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ABSTRACT

Migration and Productivity in the UK: An Analysis of Employee Payroll Data

We investigate the impact of immigration on productivity in the UK, using newly published ONS data on employees of non-UK origin by region and sector. Consistent with earlier research, we find some evidence of a positive association between non-EU migration and productivity, and some weaker evidence of a negative association between EU migration and productivity, although results are sensitive to the specifications used.

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Introduction

Productivity is the key driver of economic growth and welfare; as Paul Krugman (1997) put it, "productivity isn't everything, but in the long run it is almost everything." The UK's relatively poor economic performance since the 2008 financial crisis, and the resulting slow growth in overall living standards (and even slower growth in real wages) is largely the result of a sharp fall in productivity growth, which had averaged close to 2% per year prior to the crisis, to approximately 0.3% in the years after.

Meanwhile, immigration to the UK rose sharply, beginning in 1997, and even further after 2004, when the accession to the EU of new member states from central and Eastern Europe led both to a sharp rise in immigration and to a reorientation of migration flows to the UK away from historical source countries to the new EU member states, which increased further after the later accession of Bulgaria and Romania.

While the timing of the sharp fall in productivity does not match that of the increase in migration, the latter has been advanced by some as one possible cause of the productivity slowdown. This issue was brought into sharp focus by the Brexit referendum where the Leave campaign argued that freedom of movement had led to a large increase in lower skilled migration, which had depressed both UK wages and productivity growth, and that Brexit would enable the UK to reorient its migration system towards higher skilled workers, with an accompanying rise in productivity.

The new points-based migration system, introduced in 2021, does indeed end freedom of movement; migrants are now eligible for work visas on the basis of salary, skill level and (in some cases) specific occupations. However, even before it was introduced, there was a sharp fall in migration from the EU (and, during the pandemic, substantial return migration) while migration from outside the EU rose steadily.

The impact of migration – and in particular the differential impacts, depending on the type of worker – are therefore of substantial public and policy interest, both in assessing the likely impact of the new migration system and in determining what, if any, contribution migration policy can make towards addressing the UK's productivity problem.

Theoretical considerations

The theoretical impact of immigration on productivity is ambiguous, because there are a number of conceptually different mechanisms that are potentially at work. As discussed in Campo, Forte and Portes (2018), these include:

- The simple "batting average" effect. If individual immigrants are more or less productive on average than natives, they will directly raise or lower productivity for

the whole economy, or the particular locality or sector that they are employed in, even if they don't affect the productivity of natives;

- Within-firm complementarities, where immigrants increase the productivity of natives in the same firm (or, conceivably, reduce it, if for example there are increased frictions within the firm, perhaps because of language differences);

- Within-sector spillovers, because of economies of scale, clustering effects, and/or increased competition;

- Local or geographical effects, again because of complementarities – for example the availability of low-skilled immigrant workers could increase the productivity or labour supply of high skilled native workers (Barone and Mocetti, 2011; Peri, Romiti, and Rossi, 2015);

- Incentive effects: immigration could increase or decrease the incentive for native workers to acquire human capital, either general or sector-specific, depending on the type of immigration and how it impacted wages and labour demand;

- Impacts on investment. If immigration reduced the incentive to invest in productivity-enhancing capital – perhaps the availability of low-skilled labour makes it uneconomic to invest in automation – then it could reduce productivity. On the other hand, someinvestment might be complementary to the skills of immigrants.

It is worth listing and distinguishing these possible mechanisms, since they have different implications for empirical analysis. For example, if the impact of immigration on productivity operates primarily at a sectoral or firm level, then the definition of the appropriate labour market in which to estimate the impacts will be different than if it operates at a geographical level.

Literature Review

In contrast to the labour market impacts on jobs and wages, for which there exists now an extensive literature, the evidence for the UK (or indeed internationally) on the impact of migration on productivity is has started to build up only recently. As a result, there is not as yet a clear consensus on either the sign or the magnitude of the possible impacts; nevertheless, it is worth reviewing the available empirical evidence on the topic.

At a cross-country level, Ortega and Peri (2014) examine the impact of both immigration and trade on income: they find that while openness to trade and migration both boost per capita income, migration has considerably larger impacts than trade; moreover, the impact of migration takes place chiefly via a positive effect on TFP. However, their cross-sectional dataset is dominated by developing countries. Taking a different approach, Alesina, Harnoss, and Rapoport (2016) analyse the relationship between birthplace diversity – which they show is unrelated to traditional measures of diversity – and macroeconomic performance, showing that economic output is positively related with diversity caused by immigration, with

immigrants from richer and culturally proximate countries being associated with higher productive effects.

Similarly, Jaumotte, Koloskova, and Saxena (2016) apply a similar specification to that of Ortega and Peri to a panel of selected countries, finding that a 1% increase in the migrant share of the adult population results in an increase in GDP per capita and productivity of approximately 2 percent: this is a very large impact. The findings are consistent across a variety of empirical specifications, although again the study analyses a limited dataset.

Within countries, there exists a small but growing body of research looking at the relationship between immigration and labour productivity. For the US, Ottaviano and Peri (2006) find evidence of diversity positively affecting the productivity of workers in major cities, going as far as stating that "data support the hypothesis of a positive productivity effect of diversity with causation running from diversity to productivity of US workers" (p. 38). Peri (2012) decomposes multiple components of output growth and estimates the impact of immigration on each, finding that immigration is consistently associated with increases in total factor productivity in excess of 1% (which is found to be sufficient to counteract the lower associated growth of skill intensity and skill bias of production).

In the UK, Ottaviano, Peri, and Wright (2018) analyse the services sector and find that a 1% increase in immigrant inflow in the firms' locality is associated with an increase in labour productivity within the firm. It is however worth noting that, for lack of more granular data, their strategy relies on matching firm-level data with immigrant population estimated at TTWA level from the Labour Force Survey, which can present significant measurement error. Using the same data sources, Rolfe et al. (2013) look at productivity by region and sector and, although they do not attempt to establish causality, they find immigrant share to be positively associated with labour productivity; additionally, they provide significant qualitative evidence of the complementarity between domestic and foreign workers.

The most recent relevant research in this area was prepared for the UK government's Migration Advisory Committee. Campo et al. (2018) exploit geographical variation in the migrant share of the workforce, using an instrumental variable approach, to estimate the impact of immigration on productivity. They find that a one percentage point increase in the share of immigrants within a UK local authority is associated with an almost three percentage point increase in productivity (measured as the growth in gross value output per head over the period considered).

