

# A FIRM-LEVEL ANALYSIS OF LABOR PRODUCTIVITY IN THE UNITED KINGDOM<sup>1</sup>

*This chapter analyzes the post-recession labor productivity slowdown in the UK using firm-level data. Growth accounting suggests that the main cause of the slowdown was a broad-based decline in total factor productivity (TFP), while lessened capital accumulation has not played a major role. The TFP decline may be partly due to increased resource misallocation, which contributed approximately two-fifths of a percentage point annually to the slowdown, but this result is not highly robust.*

## A. The United Kingdom Productivity “Puzzle”

**1. This chapter presents a quantitative assessment of three common conjectures about slow labor productivity growth in the UK in recent years.** The average annual growth of output per worker in the UK dropped from almost 2 percent during 2000–08 to nearly zero during 2009–14. We analyze three common explanations of this slowdown.<sup>2</sup>

- *Hypothesis 1:* Capital deepening slowed—i.e., the increased cost of capital relative to the cost of labor caused capital investment to slow, which in turn reduced labor productivity growth.
- *Hypothesis 2:* Productivity growth slowed because of increased misallocation of resources, which resulted in part from increased financial frictions and impaired credit channels following the crisis.
- *Hypothesis 3:* The slowdown in productivity reflects a broad-based decline in TFP across sectors and firms due to factors other than resource misallocation. Such a slowdown could reflect a number of factors, including some combination of a broad-based slowdown in technological innovation (as in many other advanced economies), under-measurement of output, and changes in the skill composition of the labor force. However, disentangling a broad-based TFP decline into these underlying factors is beyond the scope of this chapter.

**2. We use firm-level panel data to assess if and how much each of the proposed mechanisms contributes to the productivity slowdown.** The analysis of resource misallocation and the decomposition of changes in productivity to those between and within firms can only be conducted with firm-level data. Since firm-specific factors (e.g., size and age) affect productivity, relying on aggregate data would also restrict the scope of the analysis and preclude the use of variation in productivity across firms. Hence, we use firm-level data from ORBIS, which contains annual data on firms’ income statements, balance sheets, employment, location, ownership, and legal information in more than one hundred countries (see Appendix II for further details).

<sup>1</sup> Prepared by Mico Mrkaic (EUR).

<sup>2</sup> Appendix I briefly reviews the relevant literature.

**3. We find support for a broad-based decline in total factor productivity, perhaps due in part to increased resource misallocation.** Growth accounting analysis finds that the main factor in the productivity decline was a sharp decline in TFP growth, with slower capital deepening playing little role. We also find evidence that the TFP growth slowdown was due in part to increases in resource misallocation, but this result is sensitive to the choice of the analyzed time period. In addition, in what is to our knowledge the first analysis of its kind, we compare the pre-recession and post-recession levels of resource misallocation in the UK to the average across European G7 countries (France, Germany, and Italy) and show that the recession-induced misallocation in the UK persisted longer than the average across these comparator countries.

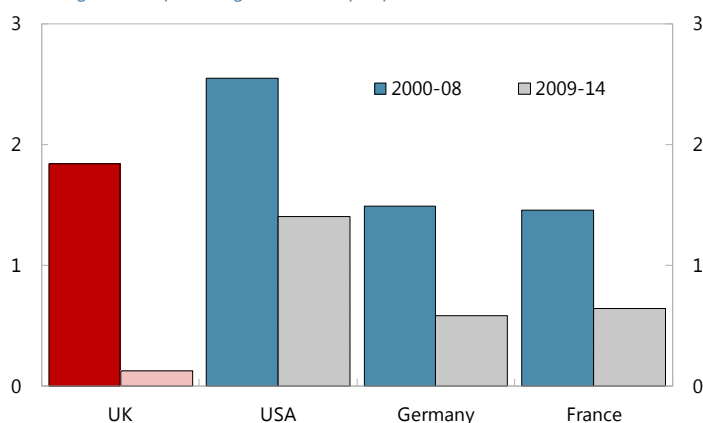
**4. The remainder of this chapter is structured as follows.** In the second section, we present some key facts about UK productivity and compare them to those in other advanced economies to highlight the puzzling nature of the UK productivity slowdown. In the third section, we present the analytical machinery used to analyze the issue. Specifically, we focus on the key elements of the seminal Hsieh-Klenow (2009) paper, which is the foundation of our analysis of resource misallocation. The section also presents the results of a growth accounting exercise for the UK and assesses the productivity impact of resource misallocation in the UK. Finally, the section compares resource misallocation in the UK to that in European G7 economies. The fifth section summarizes the results.

## B. Some Key Facts about UK Productivity

**5. Productivity growth in the UK has been exceptionally weak since the onset of the great recession.** After the great recession, productivity growth declined in all major economies. However, despite seemingly similar economic conditions, productivity growth in the UK declined considerably more than in comparable advanced economies. Measured by output per hour, average annual productivity growth declined from 1.8 percent during 2000–08 to nearly zero during 2009–14 and started accelerating only recently.

The decline in the growth of output per worker was smaller, but still sizeable at 1.3 percent. Comparing more broadly, during 2007–12, of all OECD member countries, only Greece and Luxembourg had slower productivity growth than the UK.

