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January 26, 2018

Approved By
The European Department

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DRIVERS OF UK WAGE GROWTH[1]

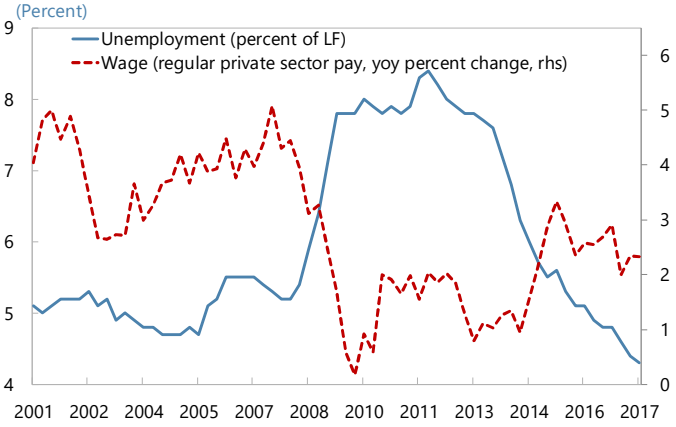
Since the financial crisis, nominal wage growth has been much weaker than during the previous decade. This chapter finds that the main factors behind the slowdown include weak productivity growth, labor market slack (both in the UK and the EU), and low inflation. We consider broader measures of labor market slack including a newly constructed measure of underemployment, aiming to capture labor market pressures more accurately than the headline unemployment rate. This measure signals limited labor market slack in 2017, which should support wage growth going forward. However, a sustained recovery in wages would require a recovery in productivity growth.

A. Introduction

1. Nominal wage growth in the UK has remained subdued in recent years despite a significant tightening of labor market conditions. After several years of robust employment growth, the headline unemployment rate has fallen from about 8 percent in 2010 to 4.3 percent in 2017Q3—the lowest level since 1975. The share of long term unemployment has also declined. At the same time, labor force participation has increased and is now equal to its pre-crisis peak.[2] Moreover, average weekly hours of work have recovered to the average level in 2003–2007. Howeover, nominal wage growth has recovered only modestly and is still well below its pre-crisis average. This has renewed the debate on the strength of the link between labor market conditions and wages (see Haldane, 2017).

Unemployment and Wage Growth

(Percent)



Sources: Haver.

2. This chapter aims to explain UK's wage dynamics in recent years. A new measure of underemployment for the UK is used in the analysis to capture the impact of self-employed workers on labor market slack. It is then complemented with the share of involuntary part-time workers to give a broader view of labor market slack. Key factors that have affected the dynamics of wages since the crisis include low labor productivity growth, significant labor market slack in the UK and the EU until recently, low actual and expected inflation, and uncertainty about the growth outlook.

[1] Prepared by Jiaqian Chen (EUR) and Weicheng Lian (RES).

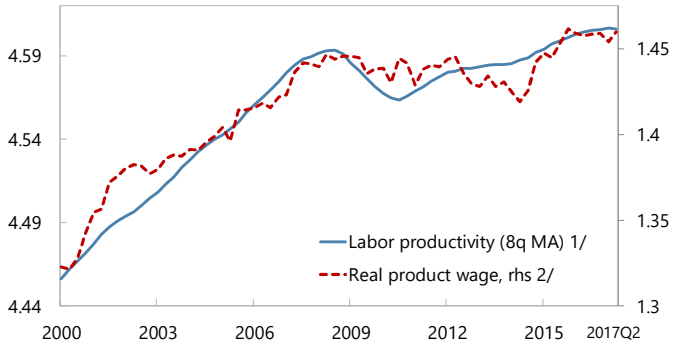
[2] This may partly reflect reforms on the pension entitlement age which has pushed up the participation of old aged workers (HMT, 2011).

B. Determinants of Wage Growth

3. Nominal wage growth is determined by the interaction of a number of factors. Some are structural in nature, other are cyclical:

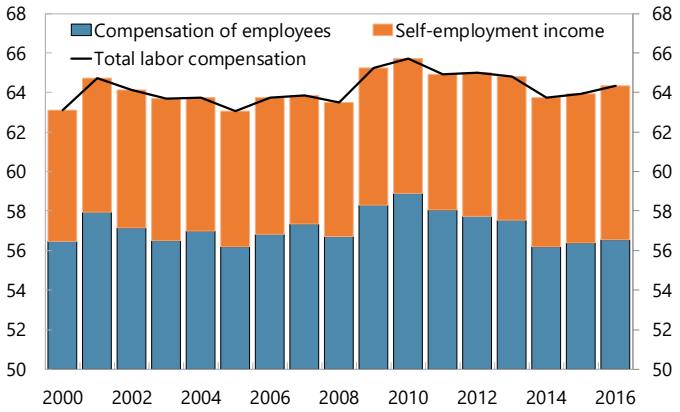
- Labor productivity growth—the growth in output per worker—is a key driver of real wage growth. As productivity increases (which could happen as firms invest in new machines and adopt a better technology, for example), the incentives to expand production and hire new workers improve, which should eventually translate into rising pressure on wages. In the UK, the labor share as percent of GDP has been close to 64 percent over time, which suggests a broadly stable relationship between labor compensation and workers' productivity.

Real Product Wage and Labor Productivity
(Log points)



Sources: Haver and Fund staff calculations.
1/ Real output per worker.
2/ Average weekly private sector regular wages deflated by GDP deflator.

Labor Share
(Percent of GDP)



Sources: Bank of England and Fund staff calculatins.

- Labor market slack—the gap between headline and equilibrium unemployment—also has an important influence on wages. During the expansionary phase of the business cycle, firms seek to hire more workers to meet increased demand for output, which leads to lower unemployment and eventually to higher wages as the supply of qualified workers diminishes. The reverse happens during downturns. Historically, the unemployment rate has been a good indicator of labor market tightness. More recently, due to the changing nature of work arrangements, one has to look at a broader range of measures to form a view on the state of the labor market. This topic is discussed in the next section.

- With globalization, goods, capital, and labor move more freely across borders, so global labor market conditions also matter for domestic wages. In our analysis we consider measures of labor market slack in the EU as an additional determinant of wage pressures in the UK.

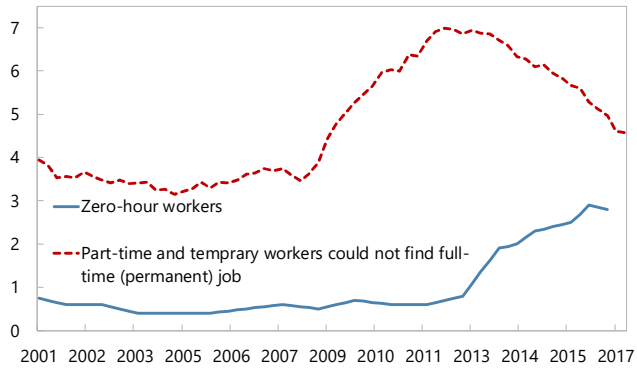
- Expected inflation is another important factor determining nominal wages. In a simple world with no business cycle fluctuations, constant non-wage costs, and no monopoly power, pay raises should be approximately equal to productivity growth plus expected inflation.

- Finally, uncertainty about medium term growth prospects can also influence hiring decisions and wage dynamics. At a time of pessimism or uncertainty about the future, firms would be less willing to hire full-time employees or pay better wages to attract more qualifies workers (even if current demand is strong). At the same time, workers may be less willing to switch jobs or seek a wage increase.

C. Assessing Labor Market Slack

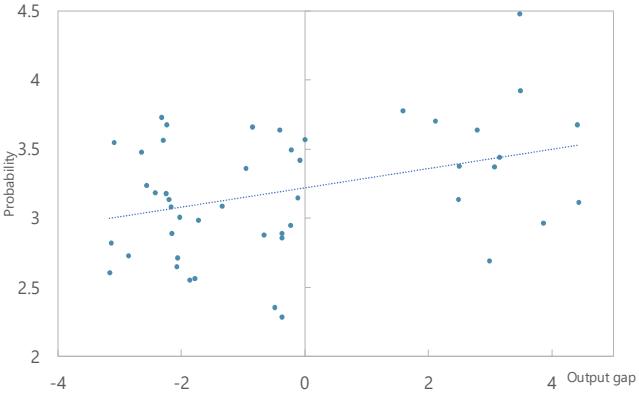
4. Historically, the unemployment rate has been a good indicator of slack, but with the rise of more flexible forms of employment, a broader assessment of labor market conditions may be warranted. For example, the share of part-time employees who would prefer fulltime jobs—involuntary part-time workers—doubled from 9.4 percent in 2007 to 18 percent in 2013, before falling back to 12 percent recently. Involuntary part-time workers may have little wage-bargaining power and may prioritize job security over higher wages. Moreover, the share of self-employed workers and zero-hour workers[3] has increased above pre-crisis levels. Some of these workers may prefer to be in regular employment, and could seek to return to it as the economy recovers. Therefore, cyclical pressures on the labor market can perhaps be assessed better by looking at changes in broader measures of underemployment.

Underutilization in the Labor Market
(Percent of employment)



Sources: Haver.

Transition Probability of Self-employed Workers to Regular Employment and Output Gap (percent)



Sources: Fund staff calculations.

5. Analysis of labor flows suggest that the transition rate from self-employment to regular employment is procyclical. Although the increase in self-employment has a structural component (some workers may have an incentive to become self-employed due to the nature of their work and/or the relatively more favorable tax treatment of the self-employed, see Tatomir 2015), our analysis suggests that

[3] People in employment on contracts where they are not guaranteed any hours in a given week.

it has a cyclical component as well. The share of self-employment rises during recessions (transition from unemployment to self-employment increases). In addition, transitions from self-employment to employment increase as economic conditions improve (see chart). Panel regression using data from 2001–15 (following Rees and Shah 1986) shows that the probability of moving to regular employment increases when the economy recovers. This is consistent with anecdotal evidence that some self-employed have been forced out of regular employment as firms try to avoid the legal obligations that come with an employment contract, such as meeting minimum wage requirements, national insurance contributions, statutory sick and holiday pay, and fair dismissal. A recent study by Tomlinson and Corlett (2017) suggests that about 60 percent of the self-employed are in the "precarious" sectors, where they are more likely to be underemployed. Overall, this evidence suggests that self-employment could affect the degree of labor market slack and wages (see Box 1).

Box 1. Could High Self-Employment Share Affect Wage Growth?

A compositional shift towards greater self-employment would structurally reduce wage growth, as self-employed workers typically have lower wage income. On average, self-employed workers receive lower labor income, although there is a significant variance, with fat tails at both ends of the income distribution (Hatfield 2015). Moreover, Blanchflower and Shadforth (2007) show that self-employed (without their own workers) have seen their median weekly income drop by about a 20 percent in real terms between 2007–08 and 2014–15, while both employees and self-employed with workers have seen milder declines. Self-employed workers are not bounded by the national minimum requirement, and are less likely to have made contributions to a private pension scheme: in 2010/11 only 21 percent had pensions compared to 50 percent of employees. Few self-employed in the UK employ staff of their own: only 17 percent of self-employed in the UK have workers compared to 44 percent in Germany (Hatfield 2015).

In addition, high share of self-employed may have a negative influence on wage growth for regular employees. Since self-employed workers have lower wages on average, they could compete with regular employees for a given task, reducing economy-wide wage pressures. Empirically, transitions from self-employment to regular employment increase when economy recovers, so some of the self-employed workers will compete with the unemployed for vacancies, thus delaying the pace of wage recovery. Indeed, the transition rate from self-employment to regular employment has increased in 2016–17 (to about 3.5 percent from an average of 3 percent after the crisis).

Box 1. Could High Self-Employment Share Affect Wage Growth? (concluded)

Panel fixed effect VARIABLES	Probability of self-employed workers to employee		Probability of unemployed to employee	
Unemployment rate	-0.04***		-0.09***	
	(0.01)		(0.03)	
Regional unemployment		-0.02*		-0.07**
		(0.01)		(0.03)
age	0.03***	0.03***	0.06***	0.05**
	(0.01)	(0.01)	(0.02)	(0.02)
age squared	-0.0001*	-0.0002*	-0.0004	-0.0005*
	(8.93e-05)	(8.93e-05)	(0.0003)	(0.0003)
Eduction level	-0.004	-0.005	-0.004	-0.004
	(0.006)	(0.006)	(0.02)	(0.02)
Single	0.02	0.02	0.03	0.03
	(0.02)	(0.02)	(0.07)	(0.08)
Constant	-0.72***	-0.61***	-0.50	-0.40
	(0.21)	(0.21)	(0.39)	(0.40)
Fixed effect	Yes	Yes	Yes	Yes
Observations	6,031	5,991	2,200	2,191
R-squared	0.011	0.009	0.027	0.023
Number of pid	1,847	1,842	1,444	1,439

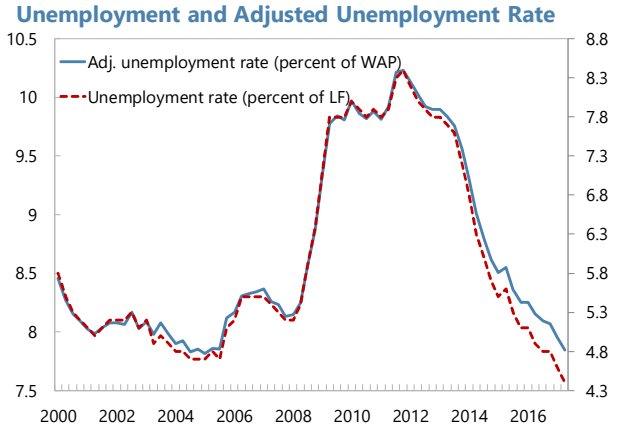
Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6. This chapter considers three alternative measures of labor market slack:

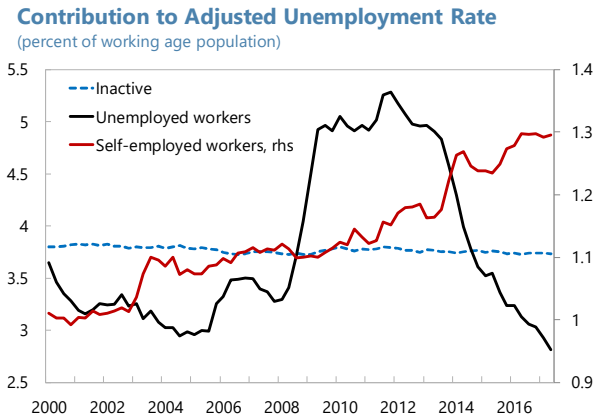
- **Headline unemployment rate.** This is the most commonly used measure of labor market slack in the literature.
- **An adjusted unemployment rate, capturing the fact that some self-employed individuals and people outside the labor force seek regular employment.** In the spirit of Kudlyak and Lange (2014), the adjusted unemployment rate is calculated as the weighted average of the unemployed, inactive, and self-employed. The weighs are calculated as the average probability of finding a regular job between 2005 and 2017 for each group.[4] On average, 3 percent of self-employed workers have taken a regular job each quarter, compared to 22 percent of those unemployed. The adjusted unemployment rate broadly tracks headline unemployment, but has diverged more recently as the share of self-employed workers has increased. In the regressions, we use alternatively the underemployment rate or the underemployment gap – the difference between the actual rate and a time-varying equilibrium underemployment rate (estimated by a

[4] The period is selected based on data availability.