Costas-Fernández (2018) assumes a CES production function and incorporates new estimates of the capital stock at a regional and sector level. The study finds that both migrants in high- and low-skilled occupations are, at the margin, more productive than their UK-born counterparts, with the central estimates suggesting that the marginal migrant is around 2.5 times as productive as a UK-born worker. Finally, Smith (2018) also looks at a region-sector level, but the key dependent variable is total factor productivity (TFP) rather than labour productivity; she also uses firm-level data and imposes less structure on the production function. The central estimate is that a one percentage point increase in the migrant share results in a 1.6 per cent increase in TFP.

Summarising the results, the MAC concluded: "Overall the existing literature and the studies we commissioned point towards immigration having a positive impact on productivity but the results are subject to significant uncertainty. While the evidence on overall migration is not entirely conclusive the evidence perhaps unsurprisingly suggests that high-skilled migrants have a more positive impact" (Migration Advisory Committee, 2018, p. 2).

Overall, the message from these papers is that the impact of immigration on productivity is generally positive, but effect sizes are likely to vary depend both on the nature of the economy and labour market and that of the immigrant workforce.

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Data description

We require data both on productivity and employment disaggregated between migrants and non-migrants. For the latter, existing empirical analysis in the UK has almost exclusively made use of the Labour Force Survey (and/or the related Annual Population Survey), the main regular UK household survey used for labour market analysis, and the source of official figures on employment. The Labour Force Survey includes a question on country of birth, enabling the identification of migrants. The analyses described above therefore construct variables showing migrant penetration of the workforce; this is the key explanatory variable.

However, while the LFS is the standard data source for this type of analysis over a range of labour market issues, sample sizes are not large when it comes to migrants – especially outside London. This issue is particularly acute when looking at (as we do) data by region and sector, where some region-sectors outside London will have very few migrants in any given quarterly (or even annual) sample. All the UK-focused papers above suffer from this limitation.

Our analysis, by contrast, makes no use of the LFS. Instead, we use a new experimental data set from HM Revenue and Customs' (HMRC). HMRC publish data on migrant workers from the Pay As You Earn (PAYE) Real Time Information (RTI) system. Unlike the LFS, it covers the whole population rather than a sample; it is based on a count of all payrolled employee jobs that were active in a given month using HMRC's PAYE RTI data. This information is then combined with the HMRC Migrant Worker Scan (MWS). This uses input from the Department for Work and Pensions (DWP) which registers National Insurance numbers for those aged over 16 years through its adult registration process, which usually includes an interview to verify identity and right to residency in the UK.

Combining this information allows the data to be disaggregated between those who were either born in the UK or arrived here before the age of 16, and those who were registered as adults. Within that, the published data disaggregates between those who are of EU origin and those from outside the EU. The data is therefore divided into three groups – EU origin employees, non-EU original employees, and UK-origin employees, where the latter also includes those born abroad but who moved here before the age of (approximately) 16. The data is reported at the region and industry level and is available from 2014 to 2022.

For labour productivity, we use the "Labour productivity by Industry and Region" dataset, published by the Office for National Statistics (ONS). The dataset contains information on labour productivity per job and per hour, reported again at the region-industry level, and is available up to calendar year 2019; it has not been reported since the pandemic.

We merge the two datasets by region, industrial sector, and year, the three categorical variables they have in common. The datasets classify regions by International Territorial Level (ITL) 1 system and industries by the Standard Industry Classification (SIC) 2007 codes. The ONS dataset aggregates a number of sectors; we aggregate the HMRC data to match.

We also exclude the real estate sector: in this particular dataset, ONS assign the value of "imputed rent", that is the output produced by homeowners 'paying' themselves rent for their residence, to this sector, which results in a large upward distortion. The HMRC data is reported monthly; we use annual averages to match the productivity data. This produces a dataset with 12 regions, 6 industries and 6 years, i.e. 1152 observations, each of which contains information about employment counts by origin (UK, EU, and non-EU) and productivity per job and per hour worked.


