

THEME 3:

PRODUCTIVITY AND THE LABOUR MARKET: CHALLENGES AND REMEDIES

MISMATCH UNEMPLOYMENT AND THE GEOGRAPHY OF JOB SEARCH

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In the aftermath of the Great Recession, the unemployment rate in the UK reached eight percent and remained high between 2009 and 2013. The picture was similar in the rest of Europe and in the United States. Even when the number of jobs available started to increase, the unemployment rate remained persistently high, prompting economists to talk about a ‘jobless recovery.’ Economists offered multiple explanations for the persistence of high unemployment after a crisis. One is the mismatch between the skill set of unemployed job seekers and the skills required in the new jobs. Another is that recessions exacerbate the geographic mismatch between job vacancies and workers. According to this geographic mismatch hypothesis, some areas lack jobs while others lack workers.

In our study we discuss this hypothesis, using data from one of the largest US employment websites, CareerBuilder.com. Commonly-used mismatch measures at the state level assume that workers can move costlessly within a state and that mobility across states is impossible. Our approach allows job seekers to search anywhere in the country, and we also take into account the fact that job seekers dislike distant jobs. Our data shows that job seekers are less likely to apply to job vacancies further away from their zip code of residence: a job seeker is 35 percent less likely to apply to a vacancy that is 10 miles away than to a vacancy next door. When incorporating this preference for jobs close to home, our new measure of geographic mismatch shows that if job seekers were relocated to areas with job vacancies, aggregate unemployment would be reduced by 5.3 percent at most. Given these results, we conclude that geographic mismatch is not a major contributor to US unemployment.

The theory of mismatch has become part of the debate over how to reduce unemployment. Some policymakers suggest that the government should encourage companies to set up factories and stores in areas with high

unemployment, while others suggest that helping workers move to areas where there are job openings might have a more significant impact. Our evidence suggests these policies might have only a minor effect on aggregate unemployment in the US. Even though the evidence shows geographic mismatch may not have a significant impact on unemployment, other types of mismatch in the labour market – such as mismatch in skills – are issues that both workers and employers struggle with and should be investigated further.

Distaste for distance

In this study we use data from CareerBuilder.com, one of the leading job boards in the US. CareerBuilder is a broad job board, featuring vacancies in all industries, occupations, and states. CareerBuilder collects anonymous identifiers for their users, along with basic characteristics about them (like their previous occupation, or their location of residence). They keep a record of the vacancies posted on the website, the occupations of these vacancies and where they are located. CareerBuilder also keeps track of the application behaviour of users. Each time a user clicks on the ‘Apply now’ button on a vacancy webpage, this creates an entry in the dataset, with the identifier of the user, the vacancy and a time stamp. It is rare for this type of data to be shared with researchers. Application data are essential because they directly show which vacancies unemployed job seekers are interested in. Such data are more revealing than administrative data on actual hires, which mix workers’ and employers’ preferences.

The data we use are a snapshot of CareerBuilder data, with half a million unemployed job seekers and half a million vacancies, observed between April and June 2012. To measure job seekers’ distaste for distant jobs, we fit a regression model on the number of applications sent by job seekers in a given location to vacancies in another location (Poisson model). We work at the zip code level, which is a very fine geographic unit. There are about 20,000 zip codes in the US. In the model, we account for the fact that some zip codes may be more attractive than others, for reasons other than the jobs themselves (better amenities, etc).

We find that when job seekers compare a job next door to a job 10 miles away from their residence, they are 35 percent less likely to apply to the latter. The probability drops quickly. When they consider a job 25 miles away, the probability of application drops to 25 percent that of the job next door. 50 miles away, the relative probability of application falls below 4 percent. These figures reveal that job seekers care deeply about distance. Distance affects job seekers in two ways. It might create commuting costs, if job seekers keep their residence unchanged. They might also create moving costs, if job seekers decide to change residence.

Mismatch

That job seekers care about distance to jobs suggests that the hypothesis of geographic mismatch should be considered seriously. Geographic mismatch in our setting would occur whenever the location of jobs is sufficiently far from the location of job seekers, so that their willingness to move does not compensate for the differences in location. Measuring mismatch is not easy. Traditional indices rely on choosing a geographic unit (say, states) and considering these units as separate labour markets. This invokes two assumptions. First, job seekers do not cross state borders, neither when they commute nor when they apply for jobs. Second, job seekers do not care about distance between jobs within a state, that is, a job in upstate New York is considered as valuable as a job in Manhattan.

Our data suggest that these assumptions are not correct. First, 11 percent of job seekers' applications are to jobs outside their states of residence. Second, jobs in the same state but 50 miles away are not considered that interesting to job seekers. In our paper, we design a theoretical framework based on a search-and-matching model. From this framework, we derive a mismatch index that depends on three inputs: the geographic distribution of job seekers, the geographic distribution of vacancies, and jobs seekers' distaste for distant jobs. We show, that even if policymakers were able to move job seekers to exactly where jobs are (and to do it for free), the number of hirings a given month would increase by just 5 percent. This would reduce the unemployment rate by around 5 percent (for instance, from 8 percent unemployment to 7.6 percent unemployment). We conclude from this

analysis that geographic mismatch is only a marginal contributor to overall unemployment.

A potential caveat is that we treat jobs and job seekers as being the same, apart from their location. In reality, jobs and workers differ in their skills and occupations. Imagine that geographic mismatch is combined with some skill mismatch: for instance all nurses are in city A and IT experts in city B, but all IT jobs are in city A and all hospitals are in city B. Our analysis above would incorrectly treat this situation as having no mismatch. In an extension of our analysis, we split labour markets by interacting broad occupations and commuting zones. Applying the same method leads to an estimate of mismatch around 7 percent, which is hardly higher than the baseline geographic mismatch index of 5 percent.

What about the UK?

As far as we know, no such data is available for the UK, even though private (e.g. monster.co.uk) and public (findajob.dwp.gov.uk) job boards are likely to collect the same information. If such data were made available to researchers, we could replicate this analysis for the UK and inform UK policymakers about the relevance of the geographic mismatch hypothesis.

The only estimate of how UK job seekers value proximity to jobs is in a paper by Manning and Petrongolo (2017). Because they do not have access to data on applications, they use a structural model to back out distaste for distance from administrative data on monthly flows between unemployment and employment. They find that UK job seekers are eight times less willing to apply to distant vacancies than American job seekers. To assess the impact of this difference, we plugged UK distaste for distance into the American model. In this case, we obtain a contribution of geographic mismatch to overall unemployment of around 11 percent. Based on this extrapolation, the unemployment rate could be reduced from 8 percent to 7.1 percent if geographic mismatch could be eliminated.

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RETHINKING THE SKILLS GAP

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Skills mismatch has large effects on productivity and unemployment. Almost all proposed policy interventions suggest education and training reforms to address perceived skills shortages, with little attention to wage setting. Such reforms, which are often expensive, will be ineffective if wages do not reflect relative skill shortages. If mismatch reflects an unresponsiveness of wages, then workers will ‘sell’ their skills where they fetch the best price, rather than where they are most needed.

The idea that the labour market suffers from severe imbalances in terms of skills offered by workers and those required by employers is pervasive. Skills mismatch is viewed as a structural issue that is independent of business cycles. However, it becomes more salient during recessions. During the Great Recession, for example, increased mismatch was discussed as the reason that unemployment remained high long after the initial, precipitating events. It is not uncommon for some sectors to complain about the trouble they experience finding workers, while unemployment rates remain stubbornly high.