Kalman filter). There is evidence that the equilibrium unemployment rate has declined over time due to rising educational attainment in the labor force, and tax and benefit reforms that have changed incentives to move from unemployment to employment (Saunders 2017).



Sources: Fund staff calculations.



Sources: ONS and fund staff calculations.

- **The hiring rate** is defined as those finding new jobs every period (existing workers, inactive, or unemployed) over total employment. Wage negotiations occur when a worker finds a new job and as the hiring rate improves, wage pressures may increase.

- **Involuntary part-time employment** as a share of the labor force is added as a separate variable to the wage regressions to compliment the above measures of labor market slack.

D. Empirical Strategy and Data

7. This chapter uses an error-correction model (ECM) for wage dynamics. Theory suggests that, over the long run, labor compensation will move in line with labor productivity, thus we assume that the long-run real wage (w_t^R) is determined by labor productivity (LP_t), similar to Blanchard and Katz (1999):[5]

$$w_t^R = \alpha_{LR,1} + \beta_{LR,1} LP_t + \varepsilon_{LR,t} = w_t^* + \varepsilon_{LR,t} \quad (1)$$

8. In the short run, nominal wages may temporarily deviate from productivity, driven by labor market developments and other factors. The short term nominal wage dynamics equation includes the lagged error term from the long run equation, measures of labor market slack ($slack_t$), lags of inflation expectations ($\pi_{t_{t-i}}^E$), lagged productivity growth (ΔLP_{t-i}), and other factors (X_{t-i}) including growth uncertainty and EU labor market conditions.

$$\Delta w_t^N = \alpha_{SR,1} + \omega_1 (w_{t-1}^R - w_{t-1}^*) + \beta_{SR,1} slack_t + \beta_{SR,2} \Delta LP_{t-i} + \beta_{SR,3} \pi_{t_{t-i}}^E + \beta_{SR,4} X_{t-i} + \varepsilon_{SR,t} \quad (2)$$

[5] Labor compensation is highly correlated with wages over time.

9. Table 1 provides summary statistics for the key variables. There are several different measures for wages.[6] This chapter uses average weekly earnings from the Office of National Statistics, since they exclude earnings of the self-employed (which may be driven by factors other than regular wages). The nominal wage is deflated by GDP deflator to get the real wage. Labor productivity is defined as real Gross Value Added (GVA) per worker. Table 2 shows that real wages and productivity are non-stationary, but their first differences are stationary.

Table 1. United Kingdom: Summary Statistics for Selected Indicators

	Obs	Mean	Max	Min	Std. Dev
Nominal wage (yoy change)	66	0.03	0.05	0.00	0.01
Labor productivity (yoy change)	66	0.01	0.04	-0.05	0.02
Unemployment rate	70	0.06	0.01	0.04	0.08
Adj. unemployment rate (percent)	70	0.09	0.01	0.08	0.10
Adj. unemployment rate gap (ppt)	70	0.00	0.01	-0.01	0.02
Hiring rate (percent)	63	0.06	0.00	0.04	0.06
Share of involuntary PT workers	70	0.03	0.01	0.02	0.05
Inflation expectations 1/	70	0.03	0.00	0.00	0.04
EU unemployment gap	70	0.33	0.98	-1.80	2.18
Growth uncertainty 2/	70	0.50	0.16	0.25	0.94

1/ 5-year ahead inflation expectation derived from government securities.
2/ Standard deviation of one-year ahead growth forecast from consensus.
Sources: Haver, Eurostat, Consensus Forecast, and fund staff calculations.

Table 2. United Kingdom: Unit Root Tests

Variable	ADF		Phillips-Perron		
Testing Levels	t-ADF	0.05	Adj t-stat	0.05	Characteristics
Real product wage	-2.630	-3.476	-2.624	-3.476	Trend and intercept
Productivity (MA,8q)	-2.473	-3.478	-1.996	-3.477	Trend and intercept
Testing first differences					
Real product wage	-7.635	-2.909	-7.780	-2.905	Intercept
Productivity (MA,8q)	-1.825	-1.946	-1.989	-1.946	no intercept

The null hypothesis for the ADF and PP tests is non-stationary.

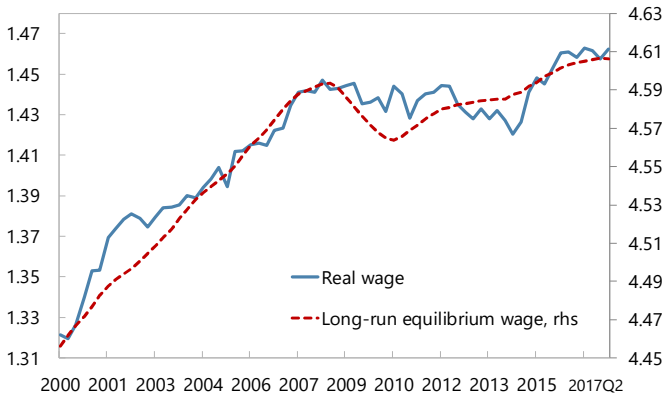
[6] Other wage measures include labor cost index from Eurostat, wage and salaries from National Accounts, labor compensation from gross domestic product.

10. Error correction models are estimated using quarterly data over the period 2000Q1–2017Q2. The sample is constrained by the fact that weekly earnings data are only available since 2000. The long run wage equation is estimated by fully modified least squares and the results are presented in Table 3. A general-to-specific approach is adopted for the short run equation.

E. Empirical Findings

11. As expected, the estimated coefficient on productivity in the long run equation is close to one, suggesting a tight relationship between predicted versus actual real wage growth (see text chart). It is interesting to note that real wages did not fall significantly during the crisis, suggesting some downward wage rigidity. However, wage growth slowed, and by 2013 real wages started to lag productivity. As of 2017Q2, real wage was broadly in line with the estimated long run equilibrium value.

Real Wage and Estimated Long-Run Equilibrium
(Log points)



Sources: ONS and Fund staff calculations.

Table 3. United Kingdom: LR Cointegration Relationship: Real Wage

Variables	*p*	
Labor productivity trend	0.86	
	(0.06)***	
Constant	-2.50	
	(0.29)***	
Observations	70	
Adjusted R-squared	0.93	
S.E. of regression	0.01	
Cointegration Tests		
	Engle-Granger	Phillips-Ouliaris
tau-statistic	-3.09	-3.08
Probability	0.10	0.11
z-statistic	-16.38	-15.95
Probability	0.09	0.10
	Hansen Instability	
Lc statistics	0.07	
Probability	>0.2	

12. The results from the second equation suggest that labor market slack is a significant determinant wage growth in the short run. All different measures of labor market slack are significant and have the expected sign. The results suggest that a one percent increase in underemployment (measured by the adjusted unemployment rate, the adjusted unemployment gap, or the hiring rate) reduces wage growth by about 0.35 percent. However, to fully account for domestic labor market slack, one also needs to consider the share of involuntary part-time workers, where one percentage point increase reduces wage growth by about 0.3 percent. Moreover, labor market slack in the EU has a statistically significant impact on wage growth.[7] Increased uncertainty about future economic growth is found to depress wage growth, which could account for the weak wage growth since the referendum. As expected, the coefficient on the error correction term is negative and significant, suggesting a correction toward equilibrium over time.

Table 4. United Kingdom: Private Sector Average Weekly Regular Pay Growth

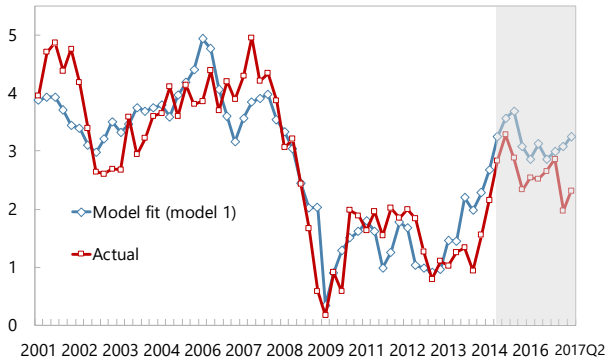
	(1)	(2)	(3)	(4)
ecm (t-4)	-0.25***	-0.21***	-0.20***	-0.22***
	(0.09)	(0.07)	(0.07)	(0.07)
Headline unemployment (t-4)	-0.59***			
	(0.06)			
Adj. unemployment rate (t-4)		-0.37***		
		(0.13)		
Adj. unemployment rate gap (t-4)			-0.32**	
			(0.13)	
Hiring rate (t-4)				0.46**
				(0.18)
Involuntary part time employment (t-4)		-0.28**	-0.34***	-0.29**
		(0.11)	(0.11)	(0.11)
Inflation expectation (t-4)	0.66***	0.34**	0.34**	0.36**
	(0.18)	(0.14)	(0.15)	(0.16)
Productivity growth (t-1)	0.28***	0.21***	0.23***	0.21***
	(0.05)	(0.04)	(0.04)	(0.04)
EU unemployment gap (t)		-0.44***	-0.43***	-0.54***
		(0.10)	(0.10)	(0.09)
Growth uncertainty (t-2)		-2.43***	-2.41***	-2.02***
		(0.47)	(0.49)	(0.60)
Constant	0.04***	0.07***	0.04***	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	66	66	66	59
R-squared	0.78	0.89	0.89	0.88

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[7] This finding in consistent with results in Chapter 2 of the 2017 April WEO, which notes significant cross-border spillovers of labor market conditions.

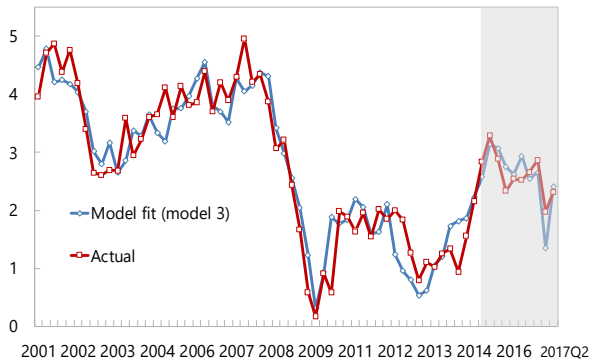
13. In-sample forecast points to the importance of controlling for wage drivers beyond headline unemployment. The figures below compare the in-sample forecast performance of models 1 and 3 from Table 4.[8] The forecast performance improves significantly when controlling for the share of involuntary part-time workers and other factors (model 1 consistently overpredicts wage growth). Thus, in the rest of the paper, the discussions are based on results from model 3.

In-sample Projection of Nominal Wage Growth
(yoy percent change)



Sources: Fund staff calculation.

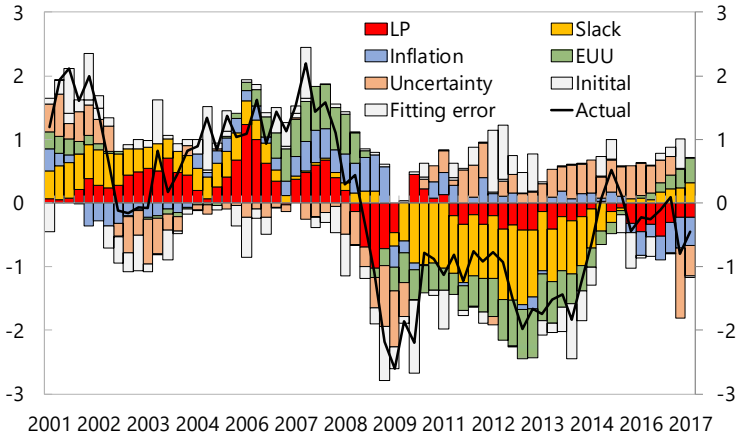
In-sample Projection of Nominal Wage Growth
(yoy percent change)



Sources: Fund staff calculation.