Descriptive Statistics

Figure 1 shows trends in productivity over the 2014-2019 period by sector. Productivity varies significantly between sectors, with output per job (in 2019) ranging from £114,000 in finance to £24,000 in accommodation and food services. And while, as noted above, productivity was on average stagnant over this period overall, there was substantial divergence between sectors, with productivity in information and communication, growin by 20% over 2014-2019. Conversely, productivity in public services only grew by 0.83%, and transportation shrank by 11% in the same period. Interestingly, we find that the productivity growth and levels of productivity show a weak but positive correlation of 0.10, suggesting that high-output sectors tend to grow more both in absolute and relative terms. This factor is explored in greater detail in our regression analysis.
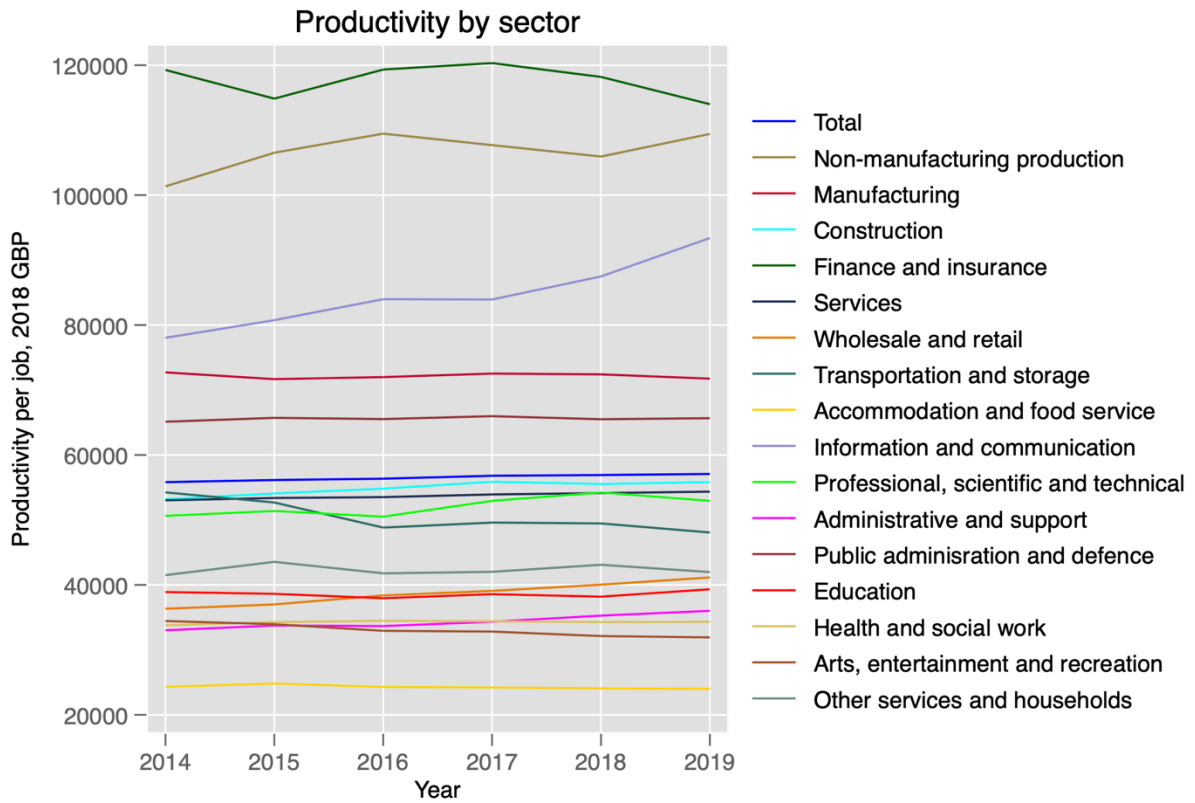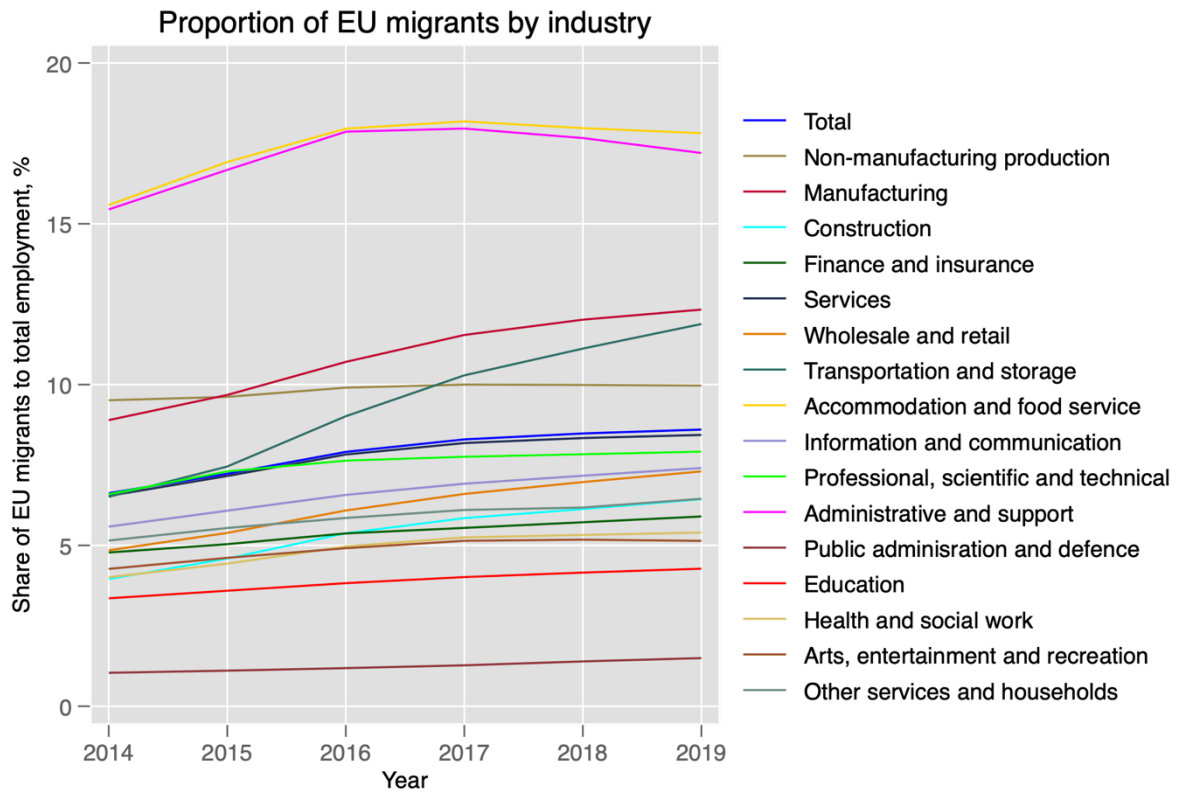
Figure 1

Figure 2 summarises the geographical trends in productivity. There is significant variance in productivity by region, albeit less pronounced than sectoral differences. Unsurprisingly, London is by far the most productive region in the UK with average output of £78,600 per job, followed by the South-East at £59,600; the lowest productivity regions were Wales and Yorkshire and the Humber. Amongst regions, we find a slight positive correlation between growth rates and levels of productivity, suggesting some small increasing regional divergence.