Three reasons could explain the persistent skills gap: (i) workers do not adjust to changes in skills demand by acquiring the skills needed to find a job; (ii) firms do not adjust to changes in skills supply by creating jobs that utilise the skills available in the labour market; or, (iii) wages do not reflect skills shortages by creating incentives for workers to acquire scarce skills, or to abandon other occupations.

An important component of the EU’s strategic framework for education policy, for example, aims “to better identify and manage the availability of required skills, competences, and qualifications, and to help prevent skills gaps and mismatches.” European countries and other advanced economies worry about the “growing gulf between the skills workers possess today and the skills businesses say they need,” as stressed in the 2014 report of

the Economist Intelligence Unit. Concerns often focus on skills shortages in science, technology, engineering, and mathematics (STEM) subjects, but, increasingly, concerns also extend to soft skills, such as communication, teamwork, and problem solving.

At the same time, many academic economists remain unconvinced of the existence of a skills gap. Accustomed to the idea of the invisible hand equating supply and demand, they are naturally sceptical about the idea that large segments of the labour market would persistently be in disequilibrium.

Researchers have begun to examine skills mismatch in greater detail and in new ways. Large sets of data about workers and firms have made it possible to gauge the effect of skills mismatch on workers' productivity and aggregate unemployment. Researchers have also started to explore the causes of mismatch and suggest policy responses.

Workers and jobs: Skills mismatch and productivity

The immediate problem with mismatch is its effect on productivity. The literature looks at existing matches of workers and jobs and tries to determine whether workers have the appropriate skills. Over- or under-qualification (also called vertical mismatch) occurs when workers have the right type of skills, but are too skilled or not skilled enough. For example, in the over-skilled category, a linguist teaching a Spanish class, or, in the under-skilled category, a mechanic working as an engineer. Field-of-study mismatch (also called horizontal mismatch) occurs when workers do not have the skills required, but they have other skills at a similar level – such as a biology teacher teaching physics.

Beginning in 2011, the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) began its Survey of Adult Skills, an assessment designed to provide representative data on workers' skills. Thus far, the data include skill measurements of 250,000 individuals in 33 countries. The official OECD measure was introduced in 2013 (Fischen and Pellizzari, 2017). The approach combines declarative measures of job qualification with objective measures of skill proficiency. The authors found

that 86 percent of workers are well-matched, four percent are under-skilled, and 10 percent are over-skilled.

Another study using PIAAC data shows that there is a negative correlation between this measure of mismatch and labour productivity at the industry level: industries where there are more under-qualified or over-skilled workers exhibit lower levels of labour productivity (Adalet McGowan and Andrews, 2015).

Two studies offer evidence beyond developed countries. A review of worldwide mismatch research (Leuven and Oosterbeek, 2011) finds that over-education affects 30 percent of workers, and under-education affects 26 percent of workers, with some variation across continents. Another study applies the OECD method to measure mismatch in developing countries using the World Bank's STEP Household Skills Survey. The authors find that over-education is the most prevalent form of mismatch.

A framework developed in 2015 analyses worker-occupation matches (Güvenen et al., 2015). If a worker does not have the ability to learn the skills for an occupation, that worker is 'mismatched.' Estimating a structural model on US data, the study finds that being mismatched early in one's career harms a worker's wages in a large and persistent manner.

Quantifying the effect of the *overall level* of labour market mismatch is much more difficult than measuring the effect on the productivity of *individual workers*. For example, given the skills workers have and the skills jobs require at some point in time, how much would production increase if it were possible to reallocate mismatched workers to different jobs where their skills are better matched to the requirements? It is difficult to answer this question convincingly because it requires assumptions about the functions that link production inputs to outputs. Considering both labour and physical capital, very large effects are shown from misallocation across firms (Hsieh and Klenow, 2009). The analysis claims that mismatch is responsible for a productivity gap of 40–60 percent between India and the US, and 30–50 percent between China and the US. These results show that the mismatch of production inputs (labour and capital) is a substantial

source of inefficiencies and a large contributor to the differences between developing and developed countries.

Job seekers and vacancies: Skills mismatch and unemployment

If the skills that firms require and the skills that workers possess are sufficiently far apart, then at least some workers will not be hired. Therefore, skills mismatch also generates unemployment, which has huge economic and personal costs.

Labour market mismatch generates unemployment if unemployed workers cannot match with firms because the workers and vacancies are not right for each other. This idea can be formalised by modelling the labour market as segmented, with workers (and vacancies) unable to move from one labour market segment to another. If there are deviations between the distributions of workers and jobs among the various segments of the labour market, then some workers will remain unemployed whilst some firms will not be able to fill vacancies.

Although there are severe issues with measurement of this type of mismatch, there is remarkable consensus in the literature on three facts about unemployment due to labour market mismatch. First, that geographic mismatch is negligibly small; second, that skills mismatch, as measured by mismatch across occupations or industries, is an important contributor to unemployment; and third, that skills mismatch is larger during recessions. Geographic mismatch was discussed in the previous Chapter. The findings about skills mismatch are discussed below.

Using Standard Occupational Classification (SOC) codes to categorise the nature of certain kinds of work, a 2014 study finds that increased mismatch across three-digit occupations accounted for around 1.5 percentage points (or about one-third) of the increase in unemployment in the US during the Great Recession (Şahin et al., 2014). Related research shows similar results for the US and the UK.

The causes of skills mismatch and how to address them

Unexpected events or phenomena may affect occupations in different ways. For instance, a 2003 study illustrates that the emergence of computers and information technologies (IT) reduced the demand for routine jobs, which were to some degree made obsolete by computers, and increased the demand for non-routine jobs, which proved to be relatively complementary to the computer (Autor et al., 2003). Like technological changes, recessions change the relative demand for different goods. Sectoral shocks may translate into asymmetric occupational shocks; for example, bakers may be less sensitive to recessions due to the relative inelasticity of baked goods, while restaurant jobs may be more sensitive because people eat out less during hard times. Because of these shocks, the fact that mismatch exists is not in itself surprising. The relevant question is: why does it seem to be so persistent?

Workers who work (or look for a job) in an occupation where the number of workers exceeds the number of positions have ways to adjust. They can apply to other higher-demand occupations that require similar skills, or they can acquire new skills. Alternatively, employers could adjust to workforce shortages by changing the skill content of occupations, or by training workers from similar occupations to fit new skill requirements. Some recent empirical literature documents that employers adjust the task and skill content of jobs (for the same occupation) with the business cycle, upskilling when workers are more abundant in a recession (Hershbein and Kahn, 2016).

Adjustment, whether by workers or employers, may be difficult and costly in the short term, especially when confronting large skill differences. Most policy interventions are based on the implicit assumption that this is the reason for the skills gap. The European Commission, for instance, believes that “Europe needs a radical rethink on how education and training systems can deliver the skills needed by the labour market.” As a result, it set up the Rethinking Education initiative “to reform education systems across the EU so as to meet growing demand for higher skills levels and reduce unemployment.”

A recent analysis uses data on wages and profits across industries and data on job-finding rates to show that it is possible to quantify how much of mismatched unemployment stems from a lack of adjustment by workers or

firms. On the workers' side, the following scenario is identified: There are industries where workers have a hard time finding jobs, but where they earn high wages if they do, and there are other industries where jobs are plentiful, but wages are low. This is what one would expect to see if workers operate along a no-arbitrage condition. That is, if they can move between industries, but will only do so if they are given the right incentives. If, on the other hand, there are many industries where both job-finding rates and wages are high, and others where both are low, the logical conclusion would be that mismatch persists because workers lack the skills required to move into better jobs. Using data for the US over the 1979-2010 period, the study finds that mismatch cannot be fully explained by barriers faced by workers and firms in adjusting to changing skills demand and supply.