14. Historical decomposition suggests labor productivity and labor market slack (in the UK and the EU) are the most important drivers of wage growth, explaining well the slowdown in nominal wage growth post-crisis. The text figure below shows the contribution of different factors to wage growth (in deviations from the sample average). Low productivity growth (LP) and weak labor market conditions (slack) contributed significantly to the slowdown in wages since the financial crisis. In addition, uncertainty about future economic growth appear to have weighed on wage growth during the crisis, as well as in recent quarters (while optimism about growth prospects supported wages during the period of steady recovery 2011–16). Low inflation in 2015–16 also

Contribution to Nominal Wage Growth
(percentage points, deviation from mean)



Sources: Fund staff calculations.

[8] Comparison with other models is available upon request.

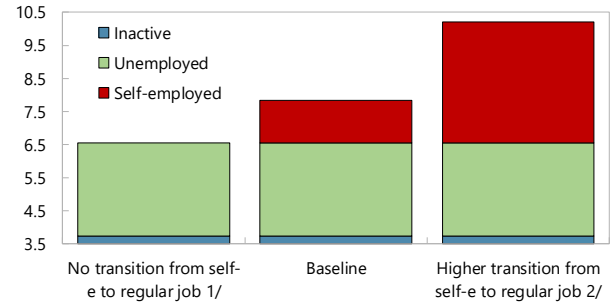
played a role in depressing wages during 2016–17. More recently, slack in the labor market has diminished, providing a modest boost to wages (although the effects have been offset by greater uncertainty and weak lagged inflation).

F. Wage Outlook

15. Looking ahead, nominal wage growth should strengthen, reflecting improvements in labor markets. In the baseline, labor markets are expected remain relatively tight, with the unemployment rate slightly below the estimated equilibrium level and the share of involuntary part-time workers dropping to pre-crisis levels. This would help raise wages temporarily above the level implied by productivity growth. Growth uncertainty (which has surged after the Brexit vote) is assumed to dissipate once a broad agreement on the shape of the future economic relationship with the EU is reached. In addition, the baseline projection assumes that inflation expectations and the EU labor market gap remain unchanged at their 2017Q2 level, and productivity growth recovers to about 1 percent in the medium term. Under these assumptions, annual nominal wage growth is expected to pick up from 2¼ percent in 2017Q2 to between 2¾ and 3 percent in 2018.

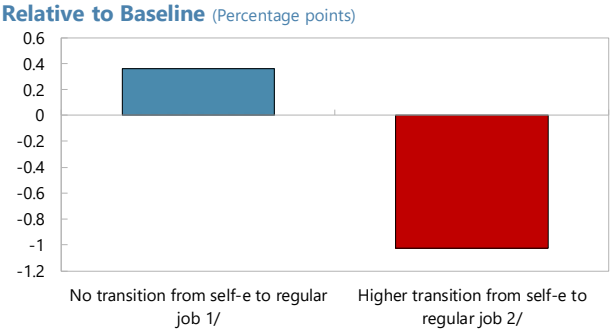
16. However, this baseline projection is subject to significant risks. On the upside, a greater share of self-employed workers could start seeking regular jobs. We have already seen an increase in the rate at which the self-employed move to regular employment (to 3.5 percent in 2017 from 3 percent average post-crisis). If the rate doubles to 6 percent, wage growth could be lower by about 1 percentage point due to a larger pool of labor competing for vacancies. In addition, uncertainty about the rate of future growth may remain elevated for some time, even after the UK leaves the European Union. Ultimately, the main determinant of wage growth would be productivity growth – if it fails to pick up as projected, wage growth would remain weak.

Adjusted Unemployment Rate under Different Scenarios
(percent of working age population)



Sources: Fund staff calculations.
1/ Assume transition of self-employed workers to regular employment is 0.
2/ Assume self-employed workers are 60 percent less likely to become regular employed compared with unemployed workers.

Nominal Wage Growth under Different Scenarios Relative to Baseline (Percentage points)



Sources: Fund staff calculations.
1/ Assume transition of self-employed workers to regular employment is 0.
2/ Assume self-employed workers are 60 percent less likely to become regular employed compared with unemployed workers.

G. Conclusions

17. Recent labor market developments in the UK appear to point to a disconnect between unemployment and wages. While the unemployment rate has fallen to a 40-year low, wage growth

continues to growth at a subdued pace. The analysis in this paper suggests that this puzzle is explained by persistent weak productivity growth and well-anchored inflation expectations, as well as by greater effective labor market slack than suggested by the headline unemployment rate. Broader measures of underemployment—accounting for involuntary part-time unemployment, inactive and self-employed people seeking regular jobs—suggest that slack in the labor market was higher than implied by the unemployment rate in recent years. Models using these broader measures capture well the observed wage dynamics.

18. Persistent tightness of the labor market should prompt some firming of wage growth in the coming year, everything else equal. A mild increase in unit labor costs would help bring domestically generated inflation in line with the inflation target. Of course, the actual outcome for wage growth would also depend on the extent to which Brexit-related uncertainty dissipates, so firms can more easily make long-term decisions. More generally, wage growth will recover in a sustainable way only once productivity growth recovers.

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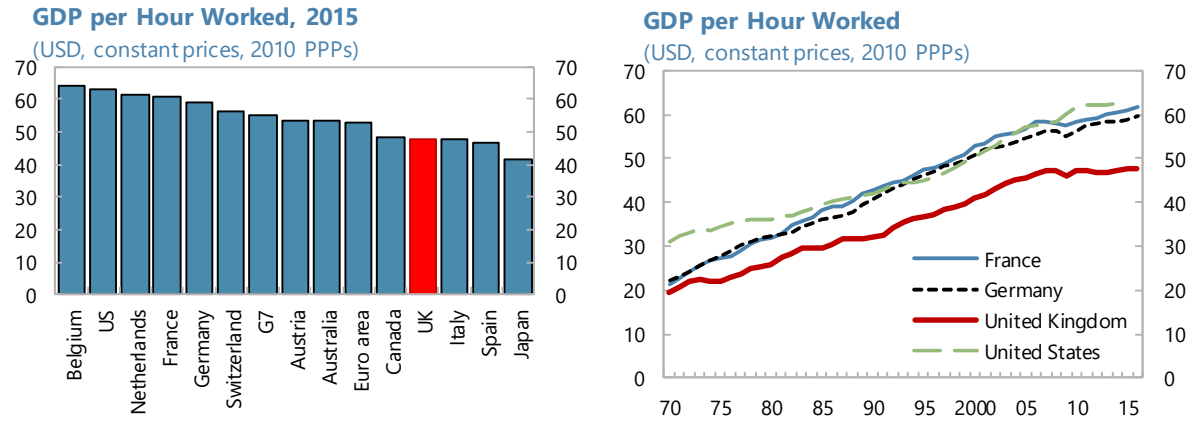
REGIONAL DISPARITIES IN LABOR PRODUCTIVITY IN THE UNITED KINGDOM[1]

A. Introduction

1. Labor productivity in the United Kingdom is low relative to that in peer economies. In 2015, GDP per hour worked was between 20 and 25 percent lower than in France, Germany and the United States (Figure 1). While productivity underperformance is not new, it has worsened over the last decade. UK productivity growth has declined from 2.1 percent during 2000–07 to 0.5 percent during 2010–16, which is very low even in the context of subdued global productivity.

Figure 1. National Labor Productivity



Source: OECD and IMF staff calculations.

2. Moreover, there are large and long-standing disparities in labor productivity across UK regions (Figure 2)**.**

- Only two regions at the NUTS 1 level show productivity levels above the country average.[2] This means that 70 percent of employment is in regions with productivity levels below average. The UK's highest productivity region (London) is nearly 60 percent more productive than its lowest. The productivity gap within each region is greater than between regions, so regional disparities are even larger at higher levels of territorial disaggregation (such as at the NUTS 3 level).

- From a cross-country perspective, regional disparities are large compared to other advanced economies. The story is two-fold: London's economic performance contributes to national

[1] Prepared by Nicolas Arregui and Lucyna Gornicka (both EUR).

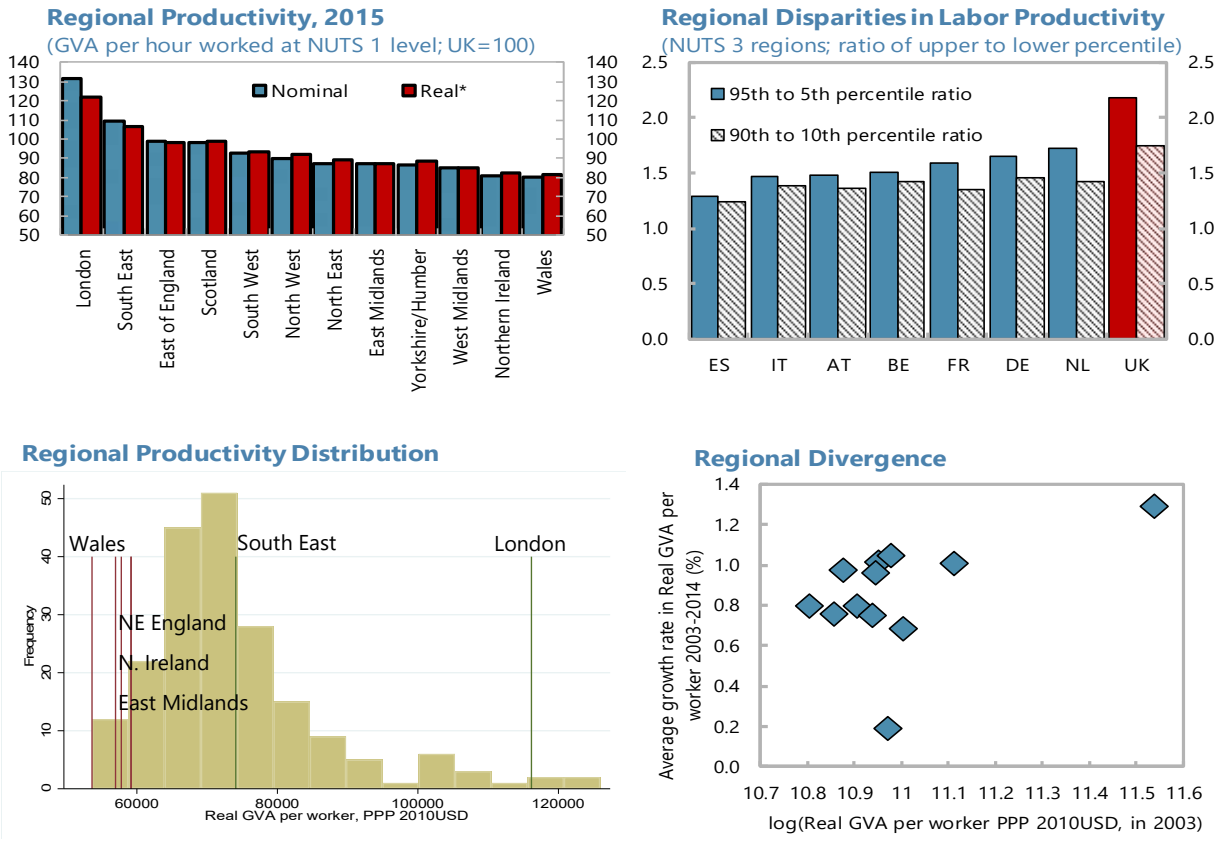
[2] The European Union Nomenclature of Territorial UNITS (NUTS) classification is used in this analysis.

averages that disguise the weakness in other regions. Indeed, UK low productivity regions underperform the least productive regions in other advanced economies.

- Regional discrepancies in the UK are long-standing and have not shown signs of convergence over the last decade.[3]

- Wealthier regions have higher productivity across most industry sectors (Annex I), suggesting that their comparative advantage is not due to a particular type of economic activity but rather to other, cross-cutting regional characteristics.

Figure 2. Regional Labor Productivity



Sources: Eurostat Regional Statistics, OECD, ONS, and IMF staff calculations.

Note: In chart 1, real productivity is estimated by deflating nominal levels by the latest available regional price indexes (2010) computed by ONS. Charts 2 to 4 compute labor productivity as GVA per worker instead of hours. The underlying distribution in chart 3 includes OECD TL2 regions for Austria, Australia, Belgium, Canada, Germany, Denmark, Spain, Finland, France, Italy, Japan, Luxembourg, Netherlands, Sweden, United Kingdom and United States (excluding District of Columbia). Productivity levels reported in Eurostat may overstate productivity differences at the NUTS 3 level in the UK, as hours worked are based on place of reference rather than of work. Still, using ONS reported data in chart 2 does not alter the UK's position relative to other countries.

[3] The persistence in regional disparities implies that these are unlikely the reason behind the ¨productivity puzzle¨ (i.e. the flattening in productivity growth in recent years).

3. Reducing regional disparities by boosting labor productivity in underperforming regions would promote faster and more inclusive growth. Interregional differences in productivity are related to differences in well-being and inclusion. For instance, UK regions with low productivity tend to have a larger share of young population that is neither employed, in training or in education. At the same time, disparities may signal untapped potential for catching up, and if addressed may contribute to overall growth. The potential benefits of addressing regional disparities have long been recognized by UK authorities, and all recent major party manifestos promised action to reduce them.[4] Policies should be judged based on their impact on growth and inclusion, rather than whether they narrow the gap between particular regions.[5] The challenge for the government is to help address failures or frictions underpinning regional disparities, allowing those less successful regions to build the conditions for economic success, while not cutting off the ability of leading regions to play their role.