Productivity by region
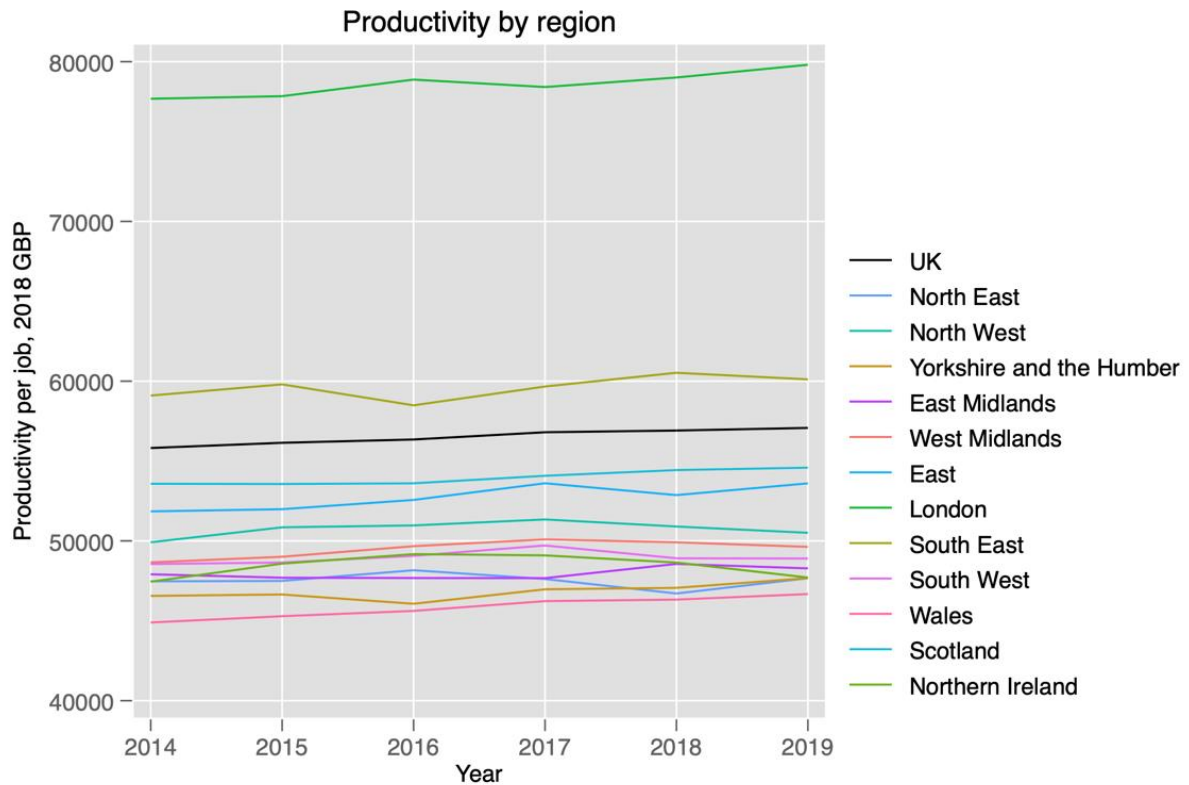
Figure 2

Figures 3 and 4 provide an overview of the trends in migrant penetration across sectors. By the end of the period, EU-origin migrants made up about 8.6% of the workforce, up from 6.6% at the start, while non-EU migrants were 6.7% of the workforce, up from 5.95%. EU migrants were particularly concentrated in accommodation and service activities, administrative and support service activities, and manufacturing. By contrast, sectors with the highest proportion of non-EU nationals included information and communications sector at 10.3%, followed by accommodation and food service, human health and social work, administrative and support service activities. So while there are considerable overlaps, non-EU migrants are overrepresented in some higher-skilled, higher productivity sectors whereas the reverse is true for EU migrants.

