly due to the industrial composition of the economy as compared to many of its neighbours, but to the demand for skill within similar sectors, suggesting work is organised differently outside of the UK. Moving to higher value-added production processes would create costs, which would need to be considered against any possible benefits in a full cost-benefit analysis.

Due to all of these factors, the numbers given below should be interpreted as a rough estimate of the expected gains of reorganising the labour market such that underutilised workers are employed in jobs

[5] The analysis conducted in this report is what economists would call a 'partial equilibrium analysis'.

[6] The share of employment of the lowest skilled occupations has held up or even grown in the US and the UK over the past three or four decades, even while middle skilled jobs in manufacturing or clerical positions have disappeared (e.g. Goos and Manning, 2007; Autor and Dorn (2013). The polarisation of employment can largely be explained by the inability to replace such low skill service or manual occupations with new technology or by offshoring those role to lower wage countries.

[7] For example, Green and McIntosh (2007) find that those with children were more likely to be overqualified than those without, and that this was related to the type of job taken by those with children (including part-time work, shift work and jobs in small companies).

that are equivalent to those enjoyed by similar workers that are currently fully utilised, ignoring any practicalities and costs associated with making such a transition.

3 Analysis

3.1 Data

The analysis uses the UK Skills Surveys (UKSS, see footnote 1), which has collected data from UK employees on work and skill requirements in 1986, 1992, 1997, 2001, 2006 and most recently in 2012. Data from the last four rounds are used in what follows. Table A1 in the Appendix shows the key variables from these datasets that are used in the regression analysis.

For a comparison with Europe, the analysis looks at data on skill use and industrial composition in the European Working Conditions Survey 2010 (hereafter EWCS). Two variables are used (aside from country identifiers): one on industry (using the NACE codes, which are equivalent to the SIC92 categories used in the UK data) and a second variable on skill utilisation, where the question asked is: "Which of the following alternatives would best describe your skills in your current job?" – an individual is underutilised if they responded that they have skills to cope with a more demanding role, and fully utilised otherwise.[8]

3.2 Results

Unrealised output at the national level

The estimated full skill use wage premiums are shown in Table 1 (see Appendix A1 for details on the different specifications). Table A1 in the Appendix shows the regressions estimates that underlie these results. Interactions between skill use and level of qualification allow for the possibility that the average underutilised graduate experiences a different penalty in terms of lost productivity than the average underutilised worker who had only completed GCSE (or equivalent) qualifications. Taking the estimates for 2006-2012 only (on the assumption that the labour market in 1997 was significantly different in terms of skill demand and utilisation) without industry controls, and with all the caveats previously given, these premia would imply a **£25.41bn loss to UK GDP** from underutilisation of available skills.[9]

[8] Being underskilled is not a potential option in the EWCS data, but not in the UKSS data. For comparability this analysis focuses only on those who are overskilled as opposed to those who are not (including those who might be underskilled).

[9] The standard error of the estimate on the full skill use premia in the first model without any interactions implies a 95% confidence interval of ±0.42%. This corresponds to an estimate of the total loss to GDP of ±£3.48bn.

Table 1: Estimated full skill use premia

Model	**Estimated using wage-reporting subsample**	**Estimated using all respondents**
No interactions, all years	3.47%	2.56%
Interactions, all years	3.52%	3.21%
Interactions, 2006 and 2012	3.01%	3.00%
Interactions, 2006 and 2012, industry controls	2.57%	2.62%

Between industry comparisons

There is a correlation between reported underutilisation and average industry wages. That is, underutilisation happens more frequently in lower wage, lower productivity sectors (see Table 2). Including controls for industry (final line of Table 1) reduces the estimate loss of underutilisation somewhat to £21.67bn. Therefore, when average sectoral differences are not taken into account, as in the first three lines of Table 1, then part of the difference in wages between the fully utilised and the under-utilised is to do with which sector they work in, rather than to do with underutilisation.

Table 2: Underutilisation and average wages

	Skill utilisation	Average gross hourly wage
Distribution, Hotels & Restaurants	79.8%	6.01
Transport and Communication	80.4%	7.29
Manufacturing	82.4%	7.93
Other Services	85.2%	6.12
Banking, Finance and Insurance	85.7%	8.61
Agriculture and Fishing	86.7%	6.27
Public Admin, Education and Health	87.0%	8.36
Construction	89.8%	8.46
Energy and Water	90.2%	11.30

Data taken from UKSS 2006-2012

There may be other variations in the experiences of workers and the way their skills and degree of skill usage corresponds to wages between different industries that are worth taking into account but which are not when looking at the whole dataset. Table 3 shows that the estimated full skill use premia differs from industry to industry (agriculture, oil and gas and other services are excluded due to small sample size). The underlying regressions are given in Table A4 in the Appendix.