4. This note takes stock of multiple (and interrelated) channels potentially underlying regional disparities and discusses policy implications. The analysis is focused on six factors: human capital, investment, innovation, agglomeration effects, international competition, and the role of the government. Main findings suggest:

- Strengthening education and training is likely to play an important role in helping address regional disparities in productivity.
- High housing prices and regulatory constraints have an impact on internal migration, possibly reducing its effectiveness as a regional convergence mechanism.
- While aggregate public investment in the UK has traditionally been below that of its peers, limited available evidence does not suggest that investment in physical capital and SME access to finance are particularly worse in underperforming regions.
- Investment in research and development (R&D) in the UK lags behind that of its peers and is uneven across the country's regions. Improving the ability of underperforming UK regions and localities to adopt innovations is likely to be crucial in enabling them to catch up.
- Agglomeration effects play a significant role in explaining regional disparities in the UK. Major infrastructure projects like the Northern Powerhouse Rail and the Midlands Rail Hub are aimed at increasing connectivity to achieve agglomeration effects in areas outside London and the South East.
- Foreign direct investment and exposure to international competition can play an important role in stimulating regional economic performance. The productivity benefits that external-facing

[4] "Improving the economic performance of every country and region of the UK is an essential element of [the Government's] objective, firstly for reasons of equity, but also because unfulfilled economic potential in every region must be released to meet the overall challenge of increasing the UK's long-term growth rate." (HMT 2001).

[5] "It is helpful to remember that we ultimately care about the effect of policies on people more than on places." (Overman 2015).

firms bring highlight the importance of openness to trade and foreign direct investment for raising productivity.

- Decentralization of governance arrangements could improve the responsiveness of policy to local economic conditions.

B. Understanding Regional Disparities

5. Regional disparities in productivity may signal a potential for catching up, a development that, if realized, would favor growth and inclusion. Differences in productivity levels across regions within countries may be the result of geographic conditions, agglomeration forces, and other factors. Therefore, one cannot expect the gaps to entirely close over time. However, a productivity gap across regions may also be the result of frictions and externalities, leaving a role for policies to promote convergence.

- Neoclassical growth theories predict regional convergence if economic markets function well and factors of production and technology are mobile.[6] Regional disparities can therefore result for various reasons. First, frictions in labor mobility and access to finance may limit the standard convergence mechanisms. Indeed, recent cross-country studies have found that significant barriers to factor mobility within countries are required to make sense of the observed levels of regional disparities (see, for instance, Gennaioli et al. 2014). Second, the adoption of technological innovation and best practices is not automatic.[7] Evidence suggests that diffusion processes require certain proximity between regions, such as proximity in geography, technology, or in skills endowments. Finally, an uneven provision of public goods, such as physical infrastructure or education, may also underpin regional disparities.[8]

- Productivity in urban areas benefits from agglomeration economies. Workers and firms in larger cities tend to be more productive. This is partly due to the greater share of highly-skilled and educated workers in larger cities, but in part it also reflects "agglomeration economies" that arise from living and working in large cities (Ciccone 2002, Ahrend et al. 2014). Three forces create agglomeration economies (Duranton and Puga 2004). First, by locating in close proximity, firms can share suppliers, thereby allowing them to specialize and through that specialization become more productive. Second, large cities are home to a variety of workers and firms, which creates more opportunities for workers to find the ideal job and for firms to find the "best-matching" – most productive – employee for a job. Third, informal interaction and learning from

[6] Importantly, the more recent endogenous economic growth theories in which long run growth depends on the creation of technological knowledge do not predict convergence across regions with different starting positions.

[7] See, for instance, Keller (2000), and Girma and Wakelin (2000).

[8] Other potential factors include the differential regional impact of successive structural shocks, such as via trade or technology.

others is facilitated by proximity. This creates knowledge spillovers and therefore better diffusion of ideas and technologies.

Human Capital and Education

6. There is scope to improve educational outcomes and increase human capital in the UK. Human capital is a key determinant of economic growth.[9] Skilled labor is likely to be more productive, and regions with easier access to skilled workers may attract technologically more advanced, productive businesses. On aggregate, adults in the UK have lower literacy and numeracy skills than the OECD average and the proportion of younger people in England with low skills is higher than the proportion among people nearing retirement age.[10] The share of those aged 15–19 that are enrolled in education is below the OECD average.

7. Large variations in the skills composition of the local workforce across UK regions correlate strongly with regional disparities in labor productivity (Figure 3). Studies using regional and firm level data suggest that workforce skills are significantly related to productivity levels.[11] The Manchester Independent Economic Review (2009) found that regional disparities in skills were the key factors explaining productivity differences. In turn, the skills level of the workforce in a region depends on both the production of skills in that region through education and training, and the movement of workers in and out of the region (i.e. the so-called sorting effect).

- **Participation.** Early-age education participation is high and homogeneous across UK regions.[12] However, regional differences in participation become more pronounced at more advanced levels of education. For instance, participation in education for students aged 17 in Wales is remarkably lower than for other regions.

- **Quality.** Comparing the quality of education across UK regions is difficult due to limited comparable data.[13] PISA scores for Wales are below UK and OECD averages. Indeed, this is a long-standing issue, as it is the fourth consecutive set of PISA results in which Welsh students have performed worse than the UK average. Within England, the Ofsted's annual report (2016) has cautioned that some areas are being left behind. A larger share of secondary schools is

[9] See, for instance, Mankiw, Romer and Weil (1992), Benhabib and Spiegel (1994), Aghion and Howitt (1998), Temple (2000), and Bassanini and Scarpetta (2001).

[10] See OECD (2017). For instance, in the OECD Survey of Adult Skills, England and Northern Ireland have some of the highest proportions of adults scoring at or below the two lowest scores (out of six) in numeracy.

[11] See, for instance, Rice et al (2006) and Webber et al (2009).

[12] The percentage of four-year-olds in early childhood and primary education in the UK is one of the highest among OECD countries (OECD EAG 2016)

[13] McNally (2015) suggests that, due to the regional differences in how GCSEs are taught, it is more informative to use international tests when making regional comparisons than the often-used measure of "percentage of pupils attaining five or more GCSEs at grades A*-C (including English and math)."

assessed to be "less than good" in the North and Midlands, compared with a relatively lower number in the South and East of England.[14]

- **Sorting.** Regional differences in local workforce skills may be exacerbated if high productivity regions attract a larger share of high-skilled labor from other regions. Six months after graduation, London employs 22 percent of all working new university graduates, given its ability to retain students and attract graduates from other regions (including those who grew up in London but studied elsewhere). London's appeal is even greater for high achievers (Swinney and Williams, 2016). D'Costa and Overman (2014) find that sorting effects account for a considerable fraction of the observed spatial differences in wages.[15]

8. Strengthening education and training may therefore play an important role in helping address regional disparities in productivity.[16]

- **Basic skills.** Webber et al. (2009) suggest that the key problem in terms of productivity relates to areas with high concentrations of workers lacking basic skills. Along this line, the MIER (2009) has stressed the need to improve skills across the board, as the whole labor force contributes to the productivity of the most highly skilled. The effectiveness of recent government initiatives to improve basic skills will need to be kept under review to assess the need for further action. For instance, for under 16s, the national curriculum and GSCEs have been reformed to provide better assurance of core literacy and numeracy than previous standards. Since 2013 math and English study programs are provided to all 16 to 19-year-old students who have not, by the age of 16, achieved at least minimum grade in these subjects.

- **Technical skills.** The UK has a shortage of technical-level skills, ranking 16th out of 20 OECD countries for the proportion with technical qualifications (HM Government Industrial Strategy Green Paper, 2017). Government initiatives to promote technical and vocational education (such as the introduction of T-level technical qualifications) could be particularly beneficial for young people who do not attend university, who are generally more prevalent in low productivity regions. The expansion in vocational training will require continuous monitoring to ensure good quality.

- **Teacher shortages.** The government has missed its recruitment targets for the last four years and indicators suggest teacher shortages are growing at the national level (NAO 2016). The NAO report calls out the Department for Education (DfE) for not paying enough attention to local and regional recruitment issues: "*The Department has a weak understanding of the extent of local teacher supply shortages and whether they are being resolved locally.*" Indeed, evidence

[14] The picture is much more homogeneous for primary schools.

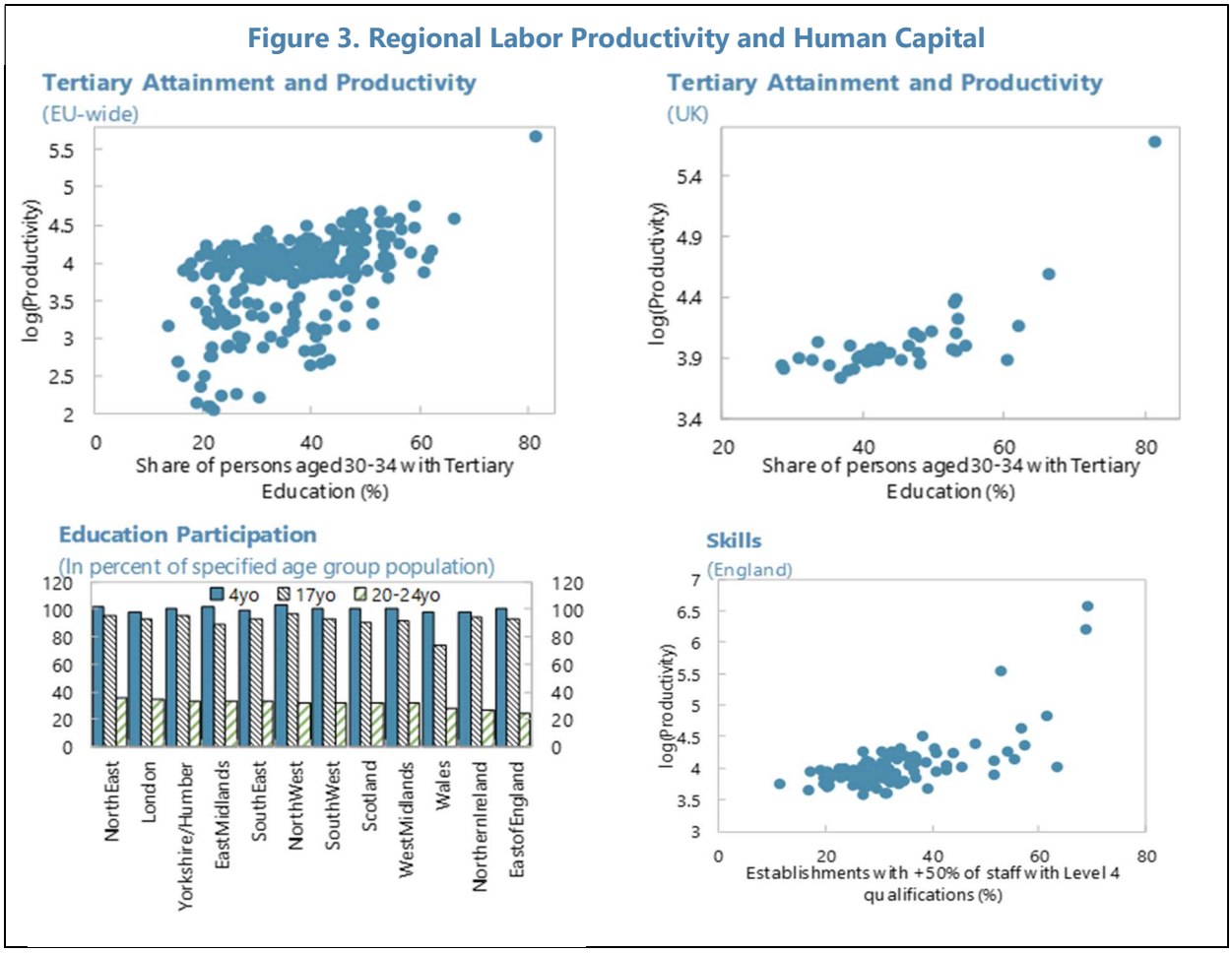
[15] Taking a different view, McCann (2016) argues that small differences in the quality of interregional migrants across regions prove that sorting cannot explain the interregional inequalities observed in the UK. However, he only studies the quality of cross-regional migrants with a graduate degree, while not looking at other groups of migrants.

[16] Expanding the pool of skilled labor to which a region has access may require a wide range of policies including housing and transport, as discussed in the following sections.

suggests that underperforming schools in disadvantaged areas find it hard to attract high-quality teachers (NAO 2016, and LSE Growth Commission 2017). [17]

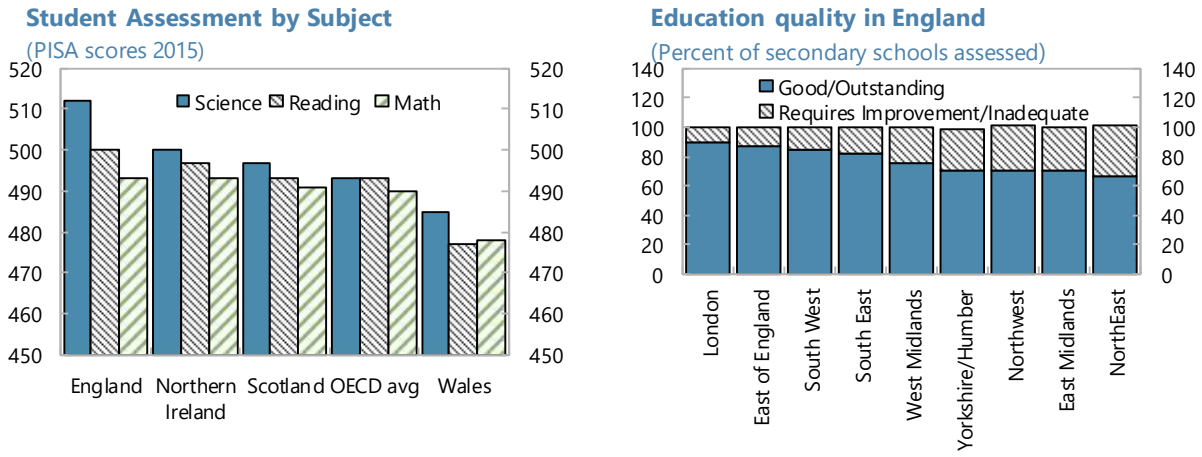
- **Continued reform in Wales.** In 2011, Wales embarked on a large-scale school improvement reform to improve students' performance in literacy and numeracy, and to reduce the impact of deprivation on student performance. A review of the school system conducted by the OECD in 2014 recommended a number of priority steps: (i) promoting the use of differentiated (more personalized) teaching, simplifying the use of targeted funding for students, and investing in support staff; (ii) raising the status of the teaching profession, improving initial teacher training, and treating developing systemic leadership as a prime driver of education report; (iii) creating a coherent assessment and evaluation framework; and (iv) defining and implementing policy with a long-term perspective. A more recent stock-taking evaluation by OECD (2017) noted that progress has been made in certain policy areas, including a shift in the approach to school improvement to one with a long-term vision. The report calls for sustaining the commitment, deepening investments in key policy areas, and strengthening the implementation process.