If workers adjust to changes in skills demand, and employers adjust to changes in supply, how can mismatch persist? The answer is wages. If wages reflect the relative abundance or the relative shortage of skilled workers, then workers' and employers' capacities to adjust would lead to the elimination of mismatch. However, jobs in industries that generate high profits (such as retail, educational services, mining, and forestry) tend to pay low wages, and are therefore unattractive to workers, while jobs in industries that pay higher wages (like finance, computer and electronics manufacturing, and paper and printing) are not profitable to firms.

Other researchers, based on very different approaches, have also emphasised the role of wage setting. Among the forces suggested are automated screening systems that rule out candidates who might have surfaced in subjective, human resources screening processes, and a preference for hiring experienced candidates over investing in training for inexperienced-but-promising candidates. If workers do not move into low-unemployment occupations, the problem may not be that they cannot train or adjust, but that wages are too low to attract them. In the UK, for instance, less than half of STEM graduates work in scientific occupations, and there is no wage premium in other occupations for having a STEM degree. Firms, on the other hand, are more interested in hiring workers with STEM skills because these workers are not only very productive but also relatively cheap – despite a widespread public perception that STEM graduates earn high salaries. Thus, companies open lots of vacancies for STEM positions, but find it very difficult to fill them.

Summary and policy advice

Skills mismatch is an important cause of productivity loss and unemployment. Policy to diminish the presence and persistence of skills mismatch can benefit economies, firms, and people who are unemployed or underemployed.

However, in the context of the European Commission's proposed "radical rethink on how education and training systems can deliver the skills needed by the labour market," a reform of education and training systems may be neither needed nor desired. The most striking conclusion from current research is that worker mobility frictions may not be the main contributor to labour market mismatch. Yet almost all proposed solutions treat the phenomenon as a problem of the education system. Interventions in education and training are likely to be expensive, and, at the same time, may not be as effective as expected.

Why would increasing the emphasis on scarce skills in schools and universities fail to guarantee that skills mismatch will be reduced? The reason is simply that students choose first what skills to acquire in school and university, and then whether and how to use these skills in the labour market. If wages do not reward certain skills, students will either choose not to pursue such skills, or will pursue the skills but seek employment in other, higher-paying occupations. The STEM gap offers the most obvious example of this problem. While firms complain about a shortage of qualified physicists and engineers in the labour market, a very large number of graduates in these fields work in the financial sector, where they use only a subset of their STEM skills but earn more money. Encouraging universities to educate more physicists and engineers will not solve the mismatch problem if these graduates choose better-paying jobs with investment banks.

These questions underline the need for additional research to understand the forces that foster and perpetuate mismatch. While the message from the current research should not be interpreted as a call to do nothing, greater knowledge is needed to guide policymakers in devising effective solutions.

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THE UK'S PRODUCTIVITY CRISIS: WHY A WEAKER LINK BETWEEN EDUCATION AND BACKGROUND COULD HELP SOLVE IT

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Recent years have seen a lot of discussion about a productivity crisis in the UK. Productivity “measures how efficiently production inputs, such as labour and capital, are being used in an economy to produce a given level of output” (OECD, 2015). Workers in the UK produce less per hour than workers in many other developed countries – 16 percent less than the G7 average according to the Office for National Statistics (ONS, 2016). Why is labour productivity in the UK so much lower than in comparable economies with similar access to capital and technology?

The skills of our workforce might be part of the problem. Workers' skills interact with other drivers of productivity – innovation, technology and management – to drive economic growth. Improving output per worker, per hour, is both simple and complicated. It might mean giving workers better technology to use, or it might mean training them to utilise the technology better. Management and technological innovation can make a big difference but so can workers who are motivated to develop, and capable of developing, new skills throughout their careers.

Skill acquisition is a lifelong process. It is difficult to predict which skills will be in demand in the long, or even the medium, term. Already, people in the workforce expect to change jobs and re-train during their working life, so workers need a foundation of literacy, numeracy and technical skills that enhance their ability to develop new skills. Each level of primary, secondary and tertiary education offers the opportunity to develop skills that translate directly into future employment and higher labour productivity. Evidence suggests that the UK may be missing these opportunities at all levels.

For example, the OECD's survey of adult skills in England in 2012¹ found that the basic literacy and numeracy skills of the generation now entering the

¹ Only England and Northern Ireland participated in this study; we focus on the results for England, in which about 85 percent of the UK population lives.

labour market are no better than those of the generation about to retire (OECD, 2016). This is bad news for future productivity, as it suggests that the level of average basic skills amongst the working age population – the base from which new skills can be developed – is likely to fall further, and England is already one of the worst performers on this measure in the OECD.

Social standing and skills

Another dimension on which England stands out is the strength of the relationship between an individual's own skills and their parents' education: young people (aged 16-20) whose parents do not have A-level (or equivalent) qualifications score almost 60 points (more than one standard deviation) lower in basic skills tests than individuals with at least one parent qualified to this level. That is a bigger difference than in all other OECD countries except the Czech and Slovak Republics.

Not only do individuals in England have lower basic skills than their counterparts in other countries, they are also far more likely to have low basic skills if their parents are poorly educated. This points to a cycle of educational disadvantage which is prevalent across many dimensions of the English education system, not just at the lower end of the skills spectrum. For example, children from families that are above the 80th percentile in terms of socio-economic status are about eight times more likely to attend a grammar school or a high status university, than those from below the 20th percentile (Burgess et al., 2017; Crawford et al., 2016).

Fulfilling potential

Ensuring that individuals from all backgrounds have access to the educational opportunities to fulfil their potential may be one way to raise productivity. For both equity and efficiency reasons, we should be looking for and nurturing talent wherever it arises – to maximise the productive capacity of the economy and take advantage of the benefits that diversity can bring. That is why social mobility and labour productivity are inextricably linked: it is not just those with the richest or best educated parents who have the potential to reignite the economy, so we must ensure that all children are given opportunities to thrive.

Unfortunately, we don't know as much as we should about how to reduce socio-economic differences in educational outcomes – and what we do know is not always put into practice. For example, there is a reasonable amount of academic inquiry into whether grammar schools are good for social mobility. The short answer is that they're not. Burgess et al. (2017) show that if you live in a selective area – one that has retained the old grammar school/secondary modern distinction – then you will, on average, have higher educational attainment if you go to a grammar school than if you just miss out. But the same research also shows that if we compare children in selective areas going to grammar schools with similar children with similar prior attainment going to state schools, with similar intakes in non-selective areas, then this is no longer the case. More importantly, the outcomes of children in selective areas who just miss out on grammar schools are lower, on average, than those of similarly qualified children in non-selective areas. And because grammar schools are so socially segregated, those from poorer backgrounds are much more likely to be among the group that miss out. So even if going to a grammar school is good for a particular child relative to the alternative in their area, when we look across all children in all areas, selective education looks less like the engine for social mobility that it is sometimes portrayed as.

Is educational attainment linked to socio-economic status?

Individuals who go to university still earn more on average than those who don't, which we can assume, at least partially, reflects higher labour productivity amongst graduates. But these returns can vary substantially according to the subject that individuals study and the institution they attend – with high status institutions often commanding the largest wage premiums. Unfortunately, we also know far less than we should about how to enable students from under-represented backgrounds to enter and thrive in these types of universities.

Since 2012, when the tuition fee cap was raised to £9000 per year in England, institutions charging above £6000 per year – virtually all of them – have had to produce 'access and participation' plans. Essentially, they've had to spell out how they are broadening access to their institution, as well

as how they are minimising the gaps in outcomes between those from different backgrounds once they arrive.