Table 3: Estimated full skill use premia, by industry

	Manufacturing	Construction	Distribution, Hotels and Restaurants	Transport and communication	Banking, Finance and Insurance	Public Admin, Education & Health
Full skill use premium	1.5%	1.4%	1.5%	-0.3%	2.5%	1.9%
Sample size	4642	1530	4351	1626	3771	7731

These premia are smaller than those given in Table 1. This implies smaller losses to productivity than above – the industry size weighted premia to full skill use is approximately 1.7%, which corresponds to a **£14.11bn loss to UK GDP**. Note, however, that because of the smaller sample sizes, this estimate is more imprecise than the earlier one.

An alternative way that these industry estimates can be used is to show the expected gain in earnings and productivity from moving workers from one sector to another. This reveals (albeit in a simplistic fashion) the extent to which industrial structure plays a role in the overall productivity of the workforce. Table 4 shows the expected average increase in earnings (and productivity) from moving a representative sample of workers from one sector into another. This hypothetical sample of workers keep all of the same characteristics that they possessed in their existing sector (e.g. labour market experience, qualifications and so on), except for their expected level of skill underutilisation (which is set equal to the existing rate in the destination industry). The majority of these figures are negative – this suggests that workers, on average, match into certain sectors based on their individual characteristics, current skill levels and qualifications. For example, workers in construction have vocational qualifications which are typically well rewarded in that sector but would be much less so in other sectors.

Table 4: Increase in wage due to change in sector of employment

		SECTOR OF ORIGIN					
		Manufacturing	Construction	Distribution, Hotels and Restaurants	Transport and communication	Banking, Finance and Insurance	Public Admin, Education & Health
SECTOR OF DESTINATION	Manufacturing	0.0%	2.4%	24.1%	9.2%	-1.8%	-5.1%
	Construction	-3.9%	0.0%	21.6%	5.6%	-9.5%	-12.0%
	Distribution, Hotels and Restaurants	-23.3%	-21.3%	0.0%	-15.6%	-28.0%	-29.2%
	Transport and communication	-9.5%	-6.5%	19.4%	0.0%	-17.0%	-17.9%
	Banking, Finance and Insurance	-6.7%	-8.1%	19.3%	2.0%	0.0%	-3.3%
	Public Admin, Education & Health	-7.0%	-9.2%	19.8%	1.7%	-0.3%	0.0%

The exception here is in distribution (including the wholesale and retail sectors), hotels and restaurants. Identically qualified individuals in this sector tend to earn around 19-25% more in other sectors. However, it should be noted that this is not due to lower levels of skill utilisation in this sector as compared to other sectors as shown in Table 5. Instead, it is better explained by different wage returns to observed skill and qualification levels, even for those fully utilised, which suggests that workers in this sector are less skilled and productive on average than a similarly qualified individual in other sectors. Measures to improve the skills of such workers would be needed if skill demand were to be increased through a growth in higher valued-added sectors. Therefore, any gains to the UK economy of moving more towards higher productivity sectors need to be considered against retraining costs (alongside the other costs associated with fundamentally shifting the country's sectoral composition).

Table 5: Increase in wage due to change in skill use in alternative sector

		SECTOR OF ORIGIN					
		Manufacturing	Construction	Distribution, Hotels and Restaurants	Transport and communication	Banking, Finance and Insurance	Public Admin, Education & Health
SECTOR OF DESTINATION	Manufacturing	0.0%	-0.6%	0.2%	0.2%	-0.3%	-0.4%
	Construction	0.9%	0.0%	1.2%	1.2%	0.5%	0.3%
	Distribution, Hotels and Restaurants	-0.2%	-0.7%	0.0%	0.0%	-0.4%	-0.5%
	Transport and communication	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
	Banking, Finance and Insurance	0.5%	-0.7%	1.0%	0.9%	0.0%	-0.2%
	Public Admin, Education & Health	0.6%	-0.4%	1.0%	0.9%	0.2%	0.0%

Cross country comparisons

The gains from increasing skill utilisation calculated above consider an unrealistic target – that all workers would become full utilised. A more realistic goal might be to move towards the levels of skill utilisation observed in countries similar to the UK. Table 6, below, shows differences in reported skill utilisation between EU countries based on self-reported utilisation data in the EWCS. As the question in EWCS is different to that used in UKSS, it is not surprising that the absolute level of underutilisation is not the same between the two surveys. Looking across the EU, it is clear that most countries have higher levels of utilisation than the UK.