Figure 3. Regional Labor Productivity and Human Capital



[17] The report recognizes that government has launched initiatives such as National Teaching Service to help improve certain underperforming schools. However, it also highlights the fact that the DfE's teacher supply model is not being used to estimate the need for teachers at a local or regional level, leaving the school system to sort out the gaps.

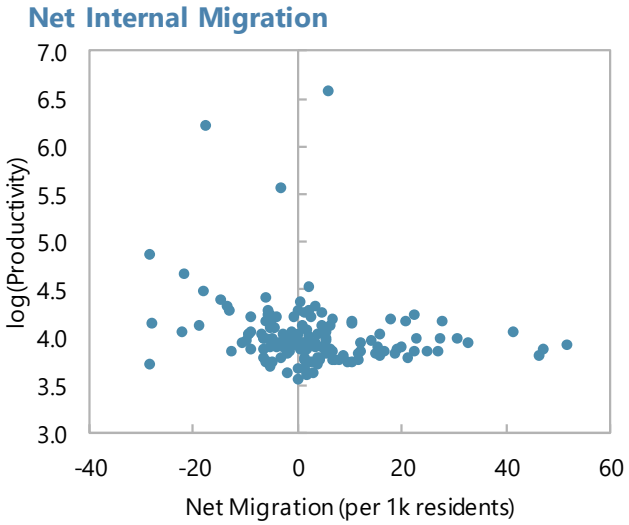
Figure 3. Regional Labor Productivity and Human Capital (concluded)



Sources: Eurostat Regional Statistics, OECD, Oftsed Annual Report (2016), ONS, UKCES Employer Skills Survey (2015). and IMF staff calculations. Note: Charts 1 and 2 are constructed at the NUTS 2 level. UKCES Employer Skills Survey data used in Chart 4 cover England only. Data is available at the local education authorities (LEA) level. Mapping into NUTS 3 regions is straightforward for most (but not all) cases. Some LEAs map into NUTS 2 regions: Cumbria, Devon, Essex, Kent, Lancashire, and North Yorkshire. The following LEAs are not included as the mapping into NUTS regions was not clear: West Sussex, Nottinghamshire, Norfolk, Northamptonshire, Hampshire, Surrey, Derbyshire, Wokingham, West Berkshire, Windsor and Maidenhead, Reading, Bracknell Forest, and Slough.

Labor Mobility and the Role of Housing Prices

9. Barriers to labor mobility may reduce its effectiveness as a regional adjustment mechanism. Migration of workers from poor, low-productivity areas to rich and highly productive ones is an important channel through which cross-region convergence may be achieved. Factors distorting internal labor flows are potentially relevant determinants of regional disparities in income and productivity. Indeed, the pattern of internal flows for England and Wales shows that highly productive regions tend to have net outflows instead of inflows.[18] This suggests that factors other than labor market conditions (i.e. productivity



Sources: ONS, and IMF staff calculations.

[18] Also, over time, regional mobility has been declining at the same time differences in productivity between regions have increased (Resolution Foundation 2017).

differentials) are likely significant determinants of internal migration patterns in the UK.[19, 20]

10. Housing prices (and regulations) have a significant impact on internal migration patterns in the UK. Analysis of bilateral gross flows between regions in England and Wales shows that house prices are negatively related to workers' movement from one region to another (Box 1). Results are in line with Biswas et al. (2009), who study inter-regional migration in England, Wales, Scotland and Northern Ireland, and Rabe and Taylor (2010), who analyze internal migration flows using household-level data for 11 regions in the UK. In turn, Hilber and Vermeulen (2015) show that housing prices are significantly (causally) affected by housing regulations.[21] The impact is economically large: if the South East (the most regulated English region) had the regulatory restrictiveness of the North East, house prices in the South East would have been roughly 25 percent lower in 2008.[22]

11. Evidence also suggests that local housing regulatory constraints have affected income convergence across regions. Data on local housing regulatory restrictions for 46 English counties is used to test whether housing restrictions have affected interregional convergence in the UK. The specification, following Ganong and Shoag (2015), models the change in workers' real earnings between 1979 and 2008 as a function of its starting level in 1979, a measure of severity of housing restrictions in the same period from Hilber and Vermeulen (2015), and an interaction term of the two variables (Table 1).[23] The coefficient on the starting level of earnings is significant and negative, suggesting income convergence between counties with low initial earnings and counties with a high starting level of earnings. The interaction term of earnings and housing regulations is highly significant and positive, indicating a dampening effect of tighter housing regulations on the speed of convergence across counties. To the extent that earnings are correlated with productivity, housing restrictions have likely contributed to differences in productivity across regions as well.

12. Policy measures to promote housing supply may therefore have a positive impact on labor mobility and growth. Regulatory constraints tend to be higher and more binding in more

[19] Additionally, migration flows data shows that skilled workers have a higher propensity to move than low-skilled workers, who are very unlikely to move between regions. Areas with higher unemployment may be within travelling distance of labor markets with high levels of vacancies (HMT 2000). Market failures in workers' skills acquisition may therefore have consequences for labor mobility, highlighting that education and training policies may have important follow-on effects.

[20] High net internal outflows in London may also be indicative of international migrants arriving in London before moving elsewhere.

[21] In particular, local regulatory constraints are found to increase the elasticity of house prices to changes in local earnings.

[22] The paper disentangles the impact of housing regulations from the effect of local scarcity of developable land, which is found to be important in highly-urbanized areas only.

[23] Ganong and Shoag (2015) show that, in the US, increasingly strict housing restrictions and rising house prices in highly productive areas have worked as a barrier to interregional migration of low-skilled workers and have slowed regional income convergence. Hsieh and Moretti (2017) find that the resulting labor misallocation had a considerable negative effect on US GDP.

developed and productive areas (see Hilber and Robert-Nicoud 2013). Evidence from the US suggests that lowering regulatory constraints in the more productive cities would favor a more efficient allocation of labor and have an economically significant effect on growth (Hsieh and Moretti 2017). Efforts should continue to further boost housing supply, including by easing planning restrictions, mobilizing unused publicly-owned lands for construction, and providing incentives for local authorities to facilitate residential development (Hilber 2015, IMF 2016, and OECD 2017).[24]

Box 1. United Kingdom: Internal Migration Flows Determinants

Migration decisions are likely to be affected by labor and housing market conditions, among other factors. On one hand, strong labor market conditions, as exemplified by low unemployment rates, should draw migrants into regions. On the other hand, expensive housing can discourage movement into a region (or encourage outflows). Additionally, other things equal, people are expected to move closer to their original location for several reasons, such as proximity to friends and family, and lower relocation costs.

The empirical analysis focuses on bilateral (gross) migration flows between regions of England and Wales at the NUTS 3 level. In particular, the following specification is estimated using a Tobit model:

$$\frac{Mig_{ij}}{Pop_i} = \alpha + \beta_1 \log\left(\frac{HP_i}{HP_j}\right) + \beta_2 \log\left(\frac{U_i}{U_j}\right) + \beta_3 Distance_{ij} + e_{ij}$$

where migration flows from region i to j are scaled by population at the region of origin i, and Prod, HP, and U denote productivity levels, housing prices (or house-price-to-earnings), and unemployment rates, respectively. In line with the description above, theory predicts a negative beta 3, and positive beta 1 and 2. The model is estimated for adults above 30 years old, as migration decisions are expected to be less driven by education destinations, and housing decisions presumably become more relevant at a later stage in life. The baseline specification uses robust standard errors.

The estimation provides evidence that migrants are drawn by strong labor markets and discouraged by high house prices and distance. Results are generally robust to clustering standard errors by region of origin, expanding the group of adults from 30 to 59 years old, and excluding regions with productivity level or housing prices at the 5 percent tails.

[24] Recent budgets commit additional (and increasing) spending to accelerate new housing supply over the coming years. This includes the creation of a Housing Infrastructure Fund to finance infrastructure targeted at unlocking new private house building in the areas where housing need is greatest. Funds are allocated to local government on a competitive basis. A Housing White Paper published earlier this year explores additional reforms to increase housing supply.

Box 1. United Kingdom: Internal Migration Flows Determinants (concluded)

	(1) Age30-49	(2) Age30-49	(3) Age30-49	(4) Age30-49	(5) Age30-49	(6) Age30-49	(7) Age30-49	(8) Age30-49
Distance	-0.0029***	-0.0029***	-0.0029***	-0.0029***	-0.0029***	-0.0029***	-0.0029***	-0.0029***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Spread in House Prices	0.0354***		0.0375***		0.0354**		0.0375**	
	(0.000)		(0.000)		(0.036)		(0.025)	
Spread in Unemployment Rates	0.0878***	0.0895***			0.0878***	0.0895***		
	(0.000)	(0.000)			(0.000)	(0.000)		
Spread in House Price to Earnings		0.0373***		0.0408***		0.0373		0.0408*
		(0.001)		(0.000)		(0.105)		(0.075)
Unemployment at Destination			-0.0154***	-0.0158***			-0.0154***	-0.0158***
			(0.000)	(0.000)			(0.003)	(0.004)
Unemployment at Origination			0.0147***	0.0151***			0.0147**	0.0151**
			(0.000)	(0.000)			(0.022)	(0.019)
Constant	0.9932***	0.9932***	0.9973***	0.9974***	0.9932***	0.9932***	0.9973***	0.9974***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	20,784	20,784	20,784	20,784	20,784	20,784	20,784	20,784
Standard Errors	Robust	Robust	Robust	Robust	Clustered	Clustered	Clustered	Clustered

*** p<0.01, ** p<0.05, * p<0.1

Source: IMF staff calculations.

Table 1. United Kingdom: Housing Regulations and Income Convergence

	(1)	(2)
Avg. real earnings of a male worker in '79 (in log)	-0.004*	-0.005*
Housing regulations	0.02***	0.02***
Housing regulations* Avg. real earnings in '79	**0.22*** **	**0.22*** **
London dummy	YES	YES
Share of developed land in 1990	YES	YES
IV: 1911 population	NO	YES
coverage: 46 English counties; R^2=0.77; robust standard errors		

Note: Dependent variable is the average annual growth rate of real weekly earnings of a male worker in 1979–2008. The measure of housing regulations is the average refusal rate of major residential projects by the local planning authorities between 1979 and 2008, which we take from Hilber and Vermeulen (2015). A higher refusal rate means more restrictive local housing regulations. The interaction term (*Housing regulations* Avg. real earnings in '79*) enters the equation after de-meaning of both variables. In specification (1) we use the share of developed land in all developable land in a county in 1990 as a measure of physical supply constraints, in specification (2) we instrument the *share of developed land* on the county population in 1911 to mitigate potential endogeneity concerns. *** p<0.01, ** p<0.05, * p<0.1.

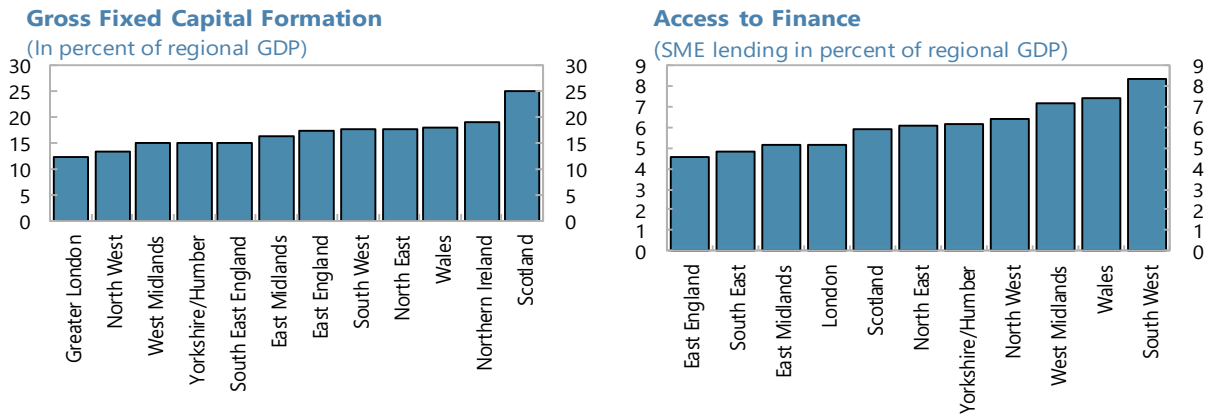
Investment

13. Existing data do not suggest that investment in physical capital and SME access to finance are particularly worse in underperforming regions (Figure 4)**.** Investment in physical capital is a key factor underlying firms' productivity performance. Uneven allocation of public investment or impediments to firms' access to finance across regions could result in regional disparities in productivity.