Figure 3
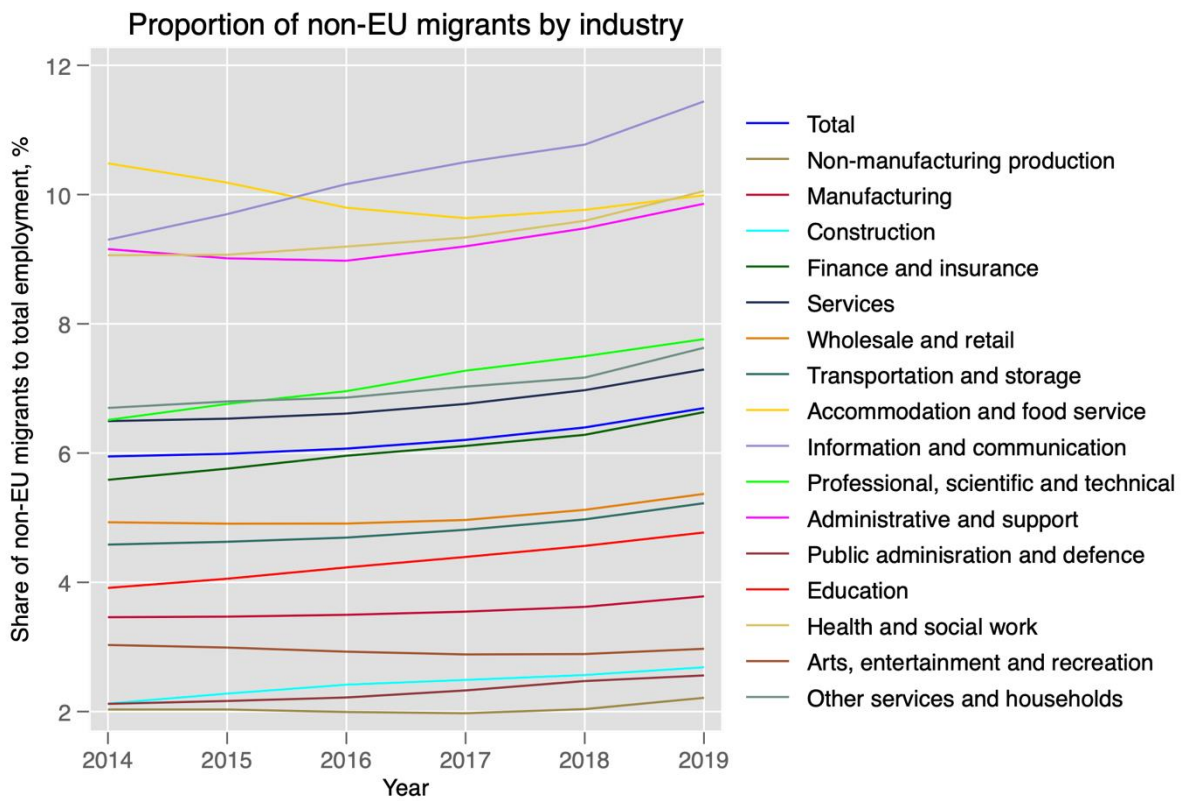
Figure 4

Both EU and non-EU migrants are, however, very much concentrated in the London area. Figure 5 reveals that EU and non-EU migrants, in roughly equal parts, made up 38.5% of London's workforce in 2019. In all other regions except for the North-East, EU migrants outnumber non-EU migrants.
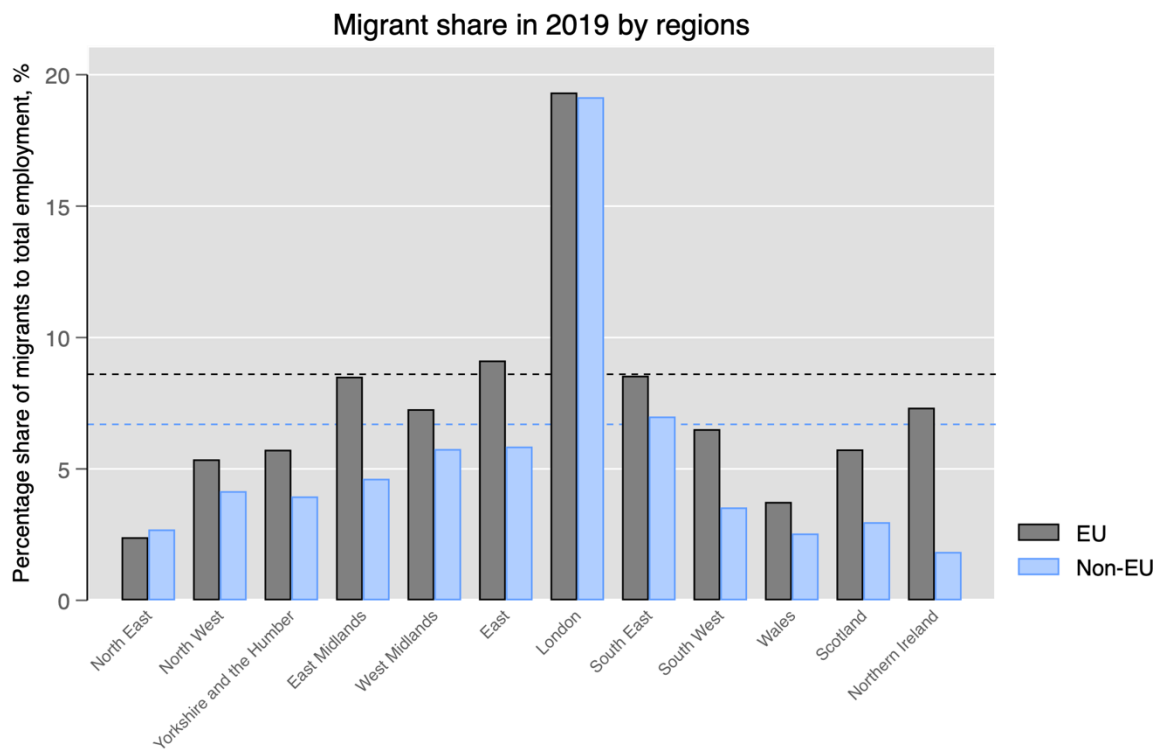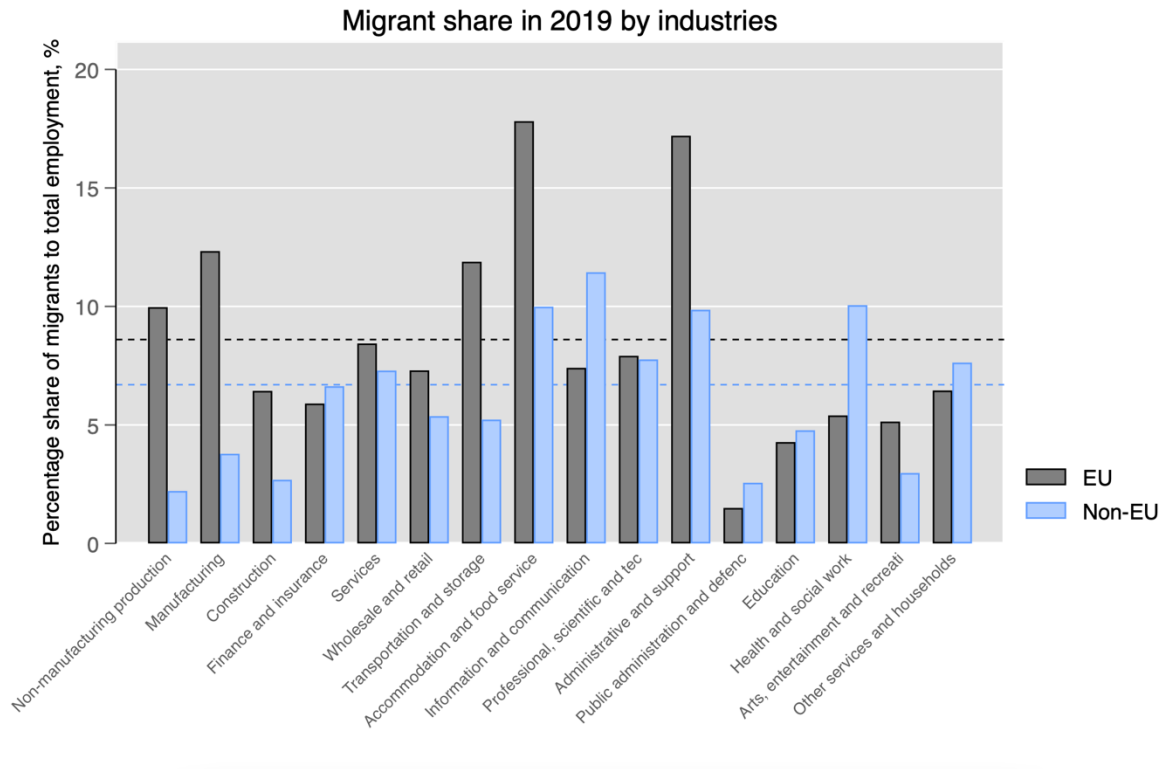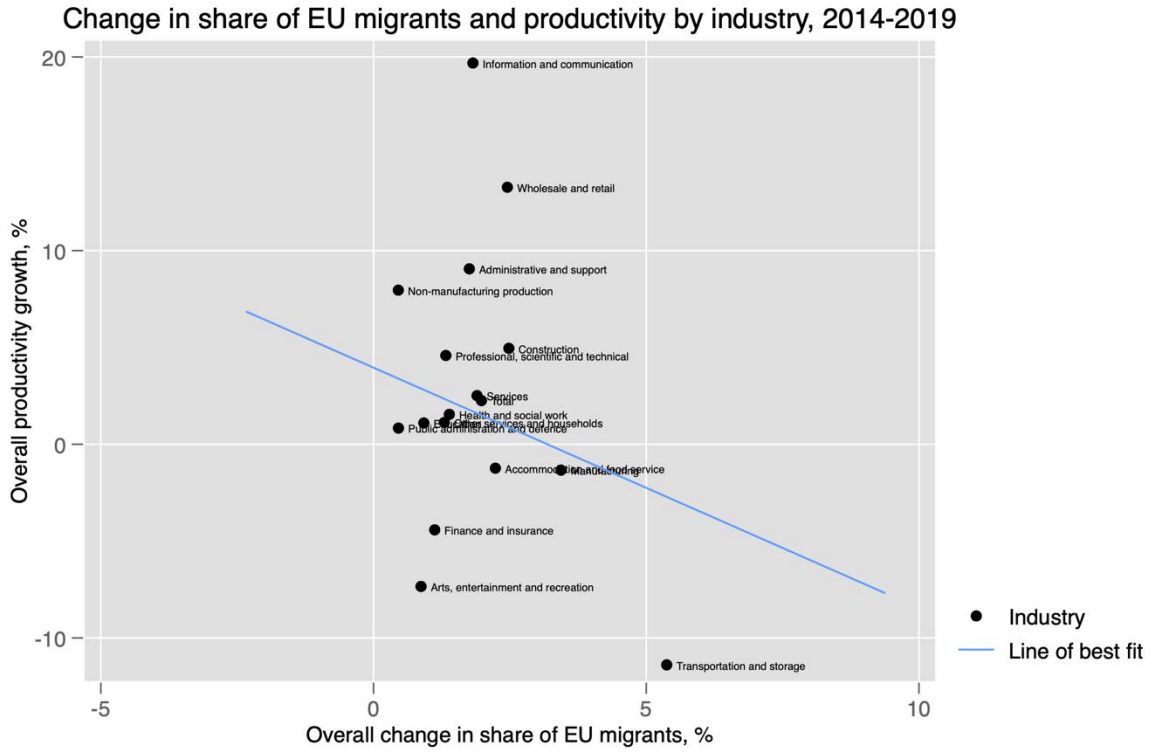
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Migrant share in 2019 by regions