There has been some progress in this regard: just over a quarter of those from the 20 percent of areas with the lowest historic higher education (HE) participation rates now go to university at age 18 or 19, compared to about 17 percent 10 years ago. The percentage of 18 year olds from these neighbourhoods going to high tariff institutions has also risen, but remains pitifully low at just over 3.5 percent. The increase over the last decade is lower than for those from the 20 percent of areas with the highest historic participation rates, meaning that the gap has widened in absolute terms (UCAS, 2016). Drop-out rates have also risen over this period, more so for those from low-participation neighbourhoods, and there are still large differences in degree attainment – even amongst students attending the same courses at the same universities who arrive with very similar GCSE and A-level grades (Crawford, 2014).

We know that differences in attainment in these earlier exams are a key part of the reason why there are such large differences in HE access and outcomes between those from richer and poorer socio-economic backgrounds (Crawford et al., 2016). There is a growing body of evidence – much of it provided by the Education Endowment Foundation – that points to ways to increase attainment for those from poorer families. But attainment is not the whole story, and despite the substantial investment in this area in recent years, we are not much further forward in understanding how to reduce gaps in HE access and outcomes than we were a decade ago. We must provide better accountability and evidence of value-for-money in this area, and it is encouraging that the Office for Students (OfS) is funding a new centre to help the sector do exactly that.

But even if we were to completely eliminate the gaps in access to grammar schools or highly selective universities, we're talking about policies that affect a small minority of the population. Of course we should aim to do this, but we also need strategies to improve the skills and education of those who do not follow these paths, which often receive far less media and policy attention.

Alternative routes

The route to university is straightforward and relatively easy to navigate: you need strong GCSE and A-level grades in the right subjects, plus some knowledge about which universities and courses are likely to be right for you. As Mani and Kirkup described earlier in this CAGE Report, the alternatives are less clear. Which of the plethora of vocational qualifications should you pursue if you do not plan to go to university? They do not all offer positive average wage returns (Patrignani et al., 2017) and with many now run in partnership with specific employers, it is important to ensure that they contain sufficient training in general, transferable skills to equip individuals for the multiple job changes that they can now expect over the course of their careers.

This would be less of an issue if we had a comprehensive system of lifelong learning through which individuals could later retrain, but this is not an area in which the UK excels. The number of mature students going to university has fallen sharply over the last decade – at least partly as a result of the changes to HE finance for these students introduced in 2012 (UUK, 2017). Opportunities at lower qualification levels have also been cut, along with the further education budget, which has experienced larger per student reductions over the last few years than primary and secondary schools or higher education (Belfield et al., 2018).

Conclusion

For our workforce to be equipped with the skills to deliver higher productivity in the future, we must ensure that our education system meets the needs of all students: nobody should leave school without basic literacy and numeracy skills. Routes other than the one straight from school to university should also be more clearly signposted, and everyone should have the opportunity to access and benefit from the education that is right for them, regardless of parental background.

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INDUSTRIAL POLICIES, AGGLOMERATION BENEFITS AND INVESTMENT IN CITIES

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The UK's current industrial strategy recognises the importance of places but has been criticised for its lack of emphasis on geography (Carter, 2017). Moreover, the industries singled out in the industrial strategy are only a small part of the overall economy and are unevenly spread across the UK, favouring the South. Thus “the government's narrow sectoral focus threatens to widen regional divides” (Fothergill et al., 2017). The strategy also requires local industrial strategies that reflect the diverse needs of different areas and complement the central government's industrial strategy (see BEIS, 2018).¹ But before we build a strategy around the idea that cities improve productivity, we need to check whether that effect really exists.

The current position – relying on this new and greater role of a (local) industrial strategy to define priorities for how cities, towns and rural areas will maximise their contribution to UK productivity – is set against a history of regional and urban policies. Regional policies have largely disappeared and urban policies have in the past concentrated on housing, regeneration and infrastructure, especially transport, and less on productivity issues and firm performance. Activities that produce economic rents have received less of the attention. In addition, some have adopted the premise that cities are the major hubs of economic growth, and this is where policy should concentrate (e.g. Centre for Cities, 2018a).² The premise that cities do better in terms of the long-run drivers of economic growth implies that they have higher productivity than non-cities, and that solving the UK's productivity problem should result in a (return to a) cities growth agenda. This line of reasoning has been at the heart of (local) industrial strategies.

¹ Note, this notion of local industrial strategies is set alongside the decentralising of urban policy through *City Deals* (for English cities and for some cities in the devolved administrations), as incorporated into the 2016 Cities and Local Government Devolution Act.

² Based on their scale, it is axiomatic that ‘cities are home to the majority of the economy’, as shown in Centre for Cities (2018b, Chapter 2); and it is not surprising that towns close to better performing cities do better (while the converse is true – Centre for Cities, *ibid*, Chapter 3). But neither is sufficient to imply that cities must therefore have higher productivity than other areas.

Cities, productivity and agglomeration benefits

At the level of the firm or plant, total factor productivity (TFP) measures how efficiently firms produce outputs of goods and services using all factors of production (e.g. labour, capital and intermediate inputs, such as energy and semi-finished products). TFP is generally recognised to be a better measure than labour productivity, and it reflects the role of efficiency and technical progress. Efficiency measures whether the firm produces output with minimal use of inputs given current technological knowledge, and technical progress³ reflects the best-practice way of using inputs to produce output over time.

Spatial spillovers or agglomeration externalities are benefits that accrue to plants from being located in the vicinity of large concentrations of other plants. Where firms in related industries are co-located, this is often referred to as a cluster; in urban locations one might find groups of diverse industries. Duranton and Puga (2004) describe the mechanisms that give rise to agglomeration externalities (see also Overman et al., 2009, who explain how these can arise from sharing, matching and learning). Here the emphasis is on urbanisation externalities that are due to the size and heterogeneity of an (urban) agglomeration and that result when different industries benefit from economies of scope.

For example, a greater range of activities such as research and development (R&D), business services, cultural and lifestyle amenities, and the overall quality of the public infrastructure leads to inter-industry spillovers (Florida, 2002; Glaeser et al., 2001). Larger firms, especially multinationals, tend to locate their head office and R&D functions in urban agglomerations. It is argued that these agglomerations generate more product innovations and increase the likelihood of spin-offs and start-ups, which creates a denser entrepreneurial culture.

³ Labour productivity will de facto be higher in firms that are capital or intermediate input intensive (as less labour is needed in the production process, cf. chemicals and steel, but also certain knowledge intensive services). Increasing labour productivity can thus be achieved by substituting (tangible and intangible) capital (or intermediate inputs) for labour when producing outputs (see section 4 in Harris and Moffat, 2017). Such substitutions are not directly driven by the underlying factors that determine efficiency and technical progress (e.g., firms doing R&D, innovating and/or exporting), but rather reflect the changing costs of different factor inputs.

Recent studies by Graham (2009) and Overman et al. (2009) find evidence that in the UK, locating a firm in an urban area has positive impacts. Harris and Moffat (2012) found that in general, firms in cities have higher productivity than firms in their rural hinterland.⁴ However, with the exception of London, firms in regions and cities outside the South East have lower total factor productivity than firms inside the South East region.

The main evidence from Harris and Moffat (op. cit.) is presented in Table 1. Only Bristol had significantly higher total factor productivity than the South East, and this was mostly due to higher productivity (on average nearly 10 percent) in services. In five other cities (including London), there was no statistically significant difference compared to the South East region, while in the remaining six cities total factor productivity was lower (in Edinburgh and Cardiff the gap was around 10 percent). The largest negative differences are caused by large gaps in the service sector (these also explain the poorer performance in Birmingham and Glasgow). For cities like Liverpool and Leicester poorer performance is associated relatively more with manufacturing than services, although services also have lower average total factor productivity in these cities. Lastly, in Coventry average total factor productivity in manufacturing was nearly 9 percent higher than in the South East but the city did less well in services, so that across all plants there was no significant difference in performance.