- **Capital formation.** Data on regional public capital stocks is not available, but aggregate public investment in the UK and the perceived quality of UK infrastructure assets has been traditionally below that of peer countries (OECD 2015). An estimate of gross fixed capital formation (GFCF) by region has been computed by the ONS for the period 2000–2013.[25] Scaling regional GFCF by each region's GDP does not show that more productive regions invest more. For instance, London invests a lower fraction of its GDP than Wales or Northern Ireland.[26, 27]

- **Access to finance.** While the UK SME access to finance index is above the EU average, some studies suggest there is room for improvement. There are several factors that impede firms' access to finance (particularly for SMEs): lack of competition in the UK banking system (Besley and Van Reenen 2013), excessive short-termism (Roland and Valero 2015), and under-supply of late-stage venture capital and low appetite for equity investment and alternative funding options among SMEs (HMT 2017) are the most commonly cited.[28] Scaling bank lending to SMEs by each region's GDP does not suggest that SMEs have better access to bank finance in productive regions (such as London or the South East). Along this line, Lee and Drever (2014) suggest that after controlling for firm characteristics there is no evidence of SMEs in relatively deprived areas finding it more difficult to access finance.[29]

Figure 4. Regional Capital Formation and Access to Finance



Sources: BBA, OECD Regional Statistics, ONS, and IMF staff calculations.

Note: Gross fixed capital formation numbers from ONS should be taken only as indicative as the data are experimental (i.e. not national statistics).

[25] Numbers should be taken only as indicative as the data are experimental (i.e. not national statistics).

[26] Firm level data for listed firms does not suggest that regions with low productivity regions have systematically lower regional median capital expenditures (to total assets). However, listed firms are not likely representative of the broader firm population.

[27] In the context of Brexit, less productive regions in the UK are more exposed to the loss of funding from the European structural funds and lending from the European Investment Bank (see OECD 2017).

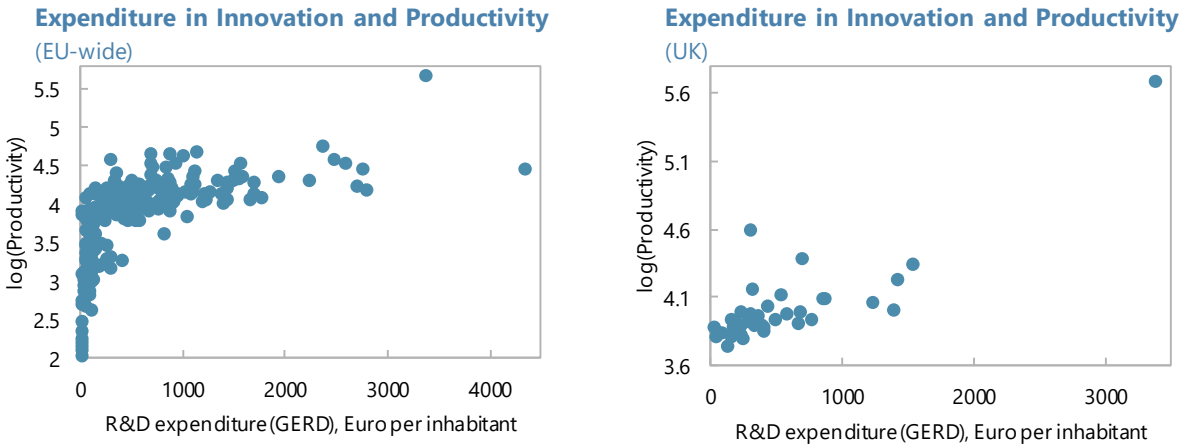
[28] Several measures have been implemented in recent years to increase effective competition in banking (see Annex 3 in Roland and Valero (2015) for a summary).

[29] However, there is evidence that other sources of finance, such as venture capital, equity investment, and crowdfunding, vary more significantly across regions and are concentrated in London and the South East (HMT 2017).

Innovation

14. Investment in research and development (R&D) in the UK lags that of peers and is uneven across the country's regions (Figure 5)**.** Innovation is a major driver of productivity growth (Bloom at al. 2013). Expenditure on R&D – which serves as a proxy for how much firms invest in the production or adoption of innovation – both private and public, has typically been lower in the UK than in other advanced economies. At the regional level, overall research and development investment tends to be lower in places with low productivity. London and the South-East account for a large share of investment in innovation and unsurprisingly represent the country's "frontier" region.

Figure 5. Expenditure on R&D



Source: Eurostat Regional Statistics. Charts at the NUTS 2 level.

15. Improving the ability of under-performing UK regions and localities to adopt innovations is likely to be crucial in enabling them to catch up. Technological adoption raises productivity as less productive firms learn from frontier firms and imitate their processes. However, the diffusion of technological innovations and best practices from frontier regions to lagging regions is not straightforward. New innovations are not always readily transferable, but need to be adapted to industry- and region-specific circumstances. For example, if technological progress requires highly-skilled workers, firms in regions with a poor skills base may not be able to take full advantage of new technologies. Key factors that improve a region's ability to adopt new technologies include the skills of the workforce and investment in appropriate R&D and physical capital, including information and communications technologies and new machinery (OECD 2016). "Regional champions" appear to play a significant role for the productivity growth within each region (Box 2).

Box 2. United Kingdom: Productivity Growth and the Role of the Regional Frontier

Recent studies have documented that productivity growth of laggard firms within a country is more strongly related to productivity developments of the national frontier as opposed to those at the global frontier (Andrews et al. 2015, Bartelsman et al. 2008, Iacovone and Crespi 2010, Van der Wiel et al. 2008). This is consistent with the process of diffusion requiring certain proximity, such as geographical, technological, or in skills endowments. Analogously, firms at the regional frontier may play an important role.

The estimation framework in Andrews et al. (2015) is adapted to test how firm productivity growth is related to the performance of the regional frontier firms, and performance of the most productive firms at the national level. If presence of local and national champions supports firm-level growth, then a larger distance of a company from the frontier firms – in terms of productivity - should imply a higher rate of productivity growth of this company. Results based on Orbis data for UK firms suggest it is the distance to the *regional* rather than *national* frontier that matters for firm-level productivity growth. In other words, regional frontier firms appear to play an important role in facilitating the diffusion of innovation to the rest of the economy.

Empirical evidence on how policies affect laggard firms' catch-up to the frontier is limited and generally focused on convergence to the national frontier. Recent studies suggest that less stringent product and labor market regulations may favor convergence. However, UK goods and labor markets are already some of the most competitive among advanced economies, limiting the scope for action. An alternative is to focus on *innovation policies* that foster adoption of frontier technologies and best practices. Policies could promote the benchmarking of firms against other companies operating in similar sectors and regions, and enable the sharing of best practices. Along this line, the Productivity Leadership Group has recently launched with support of the government an online resource including a benchmarking and measurement tool, and a collaboration hub (www.bethebusiness.com).[1]

	(1)	(2)	(3)	(4)
Distance from regional frontier	0.27***	0.27***	0.25***	0.24***
Distance from regional to national frontier	3e-7	4e-7	6e-7	9e-7
Growth at the regional frontier	-0.004	-0.007	-0.003	0.04
Growth at the national frontier	0.15	0.15	0.13	0.07
Capital per worker	0.03***	0.04***	0.04***	0.03***
Number of employees	-0.01***	-0.02***	-0.02**	-0.01**
Firm's age	-0.0003**	-0.0004**	-0.0003**	-0.0005**
Industry fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Excluding crisis years	NO	YES	YES	YES
Excluding London	NO	NO	YES	YES
Accounting for regional price differences	NO	NO	NO	YES

Note: Dependent variable is the firm-level total factor productivity (TFP) annual growth rate. The regional frontier is defined as top 5 percent of firms with highest TFP in each year, where we distinguish between regions at NUTS2 level. The national frontier includes 100 most productive firms in the UK. *Distance from regional frontier* is measured as the difference between median TFP level of frontier firms and the given firm's TFP. We follow Andrews et al. (2015) and use the *distance from regional to national frontier* rather than the distance from the national frontier to avoid multi-

Box 2. United Kingdom: Productivity Growth and the Role of the Regional Frontier (concluded)

collinearity between the distance to the two frontiers. All explanatory variables are 1-year lags. When correcting for regional price differences in (4) we use 2010 regional price indices from ONS and run the regression at NUTS1 region level, for which price indices are available. The results are robust to using labor productivity as the explanatory variable, and to extending the regional frontier to 10 percent of most productive firms. The data covers over 104 thousand firms in years 2008–2013. *** p<0.01, ** p<0.05, * p<0.1.

_____

[1] Analysis conducted as part of the MIER 2009 report suggests that innovations spread more easily within a supply chain with trading links than amongst a group of competitors.

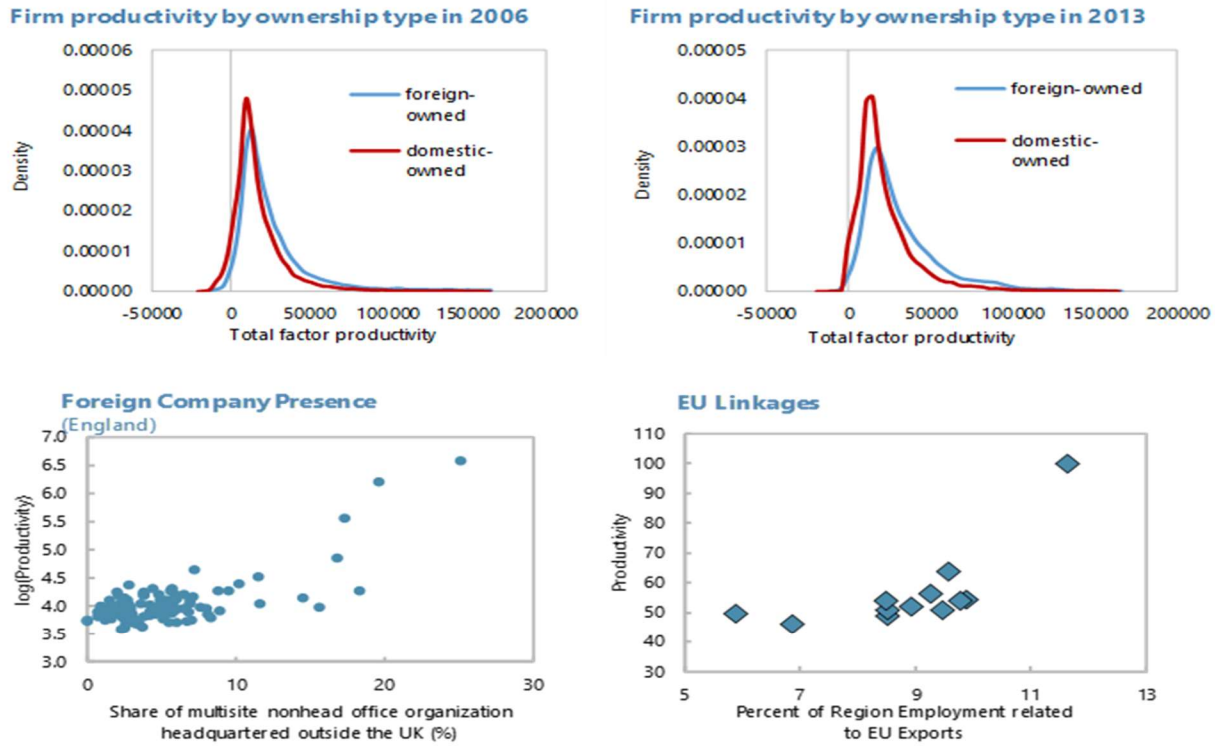
International Competition

16. Foreign direct investment and exposure to international competition can also play an important role in stimulating regional economic performance. Firms that export are likely to be exposed to global competition and to be integrated into global supply chains. This increases incentives to boost efficiencies and to match international best practices (Newman et al. 2015). Exporting firms have systematically higher levels of productivity than domestically-oriented firms, on average by around a third (Haldane 2017). The same forces are likely to be at play among foreign-owned firms, as inward FDI tends to raise productivity (Bloom et al 2012, and Haskel et al. 2007). Micro-level data show that foreign-owned firms in the UK are typically more productive than domestic companies, and their productivity advantage has increased since the crisis (Figure 6).[30] Indeed, regions with larger presence of foreign owned companies tend to be more productive. External-facing firms can also have an indirect positive impact on firms located in the same area by introducing new technologies and management practices, as well intensifying competitive pressures.

17. The productivity benefits of external-facing firms highlight the importance of openness to trade and foreign direct investment for boosting productivity. Policies should be targeted to build the conditions for economic success in lagging regions (for instance, the MIER 2009 report suggested that a key aspect to attract foreign investors is a large pool of skilled labor), while not cutting off the ability of leading regions to continue to be successful.

[30] Foreign-owned companies account for a larger share of top-performing firms in the UK than suggested by their share in total firm population.

Figure 6. Foreign Presence and Productivity



Source: Eurostat Regional Statistics, Orbis database, HMT, UKCES Employer Skills Survey (2015), and IMF staff calculations.

Note: UKCES Employer Skills Survey cover England only. Data is available at the local education authorities (LEA) level. Mapping into NUTS 3 regions is straightforward for most (but not all) cases. Some LEAs map into NUTS 2 regions: Cumbria, Devon, Essex, Kent, Lancashire, and North Yorkshire. The following LEAs are not included as the mapping into NUTS regions was not clear: West Sussex, Nottinghamshire, Norfolk, Northamptonshire, Hampshire, Surrey, Derbyshire, Wokingham, West Berkshire, Windsor and Maidenhead, Reading, Bracknell Forest, and Slough.