**Productivity Slowdown in Selected Major Economies**  
(Average annual percent growth in output per hour)

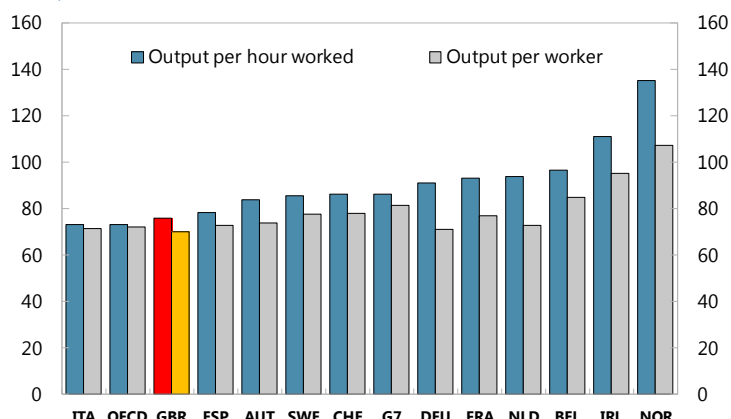


Sources: Haver Analytics and IMF staff calculations.

**6. Labor productivity in the United Kingdom is not only growing slowly, but the level of productivity is also below that in the most productive advanced economies.** In 2012, the hourly output of an average UK worker was ten percent below the G7 average, about fifteen percent below French and German averages, and a quarter lower than in the US.<sup>3</sup> If measured by output per worker, UK productivity is closer to that in its European peers, but nearly thirty percent behind that in the US. These statistics suggest that TFP in the UK is lower than in the economies that are closer to the productivity frontier.

**Labor Productivity Levels in 2012**

(percent of US levels)



Sources: OECD and IMF staff calculations.

## C. Empirical Analysis

### The Analytical Framework

**7. The analysis proceeds in two stages: first, we decompose productivity growth into the contributions of TFP and capital deepening; second, we estimate the reduction in TFP due to resource misallocation.**

- In the first stage, we assess the connection between labor productivity, TFP growth, and capital deepening by conducting a sectoral growth accounting exercise. We aggregate firm-level capital, employment, and output across each sector of the economy and compute the contributions of sectoral TFP to sectoral productivity growth. To further analyze the drivers of productivity growth, we run several sets of regressions of TFP growth and capital deepening on their lagged values and on other explanatory variables.
- In the second stage, we calculate by how much resource misallocation impeded TFP growth and study how the misallocation varies with time and across industries and firm sizes. The analysis of resource misallocation is based on the seminal paper by Hsieh and Klenow (2009). They use the variability of TFP within a sector as a proxy for resource misallocation and show how resource misallocation affects aggregate sectoral and economy-wide TFP levels. Their approach can be illustrated with the following example. Suppose there are two firms, one of which faces a distortion, such as capital subsidies, that causes the marginal products of capital to differ between the firms. If we remove the distortion and allow capital to move to equalize the marginal products of capital for both firms, the TFP of this two-firm industry increases—after the distortion is removed, firms produce more with the same inputs. This example illustrates an

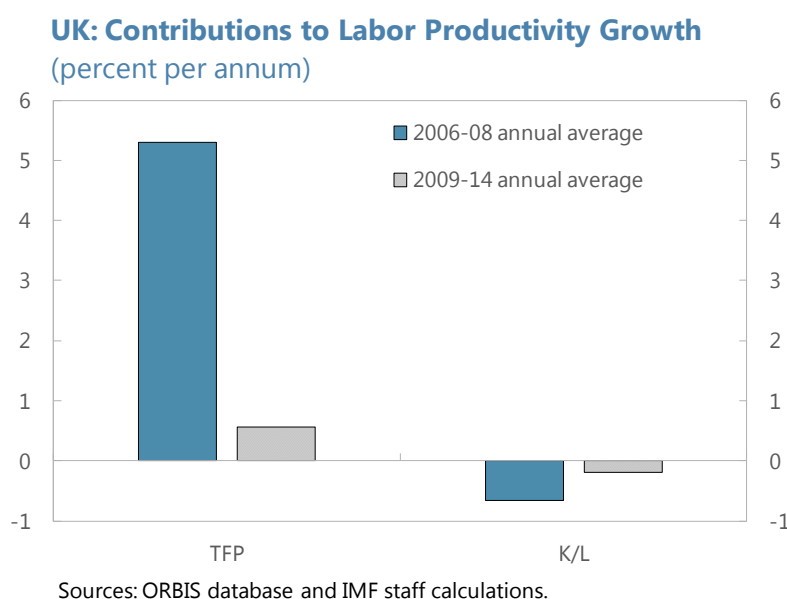
<sup>3</sup> 2012 is the last year for which the OECD disseminates internationally comparable labor productivity statistics.

important general result—the variability of marginal products *within* a sector (i.e., resource misallocation) is inversely proportional to the aggregate TFP *of the sector*.