⁴ The results by Overman et al. (2009) have a similar order of ranking to those obtained by Harris and Moffat (op. cit.) but their methodology was significantly different – see footnote 2 in Harris and Moffat (op. cit.).

Table 1: Relative mean total factor productivity in core cities, 1997-2006, Great Britain (differences are expressed as percentage)

	All		Manufacturing		Services	
	City – South East	City – rest of region	City – South East	City – rest of region	City – South East	City – rest of region
London	1.6		2.4		1.7	
Tyneside	-1.2	7.6***	4.0	5.9	-1.9	8.4***
Manchester	1.7	9.7***	1.0	3.6	1.8	11.2***
Liverpool	-6.3**	1.8	-8.6**	-5.9	-6.0**	3.4
Birmingham	-3.8**	2.0*	1.0	1.0	-4.6***	2.9
Coventry	0.9	6.8***	8.6**	8.6**	-0.7	6.8***
Leicester	-5.4**	2.3	-14.3***	-12.0***	-3.6*	6.0**
Nottingham	-1.6	6.1**	2.1	4.4	-2.0	7.5***
Bristol	8.9***	10.9***	1.5	2.1	9.7***	12.1***
Glasgow	-5.5**	8.6**	1.0	2.3	-6.4**	11.2***
Edinburgh	-10.2***	3.9	-2.6	-1.3	-10.8***	6.8**
Cardiff	-10.0***	-0.7	-0.8	0.9	-11.1***	0.9

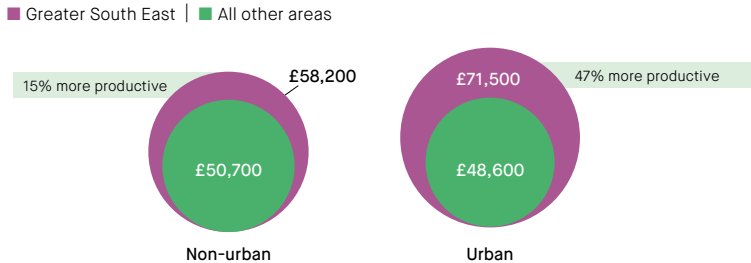
***/**/* Significant at 1/5/10 percent level based on a t-test.

Source: Harris and Moffat (2012, Table 3)

Table 1 shows that overall, cities had on average higher total factor productivity than their (non-city) hinterlands. However, in Liverpool and Cardiff there were no statistically significant differences across either sector, while in Edinburgh and especially Leicester higher total factor productivity in services (of 6.8 percent and 6 percent, respectively) was not sufficient to overcome the poorer manufacturing performance.

Harris and Moffat (op. cit.) concluded that there was no overwhelming evidence from their study to support the idea that British cities are the ideal locations for encouraging (long-run) growth, particularly in high-technology industries. For the latter, urbanisation economies were largely negative.

Figure 1: Productivity of cities and non-cities, 2016

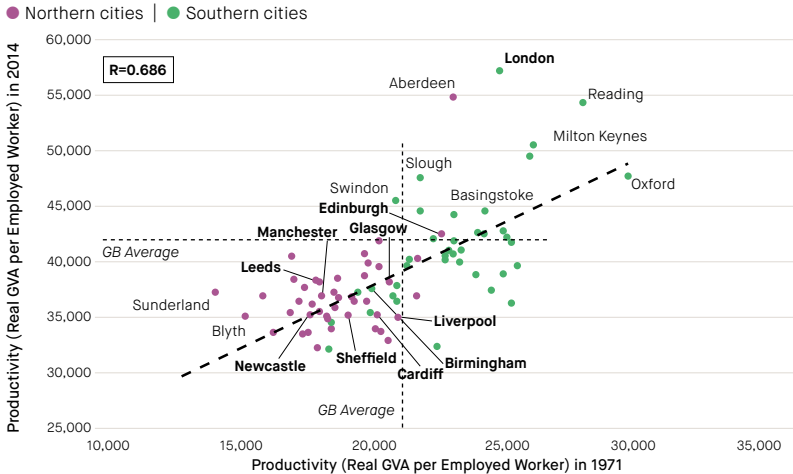


Source: Centre for Cities (2018c, Figure 9) based on ONS Regional Gross Value Added (Balanced Approach) by Local Authority in the UK; Business Register of Employment Survey

There is other evidence that suggests that cities are not always the most productive. Figure 1 shows “...cities outside the Greater South East are the least productive... The gap in performance between cities in different areas in particular is stark. While the difference in productivity between non-urban parts of Britain is 15 percent, cities in the Greater South East are almost 50 percent more productive than cities elsewhere” (Centre for Cities, 2018c, p.9).

Further evidence that northern cities perform less well is presented in Figure 2: “... what is striking is that all but four northern cities (Aberdeen, Edinburgh, Chester and Telford) are in the bottom left-hand quadrant of the figure, having productivity levels less than the national average both at the beginning of the period and at the end (Martin et al., 2018).”

Figure 2: Labour productivity across 85 British cities, 1971 and 2014 gross value added per employed worker, 2011 prices



Source: Martin et al. (2018, Figure 2)

Conclusions

Improving productivity is at the centre of the government’s industrial strategy. Most economic activity is clearly located in cities, but there is growing evidence that Great Britain’s (non-Greater South East) cities do not perform particularly well on this metric.

British cities, particularly Northern cities, do not necessarily have better productivity levels (cf. Harris and Moffat, 2012; Centre for Cities, 2018c; Martin et al., 2018), so concentrating narrowly on a city growth agenda is not optimal. Cities outside the South of England do generally worse than the non-city (and outside London) South East of England. Simple notions of agglomeration/clustering do not tell us a lot about what drives productivity. Place effects have to be set against important non-spatial factors: firm characteristics including ownership and size, and productivity enhancing activities such as exporting, R&D and innovation also play a role. To use the resilience of different industries and areas to withstand any post-Brexit shock predicted for 2019 onwards, we need to understand more about the wider set of spatial factors particular to London and the South East that give that area a significant productivity advantage.

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PRODUCTIVITY TAKES LEAVE? THE MATERNITY BENEFITS AND CAREER OPPORTUNITIES FOR WOMEN IN ACADEMIA

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'May children,' holiday babies and post-tenure pregnancies are just some of the labels attached to female academics and their pregnancy choices. Academic women often share a common burden in scheduling their maternity plans: to survive and advance in academia, women tend either to give birth during vacation time or to postpone motherhood until the end of their probation period. The result is, generally, an underrepresentation of women in higher academic positions (sometimes known as the leaking pipe problem since fewer women flow from junior to senior posts), lower salaries, lower research outcomes and promotion, lower fertility, and higher rates of family dissolution – while family and children seem to have either no impact or even a positive effect on men's performance in the academic ranks. Thus, even for women in academia, an environment that is usually praised for its flexibility in terms of working hours and family friendliness, motherhood and professional advancement appear to be conflicting goals. Of course, this pattern of women falling behind in their career path after birth is similar or even more pronounced in other sectors, such as the civil service and certain industries.