Figure 5

Migrant share in 2019 by industries

Figure 6

Before proceeding to the regression analysis, we look at the simple correlation between changes in productivity and changes in migrant penetration. Figures 7 and 8 show the correlation between changes in the proportion of workers of EU origin and productivity, first by industry sector, and then by sector-region over the entire period of our dataset (2014 to 2019); the latter plots all 192 sector-region observations used for the correlation while the former displays average changes in each industry. A small negative correlation is observed, although there is substantial heterogeneity.

Similarly, figures 9 and 10 do the same for non-EU origin workers. Here the correlation is positive, and somewhat stronger. These are simple associations but suggest that at an aggregate level there is some negative association between productivity growth and EU migration, and positive association for non-EU migrants, which we investigate further in the next section.

Change in share of EU migrants and productivity by industry, 2014-2019

Figure 7

Change in share of EU migrants and productivity by industry, 2014-2019

Figure 8

Change in share of non-EU migrants and productivity by industry, 2014-2019

Figure 9
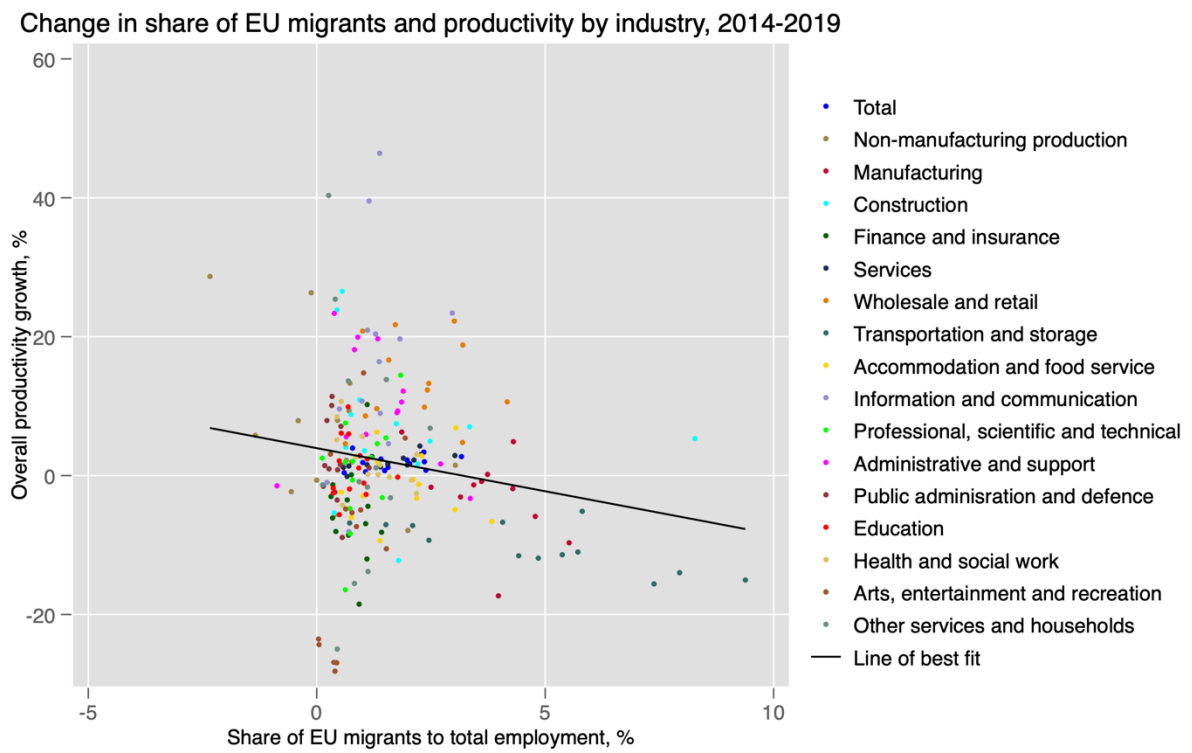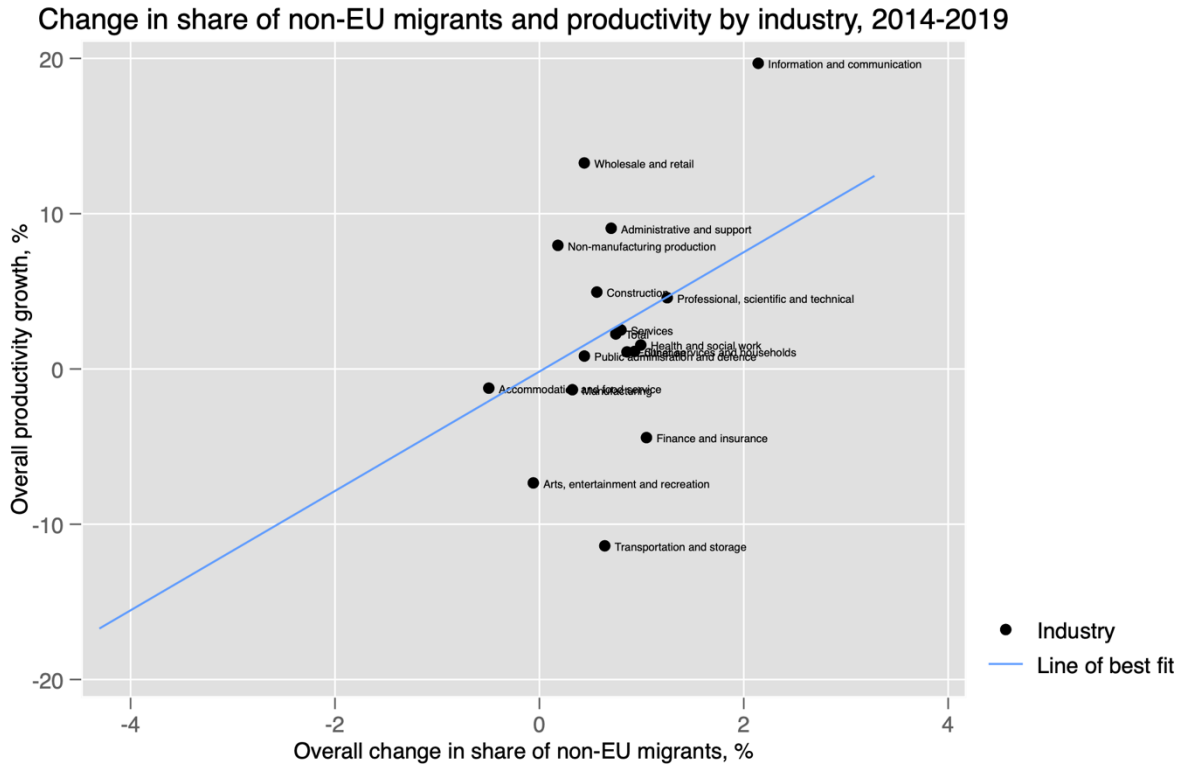
Change in share of non-EU migrants and productivity by industry, 2014-2019