## Growth Accounting Analysis

**8. To determine the drivers of labor productivity growth, we conduct a growth accounting exercise.** For each year in 2005–14 we sum firm-level real outputs, capital stocks, and employments to obtain sectoral aggregates. Next, we compute the average labor productivity and capital intensity in each sector for each year. In the last step, we decompose the growth in sectoral labor productivity into the contributions of capital deepening and TFP growth and compare the contributions to productivity growth for the pre-recession and post-recession periods.

**9. TFP declines are the main cause of weaker productivity growth while slower capital deepening contributed only marginally.** Between periods 2006–08 and 2009–14, the average annual contribution of TFP growth to aggregate labor productivity growth declined from 5 to  $\frac{1}{2}$  percent.<sup>4</sup> During the same time, the contribution of capital deepening increased marginally, from -0.7 to -0.2 percent. We conclude that the productivity growth slowdown was mainly driven by a sharp drop in TFP growth, while acknowledging that measurement error implies some uncertainty around the precise estimates. At a sectoral level, we obtain compatible results—TFP contributions to growth declined in all sectors after the Great Recession (Table 1).



<sup>4</sup> The estimates obtained from a firm-level exercise do not necessarily match aggregate values from published sectoral databases because ORBIS includes only a subset of all firms in the economy. However, what matters is the relative importance of the estimated contributions of TFP and capital deepening. The relative contributions strongly support the view that the productivity slowdown was mainly caused by the slowdown in the growth of TFP.

**Table 1. United Kingdom: TFP and Capital Deepening:  
Annual Contributions to Growth (percent)**

	TFP			Capital Deepening		
	Period Mean		Change	Period Mean		Change
	'06-08	'09-14		'06-08	'09-14	
Manufacturing	6.1	0.9	-5.2	-0.4	-0.5	0.0
Electricity, gas, steam and air conditioning	19.6	3.2	-16.4	-22.1	3.2	25.2
Water supply; sewerage, waste management	7.9	-1.6	-9.5	-0.1	-1.4	-1.3
Construction	1.9	1.7	-0.2	-0.8	0.3	1.1
Wholesale and retail trade; repair	4.0	1.4	-2.6	0.3	-0.3	-0.6
Transportation and storage	5.0	1.4	-3.6	-0.7	0.3	1.0
Accommodation and food service activities	4.9	1.5	-3.4	-0.5	0.8	1.4
Information and communication	3.5	1.3	-2.1	0.7	-0.2	-0.9
Financial and insurance activities	4.6	-0.9	-5.5	-3.8	1.4	5.2
Real estate activities	6.0	-2.6	-8.6	-8.5	7.3	15.7
Professional, scientific and technical services	9.3	0.9	-8.5	0.3	-0.7	-0.9
Administrative and support services	4.9	-1.0	-5.9	-0.6	-1.8	-1.2
Public administration and defense; compulsory social security	14.3	-5.9	-20.2	0.0	2.7	2.7
Education	6.3	-0.4	-6.7	0.6	0.2	-0.4
Human health and social work activities	4.6	-1.9	-6.5	1.2	-0.5	-1.7
Arts, entertainment and recreation	2.7	1.5	-1.2	0.0	0.2	0.2
Other service activities	5.2	-1.0	-6.2	-0.9	-0.5	0.4
Weighted average over all sectors	5.3	0.6	-4.7	-0.7	-0.2	0.5

Sources: ORBIS database and IMF staff calculations.

**10. TFP shows a tendency to converge to the productivity frontier and depends on firm size; capital deepening shows similar tendencies.** To analyze the factors that drive TFP growth, we run several regressions of TFP growth on plausible explanatory variables, with a special focus on convergence to the UK TFP productivity frontier (Appendix III).<sup>5</sup> To check the robustness of results, we add several sets of dummies to account for differences in sectors, regions, firm size, and time. Results show robust convergence of TFP to the frontier (firms that are farther from the frontier grow faster). We also find effects of firm size on the rate of TFP growth, with TFP growth being faster in smaller firms. Estimation results for capital deepening are qualitatively the same as those for TFP growth.

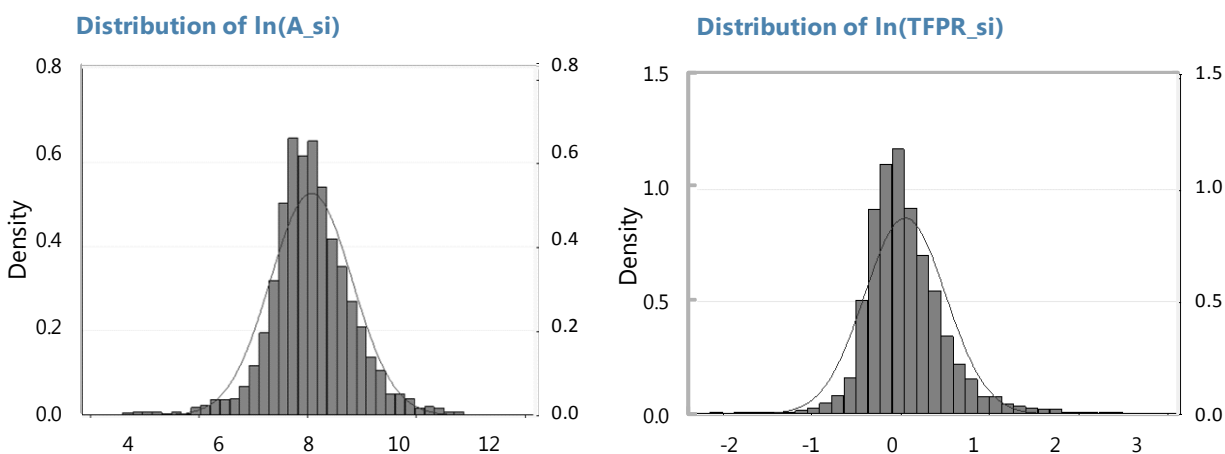
<sup>5</sup> The TFP frontier is defined as the top one percent within each sector.