Using this data, more realistic cases can be identified. For example, if the UK were to improve skill utilisation to that found in France or Sweden, these data would imply around 20% of those currently underutilised should become fully utilised. Based on the earlier estimates (and with the same caveats as before), this would represent a gain to the UK economy of £4.33-5.08bn. Matching the Netherlands or Belgium, which would be a 25% improvement, would imply an expected gain of £5.42-6.35bn. Beyond that, the gains increase in proportion, so emulating Germany or Denmark would correspond

to a gain somewhere between £6.76 and £8.46bn, while Finland (£9.47-11.10bn) and Austria (£12.07-14.15bn) would be at the far end of what has currently been achieved by the UK's neighbours.

Table 6: Skills underutilisation across EU countries

	Proportion of population underutilised	Relative to UK	Sample size
Romania	52.2%	-32.8%	1004
Greece	47.3%	-20.3%	1034
Cyprus	44.0%	-12.0%	995
United Kingdom	**39.3%**	**0.0%**	**1567**
Slovenia	39.0%	0.8%	1393
Latvia	37.3%	5.1%	995
Spain	37.0%	5.9%	995
Ireland	36.9%	6.3%	985
Hungary	35.8%	9.0%	984
Malta	33.1%	15.8%	991
Sweden	32.2%	18.0%	993
France	30.8%	21.7%	3010
Luxembourg	30.4%	22.7%	948
Slovakia	30.2%	23.1%	989
The Netherlands	29.8%	24.2%	1014
Belgium	29.5%	24.9%	3958
Poland	27.6%	29.8%	1472
Italy	27.3%	30.5%	1464
Germany	27.1%	31.2%	2107
Bulgaria	26.9%	31.7%	994
Estonia	26.7%	32.1%	985
Denmark	26.2%	33.3%	1064
Portugal	24.7%	37.2%	992
Czech Rep	22.7%	42.2%	986
Finland	22.1%	43.7%	1022
Lithuania	22.0%	44.1%	978
Austria	17.4%	55.7%	977

Data taken from EWCS 2010

One thing to note is that this does not necessarily imply that demand for skills is substantially higher in other EU countries – it could be that the demand is very similar but the supply of available skills is lower, leading to less mismatch overall. On the other hand, it could be that the German and Austrian education system, with its heavier focus on vocational routes into the labour market may be better matched to the needs of the labour market and its specific skill requirements. This would again mean that the benefits of greater utilisation need to be considered against the cost of achieving them – in

this case that could mean a fundamental shift in the balance of the education and training system. Table 7 shows evidence that is consistent with both of these elements. The UK has a much larger tertiary sector than Austria, and a somewhat larger one that in Germany. In Germany, however, a much larger proportion has completed a higher technical or vocational qualification at this level. Underutilisation across all levels is higher in the UK than in those two countries, but particular in the case of Austria, the gap is narrower. Meanwhile, underutilisation in Austria's far larger (predominantly vocational) upper and post-secondary education is very low.

Table 7: Proportion of population with different levels of educational attainment and the extent of skills underutilisation for each level.

		Germany	Austria	UK
Educational attainment	ISCED 0-2	65.9%	12.5%	55.9%
	ISCED 3-4	10.3%	75.5%	15.9%
	ISCED 5-6	23.8%	12.0%	28.2%
Skill underutilisation	ISCED 0-2	26.2%	13.1%	38.8%
	ISCED 3-4	26.7%	16.1%	41.3%
	ISCED 5-6	29.5%	29.1%	39.7%

Source: EWCS 2010

One final question is whether higher levels of skill utilisation across Europe could reflect different industrial compositions. Table 8 shows the industrial structure of a selection of countries which appear to utilised skills better than in the UK[10]. The key differences in the industrial structure come in the relative size of manufacturing, distribution, hotels and restaurants, and the public sector. Table 9 estimates the expected incidence of skill underutilisation if the UK had an industrial structure similar to these countries (holding everything else constant) and compares it to what those countries actually experience