Figure 10

Regression results

The descriptive analysis above shows some evidence of a positive association between non-EU origin migrants and productivity, and the reverse for EU-origin migrants. We proceed to investigate this more formally, by regressing productivity at the region-sector level on migrant penetration in the workforce, disaggregated between EU and non-EU origin workers. Our dependent variable in each case is (real) output per worker (ONS also published output per hour; in our data, the correla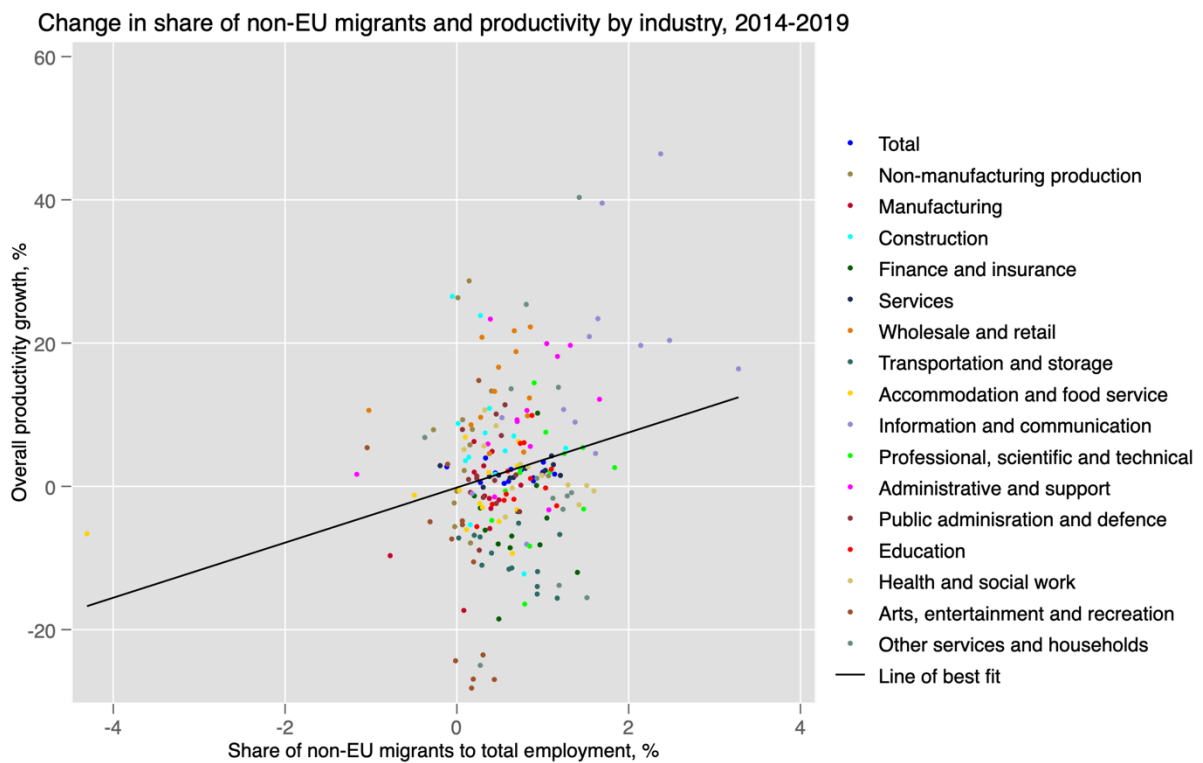tion between output per worker and output per hour is extremely strong, and using the latter makes effectively no difference to the results). The key independent variables are the percentage of the workforce made up of EU and non-EU origin workers.

As for the impact of migration on wages, there are two potential approaches here seen in the literature; to regress the *level* of productivity on migrant penetration, with the lagged value of productivity as a control, and with region, sector and time fixed effects (as in, for example, Nickell and Salaheen (2017)); or to perform the same regression in first differences, which removes the need for region and sector fixed effects (as in, for example, Dustmann, Frattini and Preston). There is no clear reason to prefer one or the other – which is more appropriate will likely depend on the structure of the errors: see Woolridge (2010). We do both.

For the latter approach, we also control for lagged productivity growth; the coefficient here is negative and significant, suggesting some negative autocorrelation (this could well reflect measurement error in productivity); and for the growth in total employment, again negative, suggesting that sectors where the workforce is growing faster see somewhat slower productivity growth. However, while we think this justified their inclusion, it doesn't actually change the results significantly (i.e., excluding these variables does not materially alter the estimated coefficients on our variables of interest). We also show results weighted by total employment, since the size of sectors (and to a lesser extent regions) varies significantly.