## Resource Misallocation

**11. The magnitude of resource misallocation is proportional to the variance of TFP under quite general assumptions.** Hsieh and Klenow show that the logarithm of actual sectoral TFP,  $TFP_s$ , can be decomposed into the weighted difference between the logarithm of the “clean” TFP that would exist in a sector with no distortions and a measure of resource misallocation:

$$\ln TFP_s = \ln A_s - \frac{1}{2}\sigma \text{var}(\ln TFPR_{si})$$

where  $\sigma$  is the price elasticity of demand and “clean” TFP is  $A_s$ . Resource misallocation is given by the variance of the logarithm of  $TFPR_{si}$  where  $TFPR_{si}$  is the total factor revenue product of firm  $i$  in sector  $s$ . This decomposition holds if  $TFP_s$  and  $TFPR_{si}$  are jointly lognormally distributed. This assumption is supported at least approximately, as can be seen from the sample histograms.<sup>6</sup> This fact simplifies the analysis and permits formal statistical testing of changes in allocative efficiency by means of standard variance ratio tests.



Sources: ORBIS database, IMF staff calculations.

**12. We estimate that increases in resource misallocation depressed productivity growth by about 0.4 percentage points per year after the Great Recession, but this estimate is sensitive to the choice of time period.** Table 2 shows sectoral estimates of average annual growth of resource misallocation for two periods: 2008–14 and 2009–14. The average annual growth rates of resource misallocation differ between the two periods, depending on the inclusion of the first crisis year, 2008. This finding stems from the fact that the main increase in resource misallocation was rapid and occurred mostly in 2008, followed by more moderate increases in subsequent years. Given this sensitivity, the annual aggregate effect of resource misallocation on post-recession productivity

<sup>6</sup> Following Hsieh and Klenow, we remove the top and bottom one percent of the tails to lessen the influence of coding errors and extreme outliers.

growth is between -0.1 and 0.4 percent per year. There exist large differences between sectors in the degree of misallocation. Unsurprisingly, financials suffered a large increase in misallocation, while some (mostly public) sectors actually reduced their misallocation (e.g., education and health and human services). Overall, we estimate that, post-recession, the level of aggregate TFP was lower by about 3 percent due to increased misallocation. Further assuming that increased misallocation lasts approximately six years, it follows that it contributed approximately 0.5 percentage points per year (i.e., about a third of the slowdown in the measured growth of output per worker) to the post-recession slowdown.<sup>7</sup>

**Table 2. United Kingdom: The TFP Impact of Resource Misallocation (percent) 1/**

	2009-14 average	2008-14 average	Midpoint estimate
Manufacturing	-0.6	1.4	0.4
Electricity, gas, steam and air conditioning	3.3	3.2	3.3
Water supply; sewerage, waste management	0.3	3.8	2.0
Construction	0.8	0.8	0.8
Wholesale and retail trade; repair	0.1	1.2	0.7
Transportation and storage	0.7	0.1	0.4
Accommodation and food service activities	3.9	4.8	4.3
Information and communication	0.6	1.6	1.1
Financial and insurance activities	0.3	2.0	1.1
Real estate activities	-1.6	0.5	-0.6
Professional, scientific and technical services	0.3	2.0	1.1
Administrative and support services	-0.1	-0.1	-0.1
Public administration and defense; compulsory social security	-10.3	-22.0	-16.2
Education	-7.8	-5.9	-6.9
Human health and social work activities	-7.0	-6.1	-6.6
Arts, entertainment and recreation	-4.1	-6.5	-5.3
Other service activities	-2.9	-1.5	-2.2
Weighted sum of TFP impacts	-0.2	0.9	0.4

1/ Resource misallocation impact is measured as the average annual growth rate of  $\sigma \cdot \text{variance of } \ln(\text{TFPR}_{si})/2$

Sources: ORBIS database and IMF staff calculations.