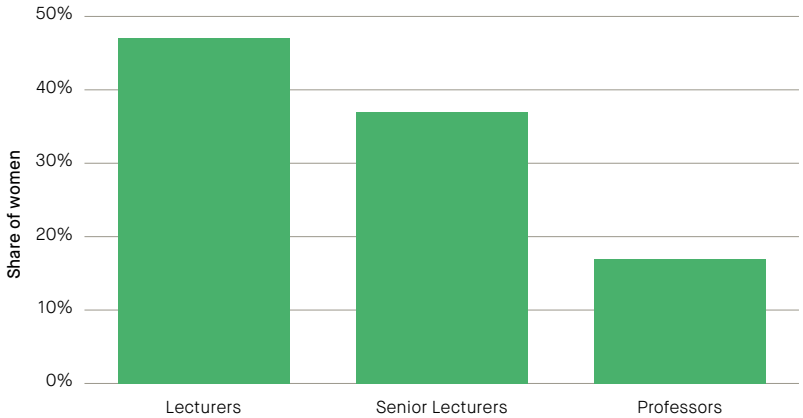
Why is maternity leave important?

The recent public discussion in the UK of the gender pay gap across different industries, and the requirement for companies to disclose differences in salaries paid to men and women, has sparked interest in the reasons for this continued discrimination in the workplace. The unconditional gender pay gap in the UK amounts to roughly 18 percent (Office for National Statistics) and with this the UK ranks in the bottom third of all EU member states. Higher education and other highly skilled sectors usually fare even worse than the national average. The UK Higher Education Statistics Agency

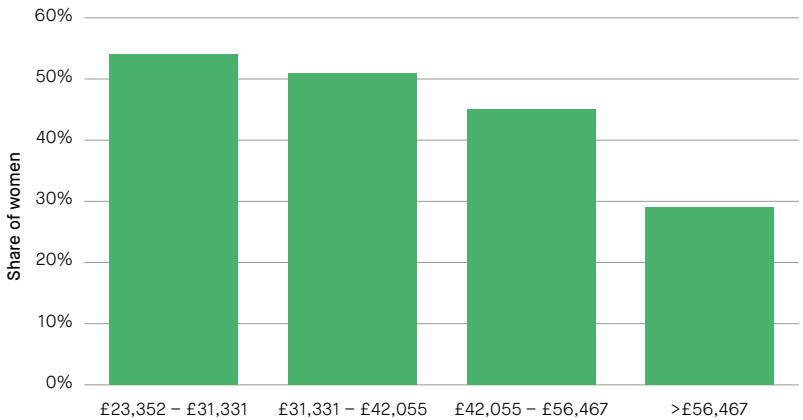
(HESA) provides useful data that underlines both the leaking pipe and the gender pay gap in British academia.

Figure 1: The leaking pipe problem and gender gap in pay at UK Higher Education Institutions (HEIs)

The leaking pipe problem: Share of female academics at each contract level across all UK HEIs in 2013



Earnings of female academics: Share of female academics in each salary category across all UK HEIs in 2013



Source: HESA 2013

Across all academic disciplines, fewer than 1 in 5 professors is a woman and less than a third of academics in the highest salary bracket are female. The argument that both promotion and salary should follow performance can, and should, be made. But even if we believe that these decisions are purely based on academic merit, we have to ask ourselves: Why is it that women in academia and other sectors are not advancing? And what can, and should, be done about it?

The vast majority of studies on gender and academic achievements identify the lower social mobility of women (mostly due to family responsibilities), child rearing burdens and women's preferences for academic disciplines that have low publication records as possible explanations for gender differences in higher education. Other studies link the gender gap in academia to gender-related attitudes such as women's propensity to choose teaching rather than research institutions.

Previous research also argued that children and maternity breaks and the lack of family friendly policies negatively affect the career path of women in academia. Compared to their male colleagues, who are more likely to benefit from family formation and fatherhood, women in academia pay a huge price for having children, in the form of lower promotion rates, higher exit patterns and personal vicissitudes such as family breakdowns and divorce. More generally, the probability of an exit from academia is higher for women at the early stage of their career, which usually coincides with their fertility age, while the lack of family oriented policies disproportionately disadvantages women's professional and personal conditions. Yet, to date, we do not know whether the status of female academics has improved over recent years, nor do we have up to date information on maternity and parental provisions for faculty members in the UK system.

There is much research – mostly across countries – that shows how maternity benefits affect female labour market participation and career outcomes. In general there seems to be a trade-off between the benefits of generous salary replacement rates in the short-term and the costs of extended maternity leaves in the long-term. High replacement incomes are beneficial to mothers’ employment rates and their attachment to the labour market in the short-term. However, long periods of leave depreciate the human capital of female workers and jeopardise their employment prospects in the long-term. Figures 2.1 and 2.2 illustrate this pattern.

Figure 2.1: Generosity of Maternity Leave: Average Payment Rate per week in percent of salary

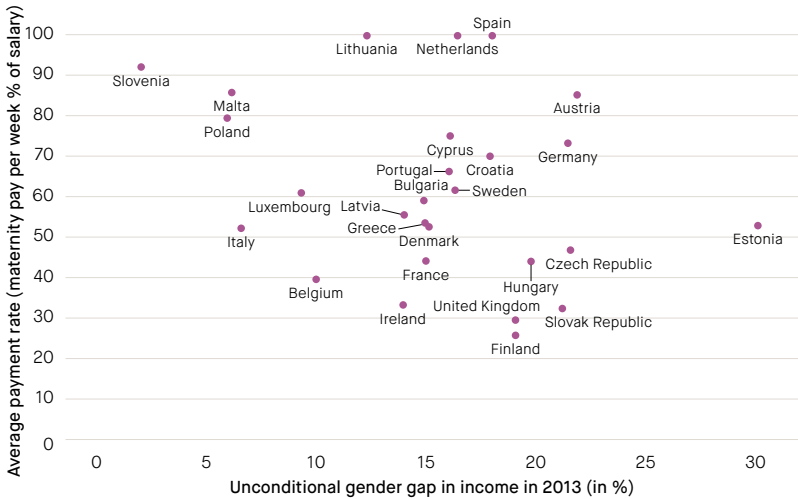
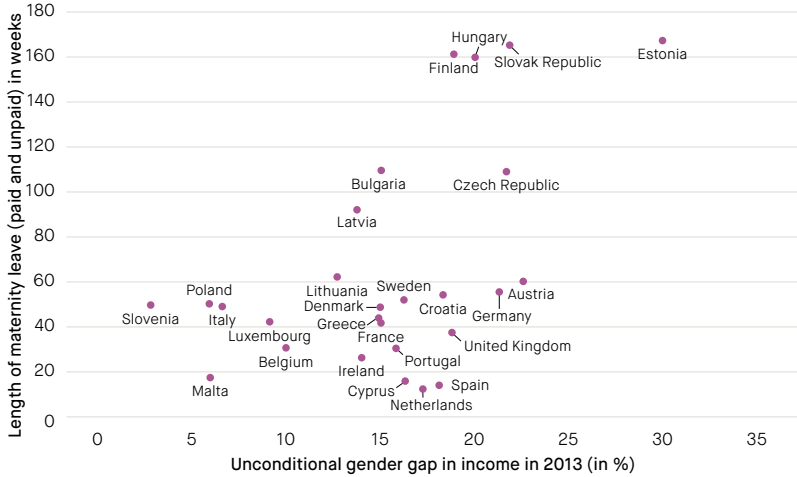