Agglomeration Effects

18. Agglomeration effects play a significant role in explaining regional disparities in the UK. Concentrations of economic activity generate economic benefits for the firms located within them, including a larger supply of workers to draw on, easier access to inputs and suppliers, and the creation of knowledge spillovers. There is a positive and significant correlation between productivity and agglomeration levels (Table 2).[31] The result is in line with Rice et al. (2006), who control for other variables, like educational attainment, and instrument agglomeration levels to establish a causal link.[32] This suggests that:

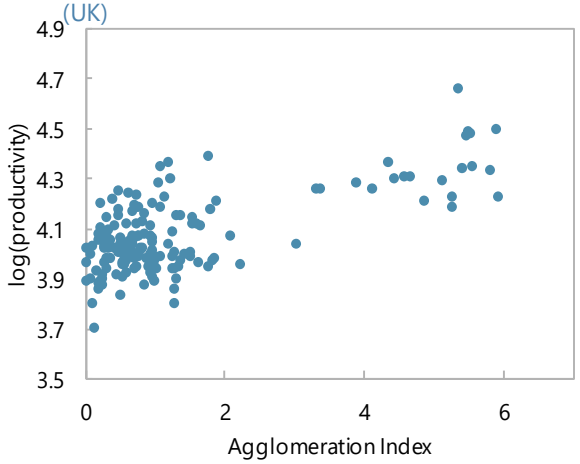
[31] The analysis measures agglomeration level at the NUTS 3 as the sum of local population plus nearby populations inversely weighted by distance up to 45 kilometers. Pairwise distances in route kilometers at the NUTS 3 level are obtained from Eurostat. Alternative measures of agglomeration may use travel times instead of distance for the weighting, or population density (see Rice et al. 2006).

[32] MIER (2009) establishes a similar result using firm-level data.

- Restrictions affecting the size of cities, such as excessive city planning restrictions, likely have a negative impact on agglomeration effects (see Swinney 2017 and discussion above).[33]

- Improvements in connectivity within and between cities are likely to have a positive impact on productivity. Evidence suggests there is indeed room for improvement: congestion is high in the rail transport network (OECD 2017) and higher for some smaller cities such as Leeds and Birmingham than in London (HMT 2017). Major infrastructure projects like the Northern Powerhouse Rail and the Midlands Rail Hub are aimed at increasing connectivity to achieve agglomeration effects.[34]

Agglomeration and Productivity
(UK)



Sources: Eurostat; ONS; and IMF staff calculations.
Note: NUTS 3 data, data for Northern Ireland missing. See Table 2 for definition of agglomeration index.

- Importantly, evidence on agglomeration economies suggests that the benefits are increasing when concentrating or connecting larger fractions of high skilled workers, and decreasing with distance (see Rice et al. 2006, Overman 2015, and Swinney 2016).

Table 2. United Kingdom: Agglomeration Effects

	(1)	(2)	(3)	(4)	(5)
Agglomeration Index	0.2314**	0.1294**			
	(0.027)	(0.024)			
Share of Establishments with +50% Staff with level 4 qualifications		0.0248***		0.0224***	0.0271***
		(0.000)		(0.001)	(0.000)
Population density - inhabitant per square metre			0.0001***	0.0000**	
			(0.001)	(0.013)	
Constant	3.6926***	3.1233***	3.7924***	3.2402***	3.1642***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	100	100	100	100	100
R-squared	0.268	0.485	0.343	0.504	0.459
NUTS 1 Dummies	YES	YES	YES	YES	YES

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Eurostat Regional Statistics, ONS, UKCES Employer Skills Survey (2015), and IMF staff calculations.

Note: Underlying data is at the NUTS 3 level, and only covers England. Productivity levels reported in Eurostat may overstate productivity differences at the NUTS 3 level as hours worked are based on place of reference rather than of work. The different model specifications regress log productivity levels on alternative measures of agglomeration. Agglomeration Index is computed as the sum of local population plus nearby populations inversely weighted by distance up to 45 kilometers. Pairwise distances in route kilometers at the NUTS 3 level are obtained from Eurostat.

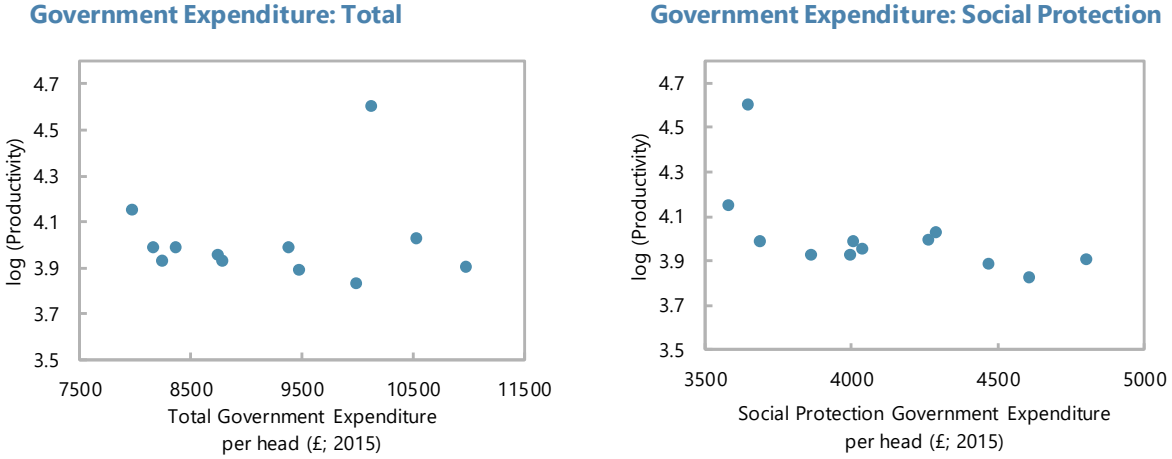
[33] Planning restriction may potentially play a beneficial role by correcting market failures. The issue is when restrictions disregard market failures or the balance between costs and benefits of interventions.

[34] The Transforming Cities Fund introduced as part of the Autumn 2017 commits £1.7 billion to supporting intra-city transport, by improving connectivity and reducing congestion.

Role of the Government

19. Perceived quality of local governments, as opposed to government spending levels, differs systematically across regions with different productivity levels. Disaggregate regional data on government spending per capita is not available beyond the NUTS 1 level. At this level of aggregation, public spending per head in England is below the UK average, and above in Scotland, Wales, and Northern Ireland.[35] Within English regions, public spending per head is lowest in South East and highest in London. Government spending on transport is typically larger in regions with higher productivity, possibly driven by larger congestion times (Figure 7). At the same time, the perceived quality of local government (measured by the European Quality of Government Index) correlates with productivity levels both within the UK, and across the EU more broadly (Figure 8).[36]

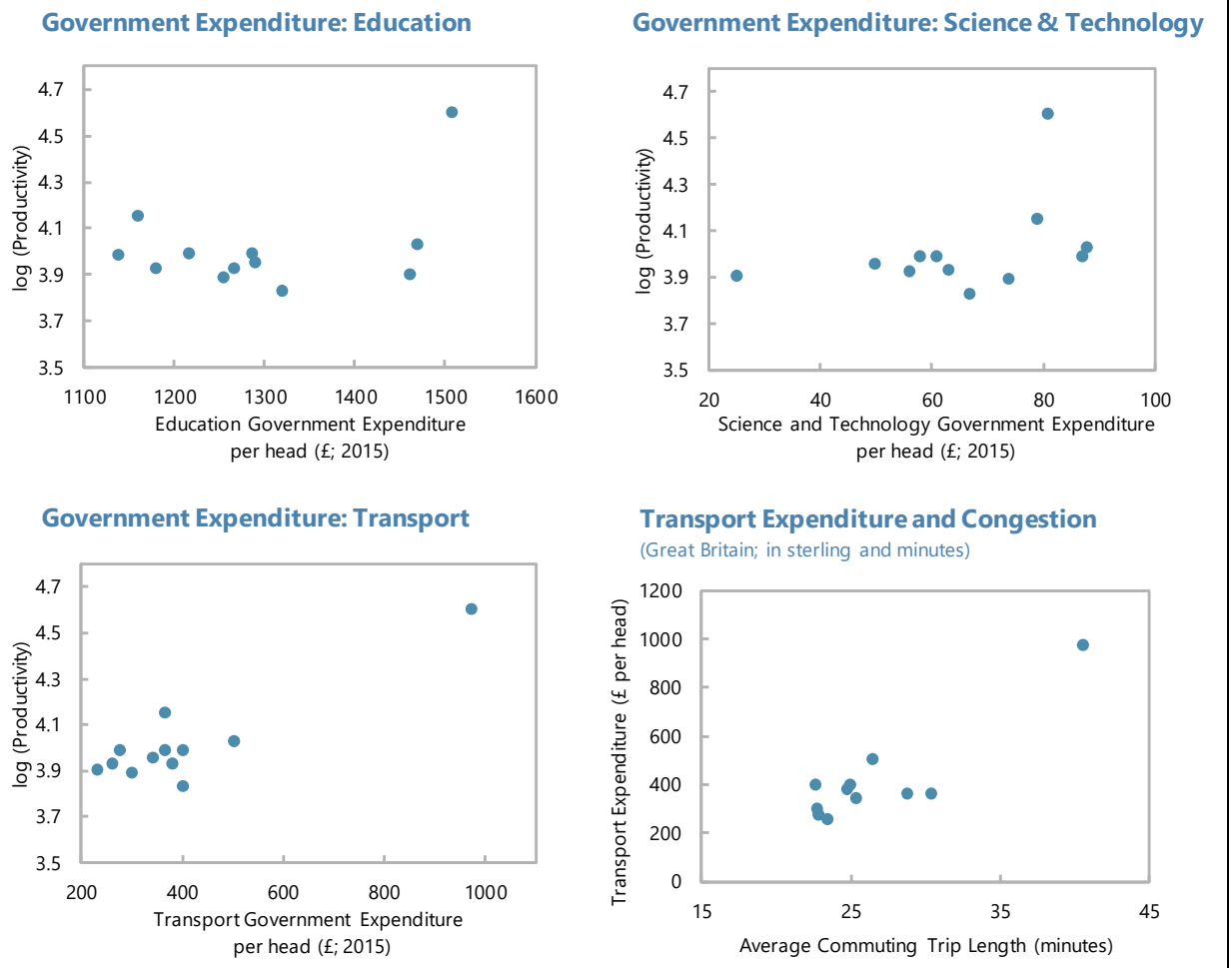
Figure 7. Regional Government Expenditures



[35] Over half of total public spending in devolved administrations (Scotland, Wales, and Northern Ireland) is allocated following the Barnett Formula. Although the annual increment in funds is made on the basis of recent population figures, the baseline—accumulated over the last thirty years—does not reflect today's population in the devolved administrations. The Barnett Formula is mechanical, and takes no account of the relative needs of the devolved administrations.

[36] The European Quality of Government Index (EQI) is a survey-based governance indicator available at the regional level within the EU (Charron et al. 2014). The data focus on both perceptions and experiences with public sector corruption, along with the extent to which citizens believe various public sector services are impartially allocated and of good quality. Over 85 thousand respondents are surveyed on the extent to which they perceive and experience corruption, quality, and impartiality in such services as education, healthcare services, and law enforcement, among other public sector functions.

Figure 7. Regional Government Expenditures (concluded)



Sources: Bank of England; and IMF staff calculations.

20. Decentralization of governance arrangements could improve the responsiveness of policy to local economic conditions. Centralized policy making risks being too far removed or having insufficient knowledge and flexibility to be tailored to local circumstances. Further, where policy makers are accountable to central not local government, their choices may not necessarily reflect local priorities. OECD (2016) finds that a well-designed regional fiscal policy supports sustainable regional growth. In particular, fiscal decentralization, as measured by the share of sub-central government taxes (or revenue) in total taxes (revenues), tends to reduce regional disparities. This happens as decentralization incentivizes local authorities to put in place business-friendly policies to raise the tax base.[37] This is achieved by more efficient management of existing resources and through competition for resources with other regions. Fiscal centralization, measured as the

[37] OECD (2016) finds that the poorest, underperforming regions benefit the most from fiscal decentralization.

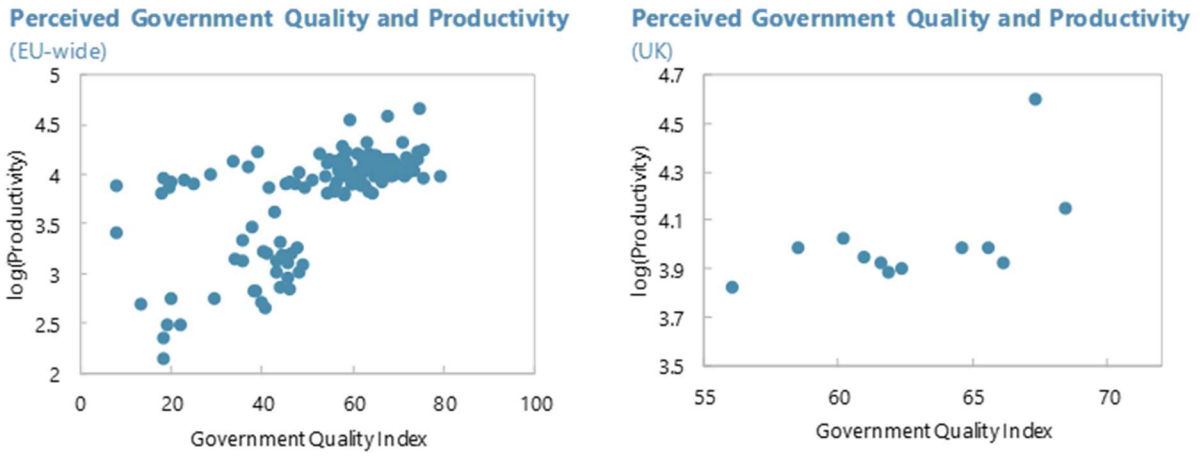
share of local revenues and expenditures in total public revenues and expenditures, is indeed relatively high in the UK from a cross-country perspective.[38]

21. A number of government initiatives seek to promote decentralization in England, but are either yet to be implemented or are too recent to assess their effectiveness.

