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IMPROVING PRODUCTIVITY—OPENING THE BLACK BOX

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Hourly productivity levels in the UK still remain behind those in some competitor countries. The government devotes much policy attention to enhancing productivity and continues to emphasise its five drivers—investment, innovation, skills, enterprise, and competition. This article argues that it is investment broadly defined that is the key to sustained productivity improvement. The emphasis should be on improving productivity simultaneously with improving the quality of production. Only thus will the gains be widely shared. In achieving these aims there are two prerequisites for policy-makers. The first is to ensure better coordination of policy than appears to be currently achieved by the present departmental structures in Whitehall. The second is to recognize fully the long and complex chain of causation that can be triggered by pulling on one policy lever. Such complexity can only be fully understood by more research on what actually goes on inside the black box of the organization.

I. INTRODUCTION

The UK's productivity performance figures high on the government's agenda. For three and a half decades after the Second World War, the country's productivity growth lagged that of most of its major competitors, with the signal exception being the USA. Since the early 1980s there has been some catch up, but the UK's levels of productivity per hour remain lower than those of France, Germany, and, of course, the USA. However, at a more disaggregated level there are some interesting differences in sectoral trends. Throughout the 1990s the UK closed the gap in some sectors—most notably in networked industries (electricity, gas, and water), manufacturing, and business services. At the same time it fell further behind in other sectors—including wholesaling and retailing, financial intermediation, and machinery and equipment.[2] The government is concerned about this for a number of

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[2] See Griffith *et al*. (2003).

reasons, including what it might indicate about the UK's productive efficiency and what it might imply for international competitiveness and for standards of living. The puzzle is that the aggregate hourly productivity gap remains hard to close, despite policy interventions on many fronts.

There is a large body of literature[3] which attempts to account for the UK's historical productivity failings. This issue of the *Oxford Review of Economic Policy* is mainly concerned with recent and ongoing research on some of the factors which current official thinking appears to believe will make a significant difference—education and training, management skills and practices, innovation, and investment. Thus the emphasis of most of the contributions is on the labour market and the workplace and on getting inside the black box of the organization. They represent some of the work being done by members of an ESRC research programme (AIM)[4] and an ESRC research centre (SKOPE).[5]

This introductory article attempts to put these contributions into context and to show where they fit into the broader policy debate. Section II briefly discusses measurement issues and recent productivity performance. Section III introduces the government's five levers of productivity growth, linking them to a more traditional typology of the sources of productivity growth, emphasizing in particular the importance of distinguishing between the short run and the long run. It points out some possible lacunae in current policy thinking. Section IV concentrates on a specific contribution of many of the articles in this issue. This is to emphasize what is actually going on within the organization and specifically to use newly generated data sets to satisfy the need for researchers to delve into the internal workings of the organization in order to understand the true effects of pulling on the government's policy levers. Section V presents some implications for research and for policy, exploring the question of whether it is appropriate to think of *UK* policy.