In most cases, having an industrial structure similar to one of the UK's European neighbours would do little to levels of underutilisation, in particular because in the UK, the public sector tends to see the

[10] Specifically, the UK is compared to France and Germany as the other two largest countries in the EU where skill utilisation was higher, and Austria and Finland as examples of two countries with the lowest levels of skill utilisation.

highest levels of skill utilisation in the UKSS data.[11] Shifting towards a smaller public sector and a larger manufacturing sector, as is the case in three out of four of the higher utilisation EU countries in Tables 8 and 9, would be expected to decrease levels of skill utilisation in the UK, holding everything constant. The conclusion here is that within-industry differences in skill utilisation are therefore far more important than the industrial structure itself.

[11] 87.9% of workers in public administration, education and health report they utilise their skills, as compared to the UK average of 85.7%. By comparison, manufacturing has 83.1% of workers fully utilised.

Table 8: Industrial structure of European countries

	UK	France	Germany	Finland	Austria
Agriculture and Fishing	2.1%	1.9%	1.5%	2.6%	3.2%
Energy and Water	2.5%	1.9%	1.4%	2.1%	1.6%
Manufacturing	6.7%	8.0%	16.0%	13.0%	16.3%
Construction	6.9%	6.2%	8.0%	6.5%	7.2%
Distribution, Hotels and Restaurants	20.3%	25.6%	22.0%	14.3%	25.9%
Transport and communication	8.7%	7.3%	8.8%	8.4%	7.2%
Banking, Finance and Insurance	11.8%	11.3%	14.0%	13.6%	11.3%
Public Admin, Education & Health	34.9%	23.0%	22.3%	35.4%	20.4%
Other Services	6.1%	15.0%	6.0%	4.0%	7.0%

Source: EWCS 2010, Author's calculations.

Table 9: Estimated effect of alternative industrial structures on incidence of underutilisation

	UK	France	Germany	Finland	Austria
Expected level of underutilisation given industrial structure	15.4%	15.9%	15.9%	15.2%	16.1%
Actual level of underutilisation (adjusted)	15.4%	12.0%	10.6%	8.6%	6.8%

Source: EWCS 2010. Author's calculations. Notes: Actual level of underutilisation is adjusted so the relative difference between the countries is identical to the EWCS figures, while the levels corresponds to the UK figures from the UKSS, where underutilisation is less frequent.

4 Conclusions

This report has given an estimate of the potential costs of inadequate skill demand for the available skill supply in the UK. Were it to be possible that all underutilised workers were instead to find employment in jobs that were similar (in terms of skill demand and productivity) to those currently held by fully utilised individuals with similar qualification levels, then we might expect a boost to productivity equivalent to 1.5-3.0% of labour's share of UK GDP, which corresponds to between £12bn and £25bn. Taking the aggregate analysis with industry controls in place as the baseline, full utilisation of skills would be estimated to just under £22bn to the UK economy, while achieving a more realistic of moving towards the levels of skill utilisation seen in other European countries like Germany and France would represent a boost of £5-9bn. As has been noted throughout, the true net benefits of this are likely to be lower – such a transition would itself not be costless, even if it were possible (and it may not be if there are diminishing returns to scale in the sorts of jobs that would better employ available skills). This analysis has focused on the hypothetical benefits in terms of greater productivity and output of the UK economy of using currently available skills more effectively. It has not looked at the costs of producing these skills, so is an open question as to whether measures to increase skill demand – if they can be found - or altering the skill composition of the workforce on the supply side is preferable in a full cost-benefit analysis.

Skill utilisation is lower in lower wage and productivity sectors – the distribution, hotels and restaurants sector and the transportation sector has around 80% full utilisation in the data examined here, whilst construction and the energy and gas sector see the highest level of utilisation. However, the sectoral composition of the UK does not itself explain much of the source of total underutilisation. Instead, it is the level of skill utilisation within a sector that matters most. Most European countries have lower levels of underutilisation than the UK, despite an industrial structure that, if replicated in the UK, wouldn't be expected to reduce levels of underutilisation. In particular, the public administration, education and health sector in the UK is relatively large and has better than average levels of skill utilisation, while the manufacturing sector is small and has lower than average levels of skill utilisation. If the UK were to expand in the latter and shrink the smaller such that its industrial structure started to be closer to places like Germany or Austria then holding everything else equal, skill utilisation would not improve. The type of work that is happening within sectors in other countries has higher level of utilisation that is typical in the UK.