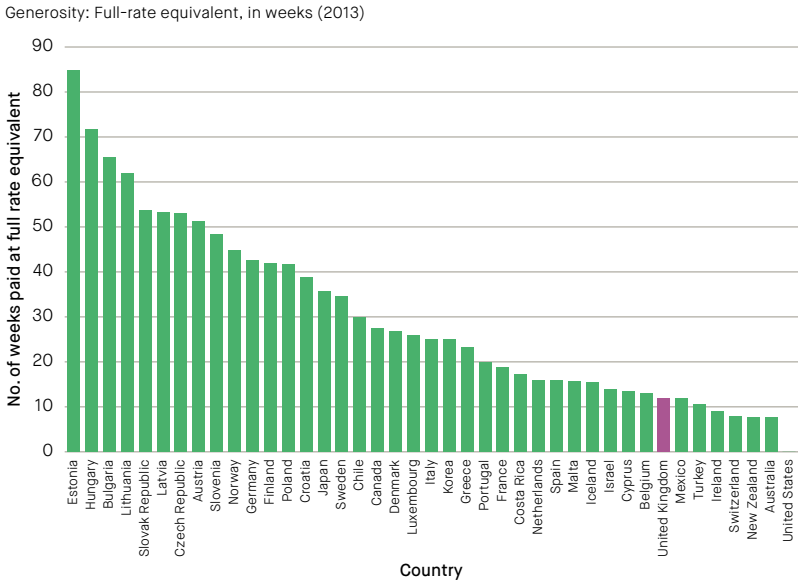
Figure 2.2: Length of Maternity Leave: Legal entitlement of paid and unpaid leave in Weeks



Source: length and generosity of maternity leave from OECD social expenditure database 2013, unconditional gender gap in pay data from the Statistische Bundesamt

In terms of overall length (52 weeks), maternity leave in the UK is close to the OECD average and research shows that longer leave periods depreciate the career and earning capacities of mothers. However, the generosity of maternity pay and public expenditure on parental leave in the UK are rather low when compared with other developed economies.

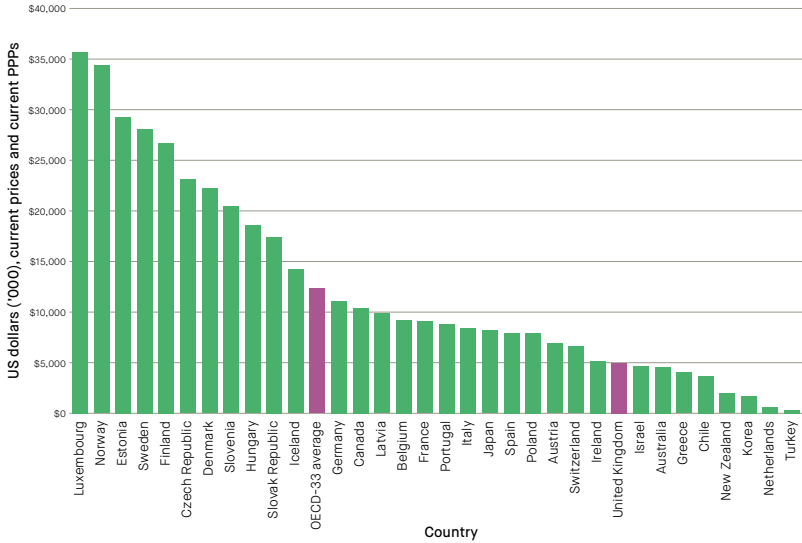
Figure 3: Generosity of UK maternity pay in comparison



Source: OECD Social Expenditure Database

From figure 3 we can see that statutory maternity pay in the UK is one of the lowest across OECD countries and is only undercut by Ireland in the EU.

Figure 4: Public Expenditure on Parental Leave Benefits (per child born) in the UK in comparison (2013)



Source: OECD Social Expenditure Database, Health Statistics

Note: Public expenditure on maternity and parental leaves, OECD 2013: Public expenditure on maternity and parental leaves per child born, at current prices and current PPPs, in US dollars. Data for Canada and Japan refer to 2011 and for Greece and Poland to 2012.

Public expenditure per child born remains extremely low in the UK. Within the EU only Greece and the Netherlands spend less.

Maternity provisions across UK universities – determinants and outcomes

Given that maternity provisions strongly affect mothers' labour market participation and the gender pay gap, we need to understand the underlying mechanisms better. We analyse higher education institutions in the UK and their maternity leave provisions and examine the effects on women's career achievements (e.g. promotion to full professor) and salaries. In general, we find that the generosity of maternity pay and the availability of childcare positively affect female academics' career opportunities and incomes.

The UK higher education sector provides fertile ground to examine the effects of generosity of maternity provisions on individual and aggregate outcomes. First, statutory maternity benefits in the UK lag behind in generosity, so many universities (and companies) top up the benefits – but not uniformly. Second, higher education is arguably the only sector where individual productivity can be directly measured (as quantity and quality of individual publications) and thus linked to other outcomes such as salary and career progression.

Most UK universities provide extra Occupational Maternity Pay (OMP) that tops up the SMP (Statutory Maternity Pay) in the first 39 weeks of maternity leave. Eligibility for OMP usually depends on the length of service, and both the payments and the eligibility criteria vary among institutions. Arguably the best indicator for the generosity of maternity benefits is the number of weeks full salary replacement is paid.¹ We collect data on maternity benefits and childcare provisions for 165 institutions and match these to data on composition of academic staff and university characteristics from the Higher Education Statistics Agency (HESA).

Indeed, examining the generosity of maternity pay across 165 HEIs reveals a large variance which cannot be explained by different financial constraints faced by the university alone.² Tables 1 and 2 depict this large variation across UK universities:

¹ We also analyse other generosity measures such as the number of weeks for which the OMP tops up the SMP and the so called full weeks equivalent, which measures for how many weeks on average full salary replacement is paid.

² In a companion paper we explain this variance and find that larger, more research-intensive universities, with a (previous) larger share of female full professors and a low student-to-staff ratio implement more generous maternity packages.

Table 1: Number of weeks of full salary replacement across British HEIs

Weeks full salary replacement	Number of packages	Percent
0	15	7.0
4	51	23.8
6	27	12.6
8	38	17.8
9	5	2.3
10	1	0.5
12	3	1.4
13	9	4.2
14	2	0.9
16	14	6.5
17	1	0.5
18	37	17.3
19	1	0.5
20	3	1.4
26	7	3.3
Total	214	100.0

For example, the number of weeks for which full salary replacement is granted varies from 0 (e.g. Leeds Metropolitan University) to 26 weeks in HEIs such as Oxford, Manchester, Birkbeck College and the Royal College of Arts.

Table 2: HEIs and Generosity of Maternity Leave

Weeks	Institutions
0	Leeds Metropolitan University, Anglia Ruskin
4	Bath Spa, Liverpool Hope, Plymouth, Portsmouth, Huddersfield, Chester
8	Essex, Exeter, Bath, Birmingham City, Bangor, Heriot-Watt, Goldsmith College, Nottingham, Leicester, Aberystwyth
16	Bristol, Edinburgh, Glasgow, Kent, Leeds, Strathclyde, Warwick, Durham
18	Keele University, Heythrop College, Cambridge, UCL, LBS, LSE, Queen Mary, Royal Holloway, Reading
26	Oxford, Manchester, Birkbeck College and the Royal College of Arts

Given this large variation in the generosity of maternity pay across UK HEIs we ask two questions:

1. Why do HEIs implement vastly different maternity packages?
2. Does the generosity of maternity packages make a difference to the productivity, career progression and job satisfaction of female academics with children?

We argue that maternity leave provisions result from implicit or explicit negotiations between the board of the organisation and the bargaining units representing the workforce. In UK universities, the two sides are the university management and female employees. Within this framework, we obtain clear predictions. First, factors that raise the bargaining power of women employees, especially academic women, increase maternity benefits. Second, factors that increase the cost of providing maternity benefits reduce the generosity of maternity provisions.³ Finally, factors that

³ Both sets of predictions are consistent with an asymmetric Nash-bargaining protocol among others.

increase the institution's incentives to retain mothers in the workforce also increase the generosity of maternity pay.