- **Fiscal decentralization.** The government is assessing options for giving local governments greater control over the resources they collect, and is piloting approaches to greater retention of business rates revenue by local governments.[39] It will be important that adequate equalization mechanisms are in place to ensure that relatively poorer subnational governments have adequate resources to meet the responsibilities devolved to them.

- **Governance decentralization.** Following the crisis, there has been a growing consensus on the need for enhanced decentralization to improve policy effectiveness (Box 3). Since 2011, several local governance arrangements operating at a sub-regional scale have been introduced, including "local enterprise partnerships," and city and local growth devolution deals.

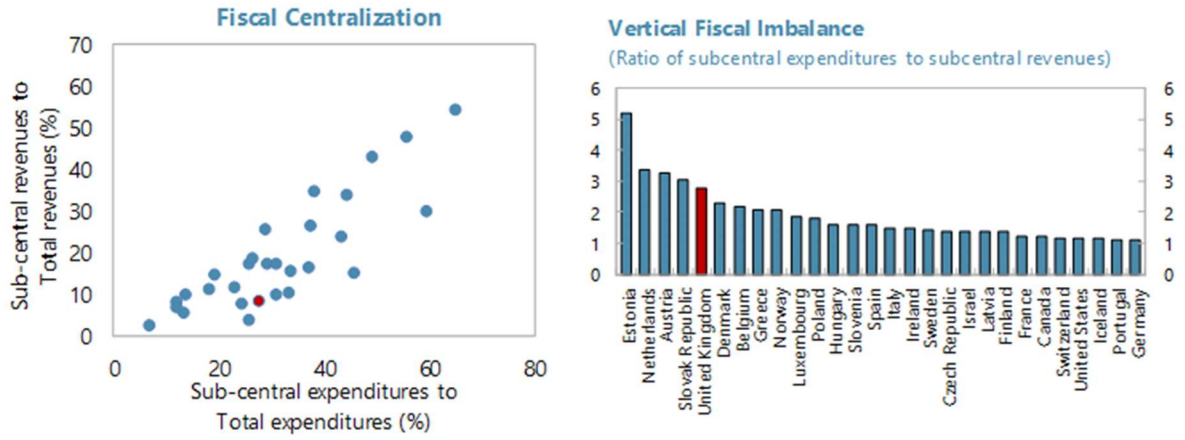
Figure 8. The Role of the Government



[38] The devolved administrations of Wales, Scotland, and Northern Ireland have a relatively high degree of autonomy in most areas of government, but together account for a small percentage of total population. In contrast, England is very centralized (see OECD 2017).

[39] Devolution could give rise to fiscal risks, at least in the transition, and local government capacity might need to be built to discharge any new fiscal responsibilities granted if these risks are to be contained (IMF UK Fiscal Transparency Evaluation 2016).

Figure 8. The Role of the Government (concluded)



Source: Charron et al. (2014), Eurostat Regional Statistics, and. IMF staff calculations.

Note: In chart 1, data at the NUTS 1 or NUTS 2 level depending by country. EU countries include Austria, Germany, Spain, France, Netherlands, Italy, Czech Republic, Poland, Romania, Portugal, and United Kingdom.

Box 3. The Evolving Governance Framework for Regional Development in England

The governance framework for regional development in England has changed significantly over the last two decades. Until recently, the Government's economic development policy was based around nine regions and a centrally-imposed target of increasing economic growth in each region and narrowing the gap in growth rates between leading and lagging regions. Policy did not focus on differences within regions, which are significant (BIS 2010). Development policy was primarily implemented by Regional Development Agencies (RDAs).[1] RDAs statutory purposes included, among others, to advance economic development, and to promote investment and development of skills relevant to employment in its area. This regional approach was not without criticisms, including:

- **Spending review.** An evaluation of RDAs commissioned by the previous Government found that the bulk of RDA spending was committed to a long-tail of relative low-value projects (PriceWaterhouse Coopers 2009). More than half of the total benefits came from less than 20 percent of the spending.
- **Scale and accountability.** Some viewed RDAs as too large to represent meaningful economic units, and unaccountable (as RDA chairs and Board members were appointed by BIS ministers- except in London- so accountability was to Central Government and not to local people and businesses).[2]

Box 3. The Evolving Governance Framework for Regional Development in England (continued)

Following the crisis, there has been a growing consensus on the need for enhanced decentralization to improve policy effectiveness (Overman 2015,17; Gardiner et al. 2016, Pike 2015)**.** The RDAs were closed in 2010 and substituted with governance arrangements at a sub-regional scale. Localized arrangements that benefit from local knowledge and are locally-accountable are expected to help policy-makers to identify and deliver the more valuable projects, allowing for greater policy variations across areas (BIS 2010). Local governance arrangements have included "local enterprise partnerships," and city and local growth devolution deals.

- **Local Enterprise Partnerships** (LEPs) are voluntary partnerships between local authorities and businesses that were established instead of the RDAs. LEPs decide on local priorities for physical infrastructure investments and apply for funding from Growth Funds, bringing strategic decision-making on economic development policies (e.g. transport) to a scale above local authorities but beneath regions.
- **City and local growth (devolution) deals** also aimed at greater local control to improve policy effectiveness. A series of City Deals were agreed between 2011 and 2014. The deals did not transfer general powers to local authorities, but provided cities with additional funding to be used flexibly. Devolution Deals transfer power over specific policy areas and funding from central government to combined authorities (i.e. legally recognized partnerships between councils that makes decisions on certain policy areas affecting the whole area). The devolved powers and the level of funding varies across the combined authorities. All devolution deals, with the exception of Cornwall, which is smaller in scope and breadth than other mayoral deals, require an elected mayor to promote accountability.

It is still early to assess the effectiveness of these recent decentralization deals, and the possible need for further devolution. For instance, the four most recent combined authorities (out of nine) were established in 2016–17 and the first mayoral elections took place in last May. As time passes, it will be important to evaluate progress and assess, for instance:

- Does the fact that devolutions deals are still ultimately made by the central government constrain local decision-making (Overman 2015,17)? Which functions and instruments are best aligned at different levels of government? Is there a need for a comprehensive UK-wide strategy? Lessons from local experimentation should inform which functions to localize across the board.[3]
- Is there a need for further fiscal devolution? A relatively centralized dispersion of funds from the Regional Growth Fund and other sources of local growth funding (such as infrastructure investment) may constrain local decision-making (Overman 2015, 17). Along this line, a report by the Transport Committee of the House of Commons (2014) suggested it is questionable whether bidding for pots of central government money allocated via rules set by central government rules amounts to genuine devolution. Devolution Deals currently give only limited financial powers to local areas.[4]

Box 3. The Evolving Governance Framework for Regional Development in England (concluded)

[1] Additionally, Regional Chambers were established in 1998 in the eight regions in England outside London. Regional Chambers were indirectly elected bodies tasked with producing strategic plans, and making recommendations to and scrutinizing the RDAs. The regions also had an associated a central Government Office by which a range of policies and programs of the central government were delivered in the regions. The Chambers were abolished between 2008 and 2010, and Government Offices in 2011. House of Commons Regional Select Committees were established in 2009 and abolished in 2010. Regional ministers within the Government were established in 2007 but were not reappointed by the Coalition Government.

[2] See BIS (2010), and Gardiner et al. (2016), and Pike et al. (2016).

[3] Gardiner et al. (2016) have expressed concerns that the deal-making approach "has all the hallmarks of ad hoc policy development and piecemeal reform, in which some nations, regions or local areas might be granted certain devolved powers while others will not – a highly uneven, unequal and potentially unstable and divisive settlement that may do more to promote further spatial imbalance rather than work towards ameliorating it."

[4] The government is assessing options for giving local governments greater control over the resources they collect, and is piloting approaches to greater retention of business rates revenue by local government. Elected mayors will have the power to add a supplement of up to two percent on business rates, with the agreement of the relevant LEP.

C. Industrial Strategy

22. The government's industrial strategy identifies the need for driving growth across the whole country as a key pillar. The white paper released in November includes a combination of horizontal (i.e. economy-wide) and vertical (i.e. targeted towards specific sectors or localities) policy proposals.

- Many of the initiatives are in the right direction, targeting issues discussed in the previous section: improving skills and addressing the chronic underinvestment in infrastructure and R&D and infrastructure spending.

- Policy intervention should be based on an understanding of the market friction it seeks to address. This is particularly important for interventions targeting specific sectors or localities. A set of transparent rules for intervention, and evidence-based evaluation both ex-ante and ex-post, could play an important role guarding against the risk of arbitrary policy intervention in the economy driven by vested interests (Banks 2015, Crafts 2017, and Valero 2017).[40]

- A strong institutional framework is important to give the industrial strategy stability and protection from the political cycle. For instance, the LSE Growth Commission (2017) recommended that industrial policy should be given a new law or long-lasting mandate, and independent decision-making or oversight, and enhanced transparency and accountability.

[40] Selective industrial policy is currently generally limited by the EU state aid framework, but this may potentially change when the UK leaves the EU.

D. Conclusion

23. There are large and long-standing disparities in labor productivity across UK regions. Regional disparities are large compared to other advanced economies. Two regions, London and the South East, have very high levels of productivity, while productivity levels are low elsewhere. In fact, UK's lowest productivity regions underperform the least productive regions in other advanced economies. Wealthier regions have higher productivity across most industry sectors, suggesting that their comparative advantage is not due to a particular type of economic activity but rather to other, cross-cutting regional characteristics.

24. Differences in human capital levels and agglomeration effects are key drivers of regional disparities. Major infrastructure projects like the Northern Powerhouse Rail and the Midlands Rail Hub are aimed at increasing connectivity to achieve agglomeration effects in areas outside London and the South East. Housing prices and regulatory constraints have an impact on internal migration, possibly reducing the effectiveness of relocation of labor as a regional convergence mechanism. Investment in research and development in the UK lags that of peers and is uneven across regions. Improving the ability of under-performing regions and localities to adopt innovations is crucial to enable them to catch up. While government spending per capita does not differ systematically across regions, fiscal centralization is high in the UK relative to other countries. Continued de-centralization of governance arrangements could improve the responsiveness of policy to local economic conditions.

25. Structural reform priorities differ based on local needs. Addressing congestion and housing restrictions is important for more successful regions; other regions should aim to increase human capital and improve transport connectivity. Evidence-based evaluation will be crucial to assess the effectiveness of reforms. However, for many reforms the positive effect would require time to materialize: gestation lags in education, for example, can last decades. It will be thus important to secure consistent implementation of any reforms over the long term.

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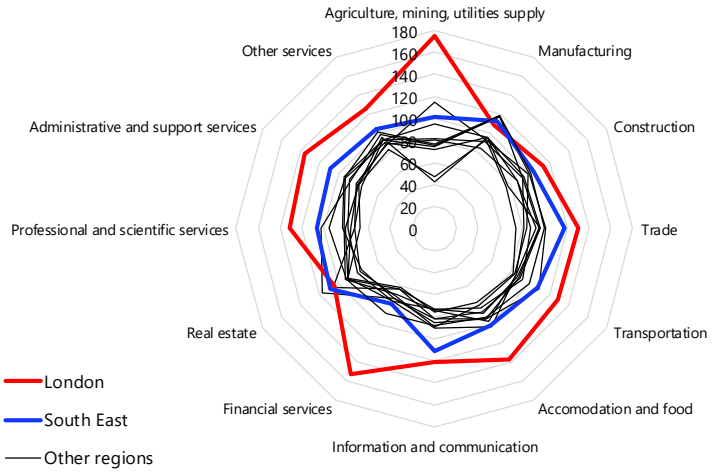
Annex I. Does Sectoral Composition Explain Regional Disparities?

Regional aggregate disparities could in principle be driven by different sectoral productivity or by different industry presence (measured by regional employment shares) across regions. An extreme example of the former is when the distribution of workers across sectors is the same in all regions, but productivity levels differ across regions for each sector. An extreme example of the latter is when sectoral productivity is equal across regions (yet different across sectors) but some regions have a larger share of workers occupied in high productivity sectors.

The most productive regions at the NUTS 1 level of aggregation tend to have higher productivity across most sectors, suggesting that the regional industry structure may play a relatively small role in explaining productivity differences across regions.

Output per job by region and sector
(UK average = 100 in each sector; 2015)



This intuition is tested using a decomposition exercise using data at the NUTS 3 level. Regional productivity levels are decomposed into a pure productivity index and an occupational composition index, following Rice et al. (2006). The pure productivity index takes each region's sectoral productivity levels and weights them by country average sectoral employment shares. The occupational composition index takes each region's sectoral employment shares and weights them by country average sectoral productivity levels.

$$Prod_i = \frac{GVA_i}{E_i} = \frac{\sum_{j \in Sectors} GVA_i^j}{\sum_{j \in Sectors} E_i^j} = \sum_{j \in Sectors} \frac{GVA_i^j}{E_i^j} \frac{E_i^j}{E_i}$$

Indeed, the correlation of the pure productivity index with productivity levels is close to 1 (0.99) and is much higher than that of the compositional index (0.33), confirming that the latter plays less relevant role in explaining regional discrepancies.