The report has shown that workers generally match into sectors where their particular skills, level of experience and qualifications could be best rewarded – the challenge in these sectors is to ensure everyone is best using those skills. One exception appears to be in the lower wage service sector – returns to qualification and skills in this sector are lower, even when individuals report full utilisation of those skills.

On one hand, this would suggest that a shift away from this sector towards other sectors could raise the UK's output. However, lower wages (and, by inference, lower productivity) are found even among well qualified individuals who are fully utilised. This suggests instead that there are unobserved differences in the skill levels of two identically qualified individuals where one works in the lower wage service sector and the other works elsewhere. The implication of this is that it would not be simple for workers to move from this sector into other sectors without some retraining or other costs to employers.

This echoes a point made at several stages of the report – the gains to full utilisation in terms of higher productivity would not come without cost. As one example, firms would need to invest in various ways in order that their methods of production adequately use available skills. From a public policy perspective, the ultimate net benefit of improving skill utilisation of existing skills would need to be compared to a scenario where overinvestment in skills given their likely future demand were reduced.

References

Autor, D., and Dorn, D., (2013), The growth of low-skill service jobs and the polarization of the US labor market, *American Economic Review* 103(5), pp. 1553–1597

Battu, H., Belfield, C., and Sloane, P., (2000), How well can we measure graduate over-education and its effects? *National Institute Economic Review* 171, pp. 82–93.

Chevalier, A., (2003), Measuring over-education, *Economica* 70 (279), pp. 509–531.

Chevalier, A., and Lindley, J.,(2009) Overeducation and the skills of UK graduates. *Journal of the Royal Statistical Society: Series A (Statistics in Society)* 172 (2) pp. 307–337.

CIPD, (2015), *Over-qualification and Skills Mismatch in the Graduate Labour Market*, CIPD: London

Dolton, P., and Vignoles, A., (2000), The incidence and effects of overeducation in the U.K. graduate labour market. *Economics of Education Review* 19 (2), pp. 179–198.

Elias, P., and Purcell, K., (2013), Classifying graduate occupations for the knowledge society. Futuretrack Working Paper 5. Manchester: Higher Education Careers Services Unit.

Goos, M, and Manning, A, (2007), Lousy and Lovely Jobs: The Rising Polarization of Work in Britain, *Review of Economics and Statistics*, 89(1), pp. 118-133.

Green, F., and Henseke, G., (2014) The changing graduate labour market: analysis using a new indication of graduate jobs. LLAKES Research Paper 50. London: LLAKES.

Green, F., and McIntosh, S., (2007) Is there a genuine underutilization of skills amongst the over-qualified?, *Applied Economics* 39 (4), pp. 427-439.

Green, F., and Zhu, Y., (2010), Overqualification, job dissatisfaction, and increasing dispersion in the returns to graduate education. *Oxford Economic Papers* 62 (4) pp. 740–763.

OECD (2017a), Population with tertiary education (indicator). doi: 10.1787/0b8f90e9-en (Accessed on 22 February 2017).

OECD (2017b), Adult education level (indicator). doi: 10.1787/36bce3fe-en (Accessed on 22 February 2017)

Appendices

A.1 Econometric specification

The key assumption in the approach taken is that gross hourly wages are an appropriate measure of individual productivity. The standard Mincerian wage regressions that relate earnings to educational differences and other demographic variables is augmented with a measure of skill utilisation, which is a binary variable in the analysis (which takes the value of 1 if the individual reports they are fully utilised).

The basic specification for explaining earnings and productivity differences between UK workers is a simple Ordinary Least Squares (OLS) regression of the natural logarithm of gross hourly wage (w_i) on skill utilisation (SU_i) and other individual variables that affect pay (X_i) including education, experience and controls for gender, family status and year. The basic specification is:

$$\ln w_i = \alpha + X_i\beta + SU_i\gamma + \varepsilon_i$$

This basic specification is extended to include interactions between education and underutilisation. Interactions between skill use and level education allow for (a) differences in the incidence of underutilisation by educational group and (b) differences in the average loss of earnings and productivity for being underutilised by educational group. The model is estimated with controls industry of employment and then again for each industry separately. Finally, the analysis is performed just for the two most recent years of data (2006 and 2012), on the basis that a lot might have changed between 1997/2001 and the present.