In terms of outcomes, we expect that if women can take more time off from work – without loss of income – they are advantaged in terms of adapting to motherhood without the pressure of concerns about income or managing administration, teaching and research tasks. This increases the probability that women will return to their research position without having to take a career break and possibly with fewer effects on research and publication outputs.

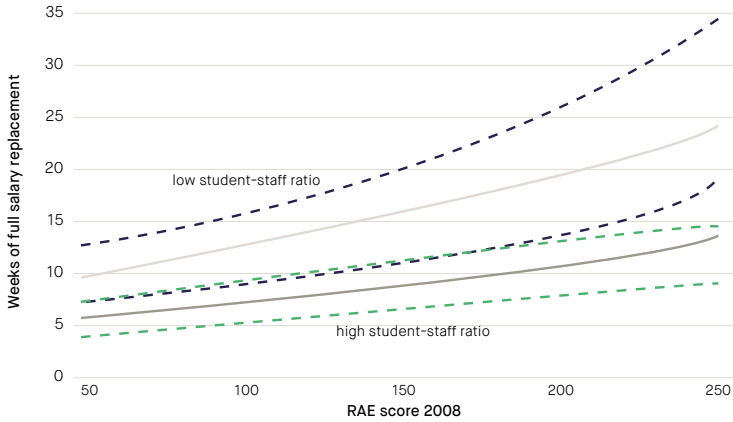
Whether more generous maternity provisions impact the career paths of female academics is an incredibly important question with serious policy implications. We address the leaking pipe and gender gap in salary questions by analysing whether better maternity provisions affect the share of female full professors, and the share of women in the highest salary bracket.

Determinants of generous maternity benefits

Our empirical findings largely support the theoretical discussion. We find that generosity depends on the size of an institution in terms of staff but not income. This points to the potential economies of scale provided by larger institutions. Moreover, we find support for our bargaining argument: universities with a historically larger share of female professors and female academics of childbearing age provide more generous maternity benefits. This is especially true at research intensive universities which have a higher incentive to keep the highly productive female talent that they have invested a lot of resources to recruit and train. However, we do not find that the share of senior female administrators or female administrators of childbearing age affects generosity, because the skill specificity of academic jobs is much higher: support staff can be replaced and redeployed much easier. Finally, a larger student-to-staff ratio affects generosity of maternity pay negatively, pointing to higher replacement costs of longer and more generous maternity leaves. Figures 5.1 and 5.2 depict the major results.

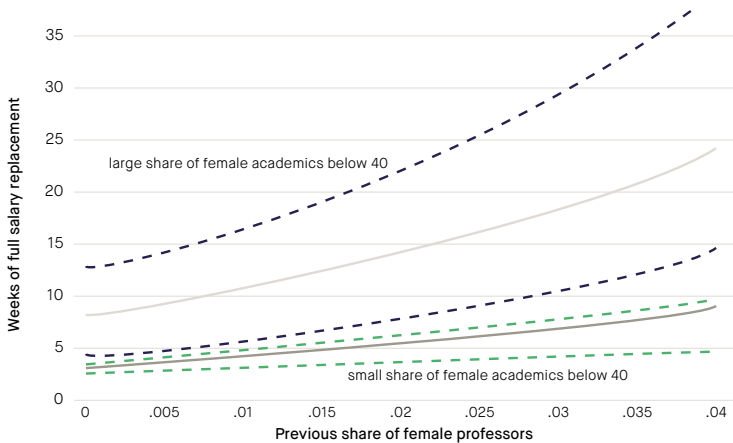
Figure 5: The determinants of generous maternity benefits

Figure 5.1 Predicted Weeks of Full Salary Replacement dependent on Student-Staff Ratio and Research Intensity



Student-staff ratio: low=2, high=28

Figure 5.2 Predicted Weeks of Full Salary Replacement dependent on Previous Share of Female Professors and Female Academics at Childbearing Age



Share below 40: small=0, large=0.25

Figure 5.1 shows the impact of student costs on generosity, which varies greatly by research intensity (measured as RAE score in 2008). In figure 5.2 we see that the bargaining power of female academics strongly affects maternity pay.

Does generosity have an effect on career paths?

Strikingly we find an unambiguously strong relationship between the generosity of maternity pay and an increase in the share of female professors across all disciplines.⁴ Universities with very generous occupational maternity pay have on average twice the number of female professors, compared to HEIs with minimal maternity benefits. This effect, however, is much stronger for research-intensive institutions than for primarily teaching institutions, as shown in figures 6.1 and 6.2.⁵

⁴ When we break down the analysis across different disciplines we find stronger relationships between the generosity of maternity pay and career advancement for the natural and social sciences than for the humanities.

⁵ Research-intensive universities have a much stronger screening process at the hiring stage and therefore have stronger incentives to retain highly productive female academics by providing more generous maternity pay.

Figure 6: Generosity of Maternity Pay and Career Progression

Figure 6.1: Predicted number of female professors depending on generosity of OMP and research intensity of HEI



Figure 6.2: Predicted number of female professors depending on generosity of OMP and availability of childcare at HEI



In addition, in-house childcare provision increases the share of female professors by up to a third. Our results suggest similar, albeit weaker, patterns for female salaries in academia: more generous maternity leave provisions lead to a higher share of female academics with an income in the highest salary bracket. We find no relationship between maternity/paternity leave provisions and career opportunities of male academics or female administrators.

Conclusions

These aggregated results have to be taken with some caution and more work has to be done to identify the effects of maternity leave provisions at the individual level.⁶ However, these findings point to the possibility that the generosity of maternity pay can positively impact the career path of female academics and help close the salary gap. Of course, generous maternity schemes affect universities' budgets. However, if the academic community, and society more broadly, want to achieve an academic workforce that mirrors the actual gender balance and is not just window dressing, we need to accept that women have children in the early stages of their academic careers. To keep female human capital in the production process, we have to ask ourselves how we can generate an environment that allows women to maintain productivity and keep up with their male colleagues, despite child rearing and family responsibilities.

Our research does not necessarily support the idea of infinitely generous and long maternity leaves, yet it is in line with previous results on the trade-off between length and generosity. Our findings suggest that a combination of limited but generous maternity benefits, coupled with institutionally provided childcare, might help to slow the leakage in the pipe.

We can possibly draw inferences from the UK's higher education sector more broadly, especially to other highly skilled sectors where the creation and implementation of innovative ideas is key. Flexible working allows people to combine routine tasks (administrative or teaching) with child rearing and therefore most mothers only take fully compensated maternity leave. This combination crowds out research or the creation of innovative

⁶ We have collected individual data for 10,000 female academics in the UK on child rearing histories, individual career paths and productivity: the results show similar patterns.

ideas in the short-term especially when generosity is low. In the medium to long-term, this generates lower productivity and therefore a lower career trajectory and earning capacity.⁷ Our research shows that more generous maternity pay can help to retain female talent in the labour market and thereby increase productivity. The UK suffers from a productivity gap compared to other highly developed economies and it ranks very unfavourably both in terms of generosity of statutory maternity pay and public spending on parental leave provisions, compared to other EU and OECD countries. It seems that UK family policies externalise the costs of parental leave to employers – which can be very onerous especially for small companies and start-ups – and the costs of childcare to parents.

There is room for improvement: more generous parental leave policies could help to close the productivity gap, and thus pay for themselves in the long-term.

⁷ We show exactly this mechanism with our analysis at the individual level.

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