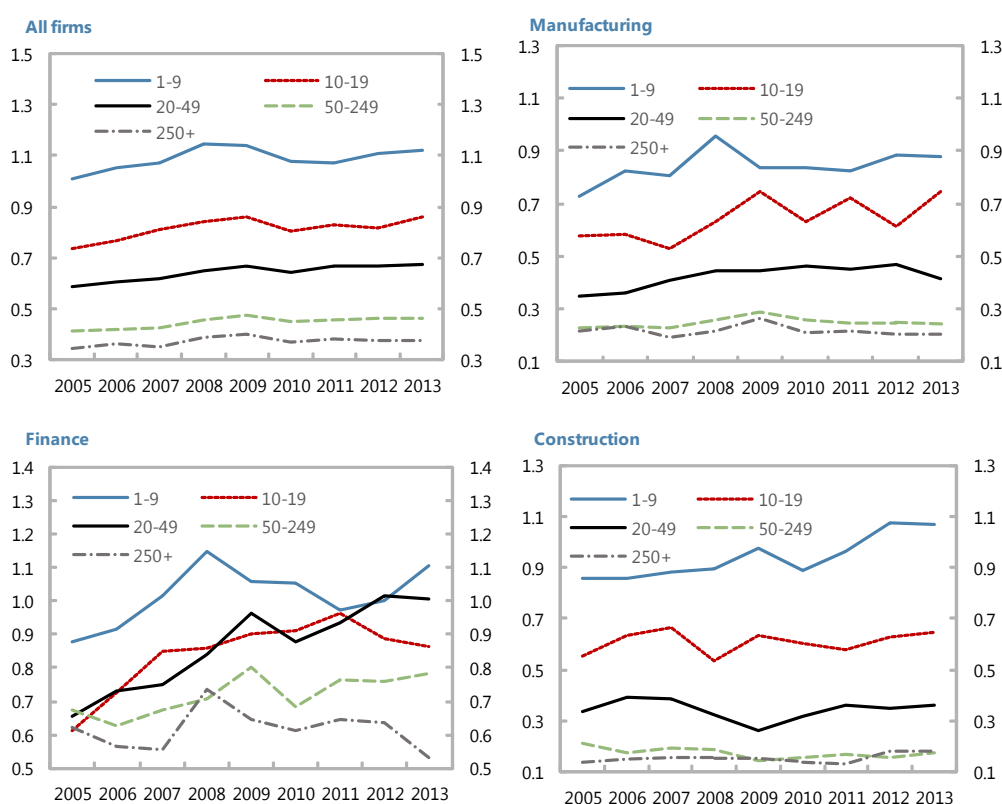
**13. Smaller firms suffer from more resource misallocation.** The level of misallocation in micro firms (1–9 employees) is about three times greater than in large firms. In addition, after the

<sup>7</sup> Our result is in broad agreement with Bank of England Working Paper No. 495: “The productivity puzzle: a firm-level investigation into employment behavior and resource allocation over the crisis” (Barnett and others). The paper finds that resource reallocation slowed significantly after the recession and that approximately one-third of the slowdown can be attributed to resource misallocation.

recession, misallocation in small firms increased three times as much as in large firms. This result supports the anecdotal evidence that smaller and medium-size enterprises suffered disproportionately during the recession because they were subject to stronger financial frictions, most likely due to their higher reliance on collateral.<sup>8</sup>

**14. The evolution of resource misallocation over time differs across sectors.** For the economy as a whole, the misallocation peaked at the onset of the recession (Figure 1). The behavior is different in some specific sectors. For example, the trajectories and relative magnitudes of misallocation fit the anecdotal evidence of persistent distress in small construction firms, large reallocation in finance, and a relatively placid picture for the manufacturing sector.

**Figure 1. United Kingdom: Resource Misallocation by Firm Size and Year 1/**



1/ Resource misallocation impact is measured as the average annual growth rate of  $\sigma \cdot \text{variance of } \ln(TFPR_{si})/2$ . Legend refers to firm size as measured by number of employees.

Sources: ORBIS database, IMF staff calculations.

<sup>8</sup> It is straightforward to demonstrate that financial frictions map directly into the Hsieh-Klenow framework of resource misallocation by imposing a credit constraint of the form  $w \cdot L_{si} + \zeta \cdot R \cdot K_{si} < W(z_{si}, \eta)$ . Here  $\zeta$  is the amount of capital expenses that can serve as collateral,  $z_{si}$  is a vector of firm characteristics, and  $\eta$  characterizes the financial system.