Our results show a reasonably clear association between non-EU origin migration and productivity. For both the levels and the first differences regression, the coefficient suggests that an "extra" 1% of the workforce from outside the EU is associated with an approximately 3% increase in productivity in the non-weighted regression, and an approximately 1.5% in the weighted regression, although for the first difference regression this latter is not significant at the 5% level. Combined with the graphs above, this appears to be reasonably strong evidence of an association, although, as discussed below, we need to be cautious about claiming causality.
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Column	(1)	(2)	(3)	(4)	(5)
Dependent Variable	logProductivityperjob			ΔProductivityperjob	
Fixed effects	No	Yes	Yes	Yes	Yes
Weighted	No	No	Yes	No	Yes
Explanatory Variable					
EUEmployment%	-.03339 .0446	-.37139 .36146	-.04018 .27762		

nonEUEmployment%	.07858 .05762	2.96091*** .88079	1.47134*** .52783		
ΔEUEmployment%				-.7041707 .5888755	-.0175677 .4453118
ΔnonEUEmployment%				3.092276** 1.348519	1.369535* .8201292
L1.Productivityperjob	.9927001*** .0047749	.3187454*** .033791	.3700014*** .033495		
L1.ΔProductivityperjob				-.121919*** .035562	-.1340132*** .0358669
ΔTotalemployment%				-.2146397* .1297999	-.1947434* .1133202
Cons	.0800037 .0513989	7.222974*** .3624533	6.691561*** .3602099	.3428495 .5783661	.3668363 .4115159
R-squared	0.9785	0.5584	0.8377	0.0287	0.0346
Adjusted R-squared	0.9784			0.0197	0.0257

Table 1. Regression results

The results for EU-origin migrants are less clear. The coefficient estimates are consistently negative, consistent with the descriptive statistics shown above. However, the estimates never approach statistical significance, and are quite small, especially when weights are applied. So while, taken together, the results may constitute suggestive evidence of an association between EU-origin migration and slower productivity growth, they are also consistent with a null effect overall.

As with the more common analyses of the impact of migration on wages, an obvious objection to the regressions above is that migration patters may be endogeneous; that is, that changes in productivity may drive migration rather than vice versa. However, the assumption that migration is exogeneous to productivity is rather less problematic than for wages: it is not obvious whether a sector where productivity is growing fast would need, or attract, more or fewer migrant workers (note that we control for employment growth overall).

The standard approach in the literature to this issue is to instrument migrant penetration (or changes in migrant penetration), generally using some measure of pre-existing migrant penetration as an instrument. Unfortunately, this is problematic when using panel data over a relatively short time period, as here; we did experiment with this approach, finding broadly similar results, but given the weakness and questionable validity of the instrument here, this is not wholly convincing; we would still prefer to describe our results as indicating an association (or lack of association) rather than clear evidence of causality.

Interpretation and policy implications

The differential impacts of EU and non-EU migration could perhaps be most directly ascribed to the heterogeneous skillsets and sectoral distributions between the two migrant groups, shaped by the different nationality-based entry requirements to the UK during 2014-2019. In this period, EU-origin migrants could enter and work in the UK under the free movement system, while non-EU origin migrants moving to work had to qualify under a relatively restrictive system, which generally required a job offer paying significantly more than average earnings in a relatively highly skilled occupation.

So the most obvious intuitive explanation is simply a batting average effect – that is, that recent non-EU origin migrants are more highly skilled/highly paid, and hence more productive, than EU-origin migrants (or UK-origin workers). However, this explanation is not likely in itself to be sufficient. In fact, by no means all non-EU origin migrants in the workforce enter through the selective work visa system: there are also large migration flows through other routes, including students, refugees, "family" migration, and dependents. Most of these have the right to work (with some restrictions for students).

As a consequence, there is substantial heterogeneity among non-EU origin employees. While it is the case that median pay is somewhat higher for non-EU origin migrants than for UK-origin workers, which in turn is somewhat higher than for EU-origin workers, the differences are not huge, and indeed there are large numbers of non-EU origin employees in relatively low wages (Fernández-Reino and Rienzo, 2021). Interestingly, recent analysis using a related version of the same data set (Sumption, Portes and Brindle, 2023) found that the earnings of non-EU workers first entering the employee workforce increased from the mid-2010s to 2021 (relative to both UK and EU-origin workers), suggesting that the average skills profile of non-EU migration increased over this period, at the same time as their overall numbers increased rapidly. However, the association of non-EU origin employees with increased productivity is far larger than can be explained simply by the batting average effect. In other words, our results imply that the workforce as a whole sees higher productivity growth in sectors and regions where the non-EU origin workforce is growing faster; no such impact (and, possibly, the reverse) is the case for EU-origin employees.

There are a number of possible explanations for this observed association. While our econometric specifications (fixed effect regressions or first differences) abstract from fixed sector-region effects, it may still be the case that employers respond to local sector-specific shocks in ways which drive a correlation between productivity growth and non-EU migration (for example, if high growth/high productivity firms rely more on non-EU migrants, non-EU migrants are more likely to set up or join high-growth firms, or the presence of a pool of available non-EU migrants makes it easier for firms to grow faster).

.Any of these could plausibly play a role in the positive association of non-EU migration and productivity. As discussed above, we do not claim to have established causality in our analysis above, and indeed these explanations are largely consistent with causality running in both directions.

What are the implications of our results for the impact of the post-Brexit migration system introduced in January 2021? As noted above and discussed in detail in Portes and Springford (2023) and UK in a Changing Europe (2023), this has further accentuated the rise in non-EU migration for work. In the latest available data (Office for National Statistics, 2023) there was a sharp rise in the number of non-EU origin employees, up by 494,000 (or 26.6%) in 2022 compared to 2019, while EU-origin employee numbers were down by more than 150,000.

In principle, if our results continue to hold in the post-pandemic period, this should provide a modest boost to UK productivity over time. It would also appear to justify the broad rationale for the new system, which ends free movement while liberalising work migration more broadly for relatively highly paid/highly skilled workers.

However, it is worth noting that much of the recent growth in non-EU migration is in the health and social care sector and has been driven in large part by the introduction of a new Health and Care Visa, which is open to employees in even relatively low-paid roles. There has also been a very large rise in the number of dependents arriving, particularly accompanying those on student visas and many of whom are likely to be working. It cannot therefore be assumed that the previous association between productivity at a sector-region level holds for the changing composition of non-EU migration.

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