To summarise, five analyses are used:

1. All data, no interaction between skill use and level of education
2. All data, including interactions between skill use and level of education
3. 2006 and 2012 only, including interactions between skill use and level of education
4. 2006 and 2012 only, including interactions between skill use and level of education, and controls for industry
5. All data, no interaction between skill use and level of education, estimated separately for each industry.

Using these regression results, the expected gain in productivity per worker per hour from full skill utilisation (the full use premium) is calculated as the percentage difference between the estimated hourly wage given existing mean characteristics of the surveyed workforce, and the counterfactual

hourly wage with the same characteristics except that skill utilisation is set equal to one for all individuals. That is:

$$Full\ use\ premium = \frac{\exp(\alpha + \bar{X}\beta + \gamma)}{\exp(\alpha + \bar{X}\beta + \overline{SU}\gamma)} - 1$$

Wages are not observed for all individuals in the data. In particular, higher qualified individuals are undersampled in the wage data. Therefore, for calculating the expected gain in productivity from full skill utilisation, the analysis uses both the mean characteristics of the whole survey and those in the subsample of the survey that are used in the wage regression.

Finally, to give the total cost of current underutilisation to the economy (or equivalently, the increase in GDP resulting from full skill use as compared to the existing levels of underutilisation) the full use premium is multiplied by total income from wages paid in the UK in 2012 from national accounts data and multiply this by to give a figure for. As nominal GDP in 2012 was £1,562.263bn and the labour share of GDP was 54%, total income paid to labour as wages is taken to be £843.62bn.

A2 Tables and figures

Table A1: Key variables used in analysis

Variable name	**Description**	**Derivation**
Education	Highest qualification. Categories are: no qualifications, GCSE or equivalent, A-Levels or equivalent, vocational qualifications, higher education (sub degree), undergraduate degree, postgraduate degree. See Appendix for coding	From variables 'dquals1-dquals3'.
Experience	Years in labour force	Calculated as: current age *minus* (age left full time education). From variables 'aage' and 'dtea'.
Skill utilisation	Indicator for using skills (=1) or not fully using skills (=0).	Survey questions asks whether individual has opportunity in their current work to use skills that they possess. Indicator variable takes a value of 1 if respondent agrees or strongly agrees, otherwise takes a value of zero.
Industry	Standard industrial classification (1992), condensed. See Appendix for coding.	From 'sic92'
Gross hourly pay	Dependent variable, measured in GB£ and in nominal terms.	From 'gghour'. Variable expressed in logs in wage regression, as is standard.

Table A2: Log gross hourly wage regressions

	(1)	(2)	(3)
Experience	0.005	0.005	0.004
	(0.00)	*(0.00)*	*(0.00)*
GCSEs	0.146	0.081	0.138
	(0.00)	*(0.04)*	*(0.00)*
A-Levels	0.247	0.148	0.106
	(0.00)	*(0.00)*	*(0.05)*
Vocational	0.257	0.192	0.186
	(0.00)	*(0.00)*	*(0.00)*
Higher Education (non-degree)	0.356	0.165	0.221
	(0.00)	*(0.00)*	*(0.00)*
Undergraduate	0.629	0.368	0.264
	(0.00)	*(0.00)*	*(0.00)*
Post graduate	0.841	0.488	0.414
	(0.00)	*(0.00)*	*(0.00)*
Skills utilised	0.164	0.040	0.069
	(0.00)	*(0.23)*	*(0.07)*
GCSEs x Skills utilised		0.076	-0.013
		(0.07)	*(0.79)*
A-Levels x Skills utilised		0.120	0.109
		(0.03)	*(0.07)*
Vocational x Skills utilised		0.078	0.007
		(0.07)	*(0.88)*
Higher Education (non-degree) x Skills utilised		0.235	0.212
		(0.00)	*(0.00)*
Undergraduate x Skills utilised		0.335	0.346
		(0.00)	*(0.00)*
Post graduate x Skills utilised		0.474	0.442
		(0.00)	*(0.00)*
Year			0.014
			(0.00)
Female			-0.196
			(0.00)
Constant	1.513	1.616	-25.275
	(0.00)	*(0.00)*	*(0.00)*
R^2	0.2156	0.2203	0.2851
Number of observations	4528	4717	3216

Source: UK Skills Survey 1997-2012. P-values in brackets underneath coefficients.