## Comparing Resource Misallocation in the UK with European G7 Economies

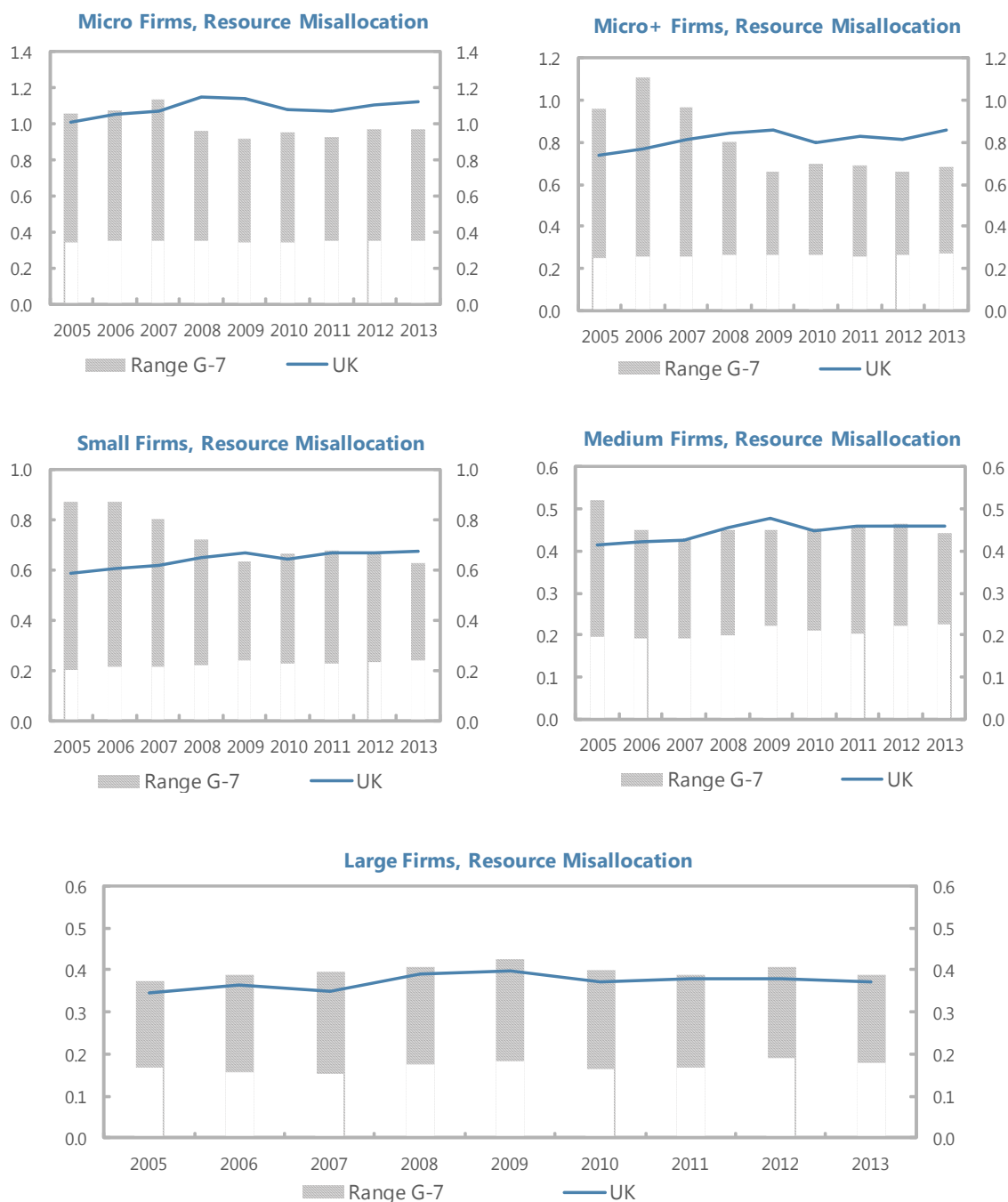
**15. An elevated level of resource misallocation persisted longer in the UK than in other European G7 economies among smaller firms.** Comparing the UK to other European G7 economies shows that the misallocation in the UK persisted longer after the onset of the recession among smaller firms, while large UK firms fall within the G7 misallocation range. Figure 2 shows the results of the comparison. We observe that the G7 range of misallocation, presented with vertical shaded bars, is relatively large. It is also interesting to note the heterogeneity of misallocation in the G7 countries across firm sizes. This differential response in resource misallocation indicates that the conditions of micro and small firms might be responsible for the larger-than-average UK productivity slowdown.

## D. Conclusions

**16. A single theory cannot explain the totality of the UK productivity slowdown, but the decline in TFP growth is its main cause.** The slowdown is mostly caused by a broad-based TFP decline and not by a decline in capital deepening. The decline in TFP growth occurred in most sectors, though it was stronger in some sectors than in others.

**17. Resource misallocation may have been one factor behind the decline in TFP growth, but the result is sensitive to the choice of time period.** The analysis in this chapter suggests that resource misallocation—perhaps due to impaired credit channels following the crisis—may have contributed approximately 0.4 percent per annum quarter to the UK’s post-crisis productivity slowdown. The misallocation in the UK appears to be at the upper limit of the misallocation in other European G7 countries. There is a large variation in misallocation by firm size—larger UK firms are relatively closer to those in other European G7 countries than are smaller ones. Misallocation in the economy as a whole has subsided in recent years, but there are pockets where it persists, for example in small construction firms and in financial intermediation.

**18. The estimated effect of resource misallocation still leaves most of the decline in TFP growth unexplained.** A number of other theories have been proposed to further explain the “productivity puzzle,” such as technological change, shifts in labor force composition, and mis-measurement (Appendix I). Further disentangling the TFP decline into these and other factors is beyond the scope of this analysis.

**Figure 2. Comparison of UK and European G7 Resource Misallocation 1/**

1/ Micro firms: 1-9 employees, Micro+ firms: 10-19 employees, Small firms: 20-49 employees, Medium firms: 50-249 employees, Large firms: 250+ employees.  
Sources: ORBIS database and IMF staff calculations.