Table A3: Log gross hourly wage regressions, by sector

	Manufacturing	Construction	Distribution, Hotels and Restaurants	Transport and communication	Banking, Finance and Insurance	Public Admin, Education & Health
Experience	0.0033	0.0042	0.0023	-0.0002	0.0034	0.0045
	(0.00)	*(0.00)*	*(0.00)*	*(0.90)*	*(0.04)*	*(0.00)*
GCSEs	0.1119	0.0621	0.0811	0.0642	0.2283	0.1348
	(0.00)	*(0.26)*	*(0.00)*	*(0.24)*	*(0.00)*	*(0.00)*
A-Levels	0.2552	0.1651	0.1092	0.0593	0.3651	0.2587
	(0.00)	*(0.03)*	*(0.00)*	*(0.50)*	*(0.00)*	*(0.00)*
Vocational	0.2066	0.1864	0.1118	0.0904	0.2187	0.1449
	(0.00)	*(0.00)*	*(0.00)*	*(0.10)*	*(0.00)*	*(0.00)*
Higher Education (non-degree)	0.2329	0.1741	0.0746	0.1513	0.3320	0.4860
	(0.00)	*(0.06)*	*(0.02)*	*(0.05)*	*(0.00)*	*(0.00)*
Undergraduate	0.4681	0.4589	0.2572	0.2026	0.8253	0.7018
	(0.00)	*(0.00)*	*(0.00)*	*(0.01)*	*(0.00)*	*(0.00)*
Post graduate	0.8569		0.1441	-0.3113	0.8923	0.8761
	(0.00)		*(0.09)*	*(0.34)*	*(0.00)*	*(0.00)*
Skills utilised	0.0844	0.1333	0.0748	-0.0131	0.1711	0.1472
	(0.00)	*(0.01)*	*(0.00)*	*(0.77)*	*(0.00)*	*(0.00)*
Year	0.0293	0.0250	0.0311	0.0400	0.0230	0.0249
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Female	-0.2603	-0.2197	-0.1473	-0.1536	-0.1627	-0.1304
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Constant	-56.6551	-48.0107	-60.4876	-78.1596	-44.3589	-48.1905
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*	*(0.00)*
Number of observations	520	174	795	210	301	994

Source: UK Skills Survey 1997-2012. P-values in brackets underneath coefficients.

Table 4: Increase in wage due to change in sector of employment

		SECTOR OF ORIGIN					
		Manufacturing	Construction	Distribution, Hotels and Restaurants	Transport and communication	Banking, Finance and Insurance	Public Admin, Education & Health
SECTOR OF DESTINATION	Manufacturing	0.0%	2.4%	24.1%	9.2%	-1.8%	-5.1%
	Construction	-3.9%	0.0%	21.6%	5.6%	-9.5%	-12.0%
	Distribution, Hotels and Restaurants	-23.3%	-21.3%	0.0%	-15.6%	-28.0%	-29.2%
	Transport and communication	-9.5%	-6.5%	19.4%	0.0%	-17.0%	-17.9%
	Banking, Finance and Insurance	-6.7%	-8.1%	19.3%	2.0%	0.0%	-3.3%
	Public Admin, Education & Health	-7.0%	-9.2%	19.8%	1.7%	-0.3%	0.0%

Table 5: Increase in wage due to change in skill use in alternative sector

		SECTOR OF ORIGIN					
		Manufacturing	Construction	Distribution, Hotels and Restaurants	Transport and communication	Banking, Finance and Insurance	Public Admin, Education & Health
SECTOR OF DESTINATION	Manufacturing	0.0%	-0.6%	0.2%	0.2%	-0.3%	-0.4%
	Construction	0.9%	0.0%	1.2%	1.2%	0.5%	0.3%
	Distribution, Hotels and Restaurants	-0.2%	-0.7%	0.0%	0.0%	-0.4%	-0.5%
	Transport and communication	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
	Banking, Finance and Insurance	0.5%	-0.7%	1.0%	0.9%	0.0%	-0.2%
	Public Admin, Education & Health	0.6%	-0.4%	1.0%	0.9%	0.2%	0.0%