## Appendix I. Literature Review

Existing research on the UK's productivity slowdown has proposed a number of possible explanations, including the following:

- ***The productivity slowdown is at least in part a consequence of measurement errors.*** Research by the Bank of England shows that measurement errors (e.g., under-estimated growth) could account for approximately one-quarter of the reported productivity slowdown.<sup>1</sup> While the bias does not explain the whole productivity “puzzle”, it could be an important piece of the puzzle, especially if it turns out that the UK bias was greater than the biases in other G7 and OECD countries.
- ***Productivity fell because firms hoarded labor to preserve firm-specific human capital in the uncertain recessional environment.*** When the fall in labor productivity first appeared, around 2009, many attributed it to labor hoarding—that is, firms holding on to labor, especially skilled labor, in a time of uncertainty.<sup>2</sup> But as time went by, the uncertainty argument became less persuasive and is now considered a less credible explanation of the slowdown during 2007–14. Furthermore, this theory can account for the *absolute* productivity slowdown, but it is less persuasive at explaining the slowdown *relative* to other advanced economies, which faced similar levels of uncertainty.
- ***Increased labor participation and low investment have weighed on productivity.*** Jon van Reenen and João Paulo Pessoa suggest that the productivity slowdown is the result of firms responding to changes in relative factor prices.<sup>3</sup> Pension reforms increased labor participation, which, in a flexible UK labor market, pushed down the cost of labor. At the same time, increases in the cost of capital further reduced the relative cost of labor as a factor of production. In response to the shift in factor costs, firms increased demand for labor and reduced investment. As a result, capital deepening slowed and productivity growth stagnated. This theory implies no market failure and suggest no need for policy intervention—firms responded optimally to an exogenous shock with no associated market failure and no need for policy intervention.<sup>4</sup>

<sup>1</sup> *The UK productivity puzzle* by Barnett, Batten, Chiu, Franklin, and Sebastián-Barriel of the Bank's Monetary Analysis Directorate, Bank of England Quarterly Bulletin, 2014Q2. The uncertainty of output measurements is illustrated in an ONS 2014 publication, *National accounts articles — impact of ESA10 changes on current price GDP estimates*.

<sup>2</sup> The option value of delaying (investment) until uncertainty resolution is well-established. An instructive analysis is *Uncertainty and Investment Dynamics* by Bloom, Bond, and Van Reenen (2007).

<sup>3</sup> *The UK Productivity and Jobs Puzzle: Does the Answer Lie in Labour Market Flexibility?* Joao Paulo Pessoa and John Van Reenen, CEPR Special Paper No. 31, June 2013 and *The Great British Jobs and Productivity Mystery*, CEPR Policy Portal, June 2014.

<sup>4</sup> Weale expounded on the links between the labor market and productivity in a speech at the Manchester Economics Seminar in November 2012.

- **Declining high-value sectors (e.g., oil production and financial services) have weighed on productivity.** As high value-added sectors shrink, labor reallocates to less productive sectors, which could lower aggregate productivity.<sup>5</sup> However, lower productivity growth has mainly been a phenomena about lower productivity growth within sectors, rather than about shifts in the composition of production across sectors.
- **The slowdown is a consequence of resource misallocation due to damage to financial intermediation.** A well-known proponent of this theory is Ben Broadbent., who has proposed a thesis of productivity held back by damage to financial intermediation.<sup>6</sup> The damage increased the cost of capital, worsened credit rationing, and, most importantly, impaired reallocation of capital from less productive to more productive firms. This theory could in principle help identify market imperfections that could be mitigated with suitable policies, though damage to financial intermediation caused by the crisis is likely to recede as financial sector balance sheets are repaired.
- **A collapse of within-firm productivity.** An analysis by Riley, Rosazza, Bondibene, and Young (2014) finds that the major part of the post-recession decline in UK productivity growth was accounted for by a widespread productivity shock within firms, while the resource misallocation contributed a smaller amount. Their findings point to the importance of a common factor in explaining the productivity “puzzle”. They do not see wage flexibility or sectoral declines as significant contributing factors, but rather see the slowdown as a pro-cyclical process, associated with “productivity weakness within firms and probably reversible when output recovers on a sustainable basis.”<sup>7</sup> This view assumes that the current business cycle has been extremely long and that, since productivity is likely to recover on its own, the scope for interventionist policies is limited.

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<sup>5</sup> This effect assumes that high labor productivity in these sectors reflects sector-specific effects (e.g., economic rents) rather than differences in the skill composition of their labor force that would cause this labor force to have high productivity even if it moved to another sector.

<sup>6</sup> *Productivity and the allocation of resources*, speech at the Durham Business School, September 2012 and *Conditional guidance as a response to supply uncertainty*, speech at the London Business School, September 2013.

<sup>7</sup> NIESR supports this view in a May 2015 survey.

## Appendix II. Data Preparation

**The ORBIS database is the main source of analyzed data.** The ORBIS database is compiled and marketed by Bureau van Dijk (BvD).<sup>1</sup> The database contains about 100 million records on firms from more than 100 countries. Each record includes annual information on firms' balance-sheets, income statement, and other firm-specific information. BvD updates the database four times a year to increase coverage and improve timeliness of the data. The coverage of the UK economy appears detailed since the database contains more than 30 million observations for the period 2005–14. However, far fewer records include the information on added value and employment, two key variables needed in the analysis of labor productivity. Furthermore, the reported sample is not random, since it does not match the size distribution of UK firms. On the whole, the database provides useful raw material that needs to be refined.

**The database requires extensive preprocessing before the analysis.** First, we purge the data of all records with missing information on value added or employment. Second, we remove all observations that grossly differ from acceptable values for typical economic variables, with the goal of reducing the impact of coding, data entry, and processing errors. Third, to deflate the data, assure international comparability, and compute TFP values, we broadly follow the procedure in Gal (2013).<sup>2</sup> We deflate nominal values with NACE 1-digit level deflators for added value and capital investment and convert all values into 2005 international dollars. In this conversion, we distinguish between firms in tradable sectors (manufacturing) and service firms.<sup>3</sup> Finally, we re-weigh the data to match the distribution of firm sizes in the economy.

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<sup>1</sup> For details see <http://www.bvdinfo.com/en-gb/our-products/company-information/international-products/orbis>.

<sup>2</sup> However, we do not use the permanent inventory method (PIM) to estimate the stock of capital. In short panels the PIM could be seriously biased because it depends on the accuracy of the initial capital stock.

<sup>3</sup> STATA code, used in preprocessing, that documents the whole procedure is available from the author on request. However, raw data cannot be distributed, since ORBIS is a commercial database.

## Appendix III. TFP and K/L Growth Regressions

Tables A1 and A2 present the results of TFP growth and capital deepening regressions.

**Table A1. United Kingdom: TFP Growth Regressions 1/**

Distance to TFP frontier	0.148***	0.148***	0.165***	0.165***	0.186***
2007		-0.0110		-0.00931	-0.00934
2008		0.0205***		0.0245***	0.0248***
2009		-0.0542***		-0.0466***	-0.0460***
2010		-0.000575		0.0108	0.0125*
2011		-0.0192***		-0.00395	-0.00120
2012		-0.0456***		-0.0285***	-0.0255***
2013		-0.0225***		-0.00351	0.000293
2014		-0.0389***		-0.0206***	-0.0176**
Size: 10-19 employees	-0.109***		-0.0752***	-0.0740***	-0.0701***
Size: 20-49 employees	-0.154***		-0.150***	-0.148***	-0.151***
Size: 50-249 employees	-0.196***		-0.226***	-0.224***	-0.240***
Size: 250+ employees	-0.205***		-0.254***	-0.252***	-0.267***
Electricity, gas, steam and air conditioning					0.0917**
Water supply; sewerage, waste management					-0.0421**
Construction					-0.0586***
Wholesale and retail trade; repair					-0.104***
Transportation and storage					-0.0606***
Accommodation and food service					-0.141***
Information and communication					-0.0237***
Financial and insurance activities					-0.0222**
Real estate activities					-0.0761***
Professional, scientific and technical services					-0.0181**
Administrative and support services					-0.0743***
Public admin., defense, compulsory soc. security					0.0678
Education					-0.0359
Human health and social work					-0.0445***
Arts, entertainment and recreation					-0.174***
Other service activities					-0.112***
Constant	0.259***	-0.196***	-0.177***	-0.0328***	-0.0268***
					-0.00202

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

1/ Based on annual, firm-level data for 2006-14. Manufacturing is the omitted sector dummy. Including lagged TFP growth as an explanatory variable does not change the results substantially.

Sources: ORBIS database and IMF staff calculations.

**Table A2. United Kingdom: Capital Deepening (K/L growth) Regressions 1/**

Distance to K/L frontier	0.431***	0.432***	0.432***	0.433***	0.615***
2007		-0.0891		-0.0788	-0.0898
2008		-0.435**		-0.417**	-0.432**
2009		-0.0623		-0.0271	-0.0427
2010		-0.237		-0.186	-0.172
2011		-0.172		-0.107	-0.113
2012		-0.0723		0.000331	-0.00285
2013		-0.110		-0.0323	-0.0454
2014		-0.216		-0.135	-0.151
Size: 10-19 employees	0.285		0.166	0.160	-0.0580
Size: 20-49 employees	-0.510**		-0.556***	-0.565***	-0.884***
Size: 50-249 employees	-0.812***		-0.831***	-0.842***	-1.238***
Size: 250+ employees	-0.805***		-0.972***	-0.983***	-1.391***
Electricity, gas, steam and air conditioning					1.953*
Water supply; sewerage, waste management					-0.199
Construction					-1.583***
Wholesale and retail trade; repair					-0.251**
Transportation and storage					-0.753***
Accommodation and food service					-0.518**
Information and communication					-0.472**
Financial and insurance activities					-1.170***
Real estate activities					-1.603***
Professional, scientific and technical services					-1.466***
Administrative and support services					-1.204***
Public admin., defense, compulsory soc. security					-1.515
Education					-0.229
Human health and social work					1.079***
Arts, entertainment and recreation					0.739*
Other service activities					-1.089***
Constant	0.923***	-1.356***	-1.204***	-0.664***	-0.551**
					-0.324

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

1/ Based on annual, firm-level data for 2006-14. Manufacturing is the omitted sector dummy. Including lagged K/L growth as an explanatory variable does not change the results substantially.

Sources: ORBIS database and IMF staff calculations.

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