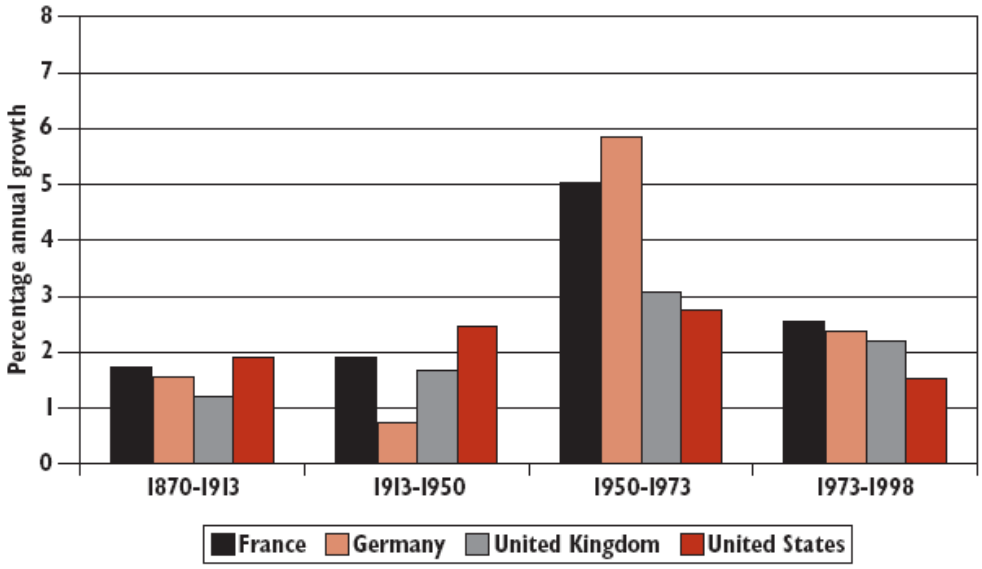
II. DIFFERENT WAYS OF MEASURING PRODUCTIVITY AND UK PERFORMANCE

Conventionally, researchers employ two metrics of productivity—labour productivity and total factor productivity. In this article we concentrate on the former. Three, rather different, measures of labour productivity are deployed at the aggregate level: output per capita, output per person employed, and output per employed hour. The UK relative position is different depending on the measure used. It is behind the USA on all three. It is ahead of France and Germany on output per capita. It is ahead of Germany but behind France on output per person employed, and behind France and Germany on output per employed hour. These differences can be explained by differences between countries in employment rates and hours worked per annum. The UK's employment rates are higher than those of France and Germany, as are its annual hours of work. Thus a relatively poor performance on output per hour is, at least partially, compensated for by these other two factors. In this context the government takes some justifiable pleasure in the fact that the UK's relatively healthy rates of productivity per hour in recent years have been achieved at the same time as fast employment growth, since it might be expected that the latter development would imply the use of less productive workers. This section concentrates on output per hour, since it is the most direct indicator of productive efficiency.

Figure 1 is reproduced from HM Treasury and DTI (2006). It demonstrates how the severely the UK's productivity *growth* lagged behind France and Germany in the 1950–73 period, though it was a little better than US performance. In the 1973–98 period, UK productivity growth continued to be slower than in France and Germany, but the differences were much smaller and it remained faster than in the USA. Figure 2, taken from the same publication, is concerned with *levels* of output per hour for the period 1990–2004. It shows how, in these more

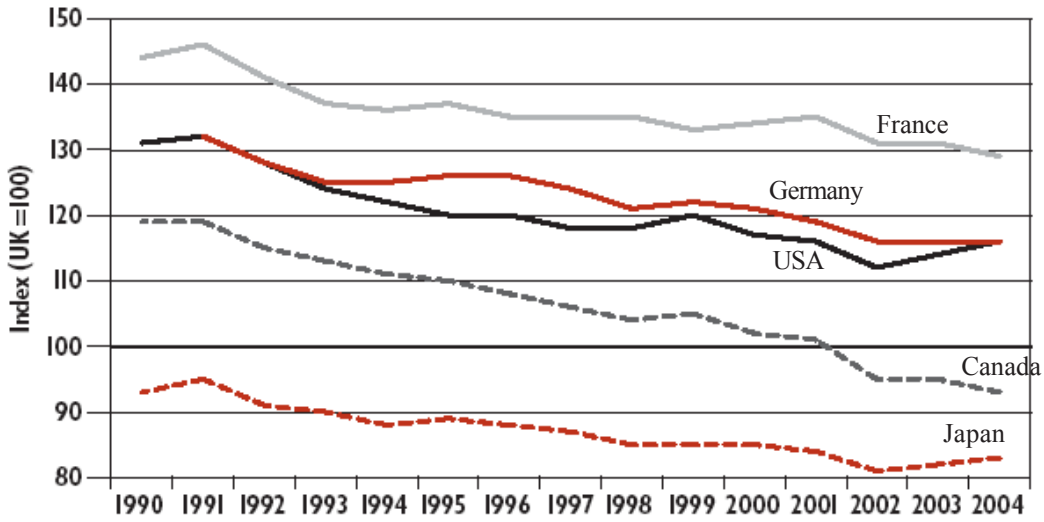
[3] See, for example, O'Mahoney (1999) and HM Treasury and DTI (2006).
[4] Advanced Institute of Management Research.
[5] Centre for Research on Skills, Knowledge and Organizational Performance.

Figure 1
History of Growth Rate of GDP[a] per Hour Worked



Note: [a] Average compound growth rate.
Source: HM Treasury and DTI (2006) (Crown copyright).

Figure 2
Output per Hour (UK = 100), 1990–2004



Source: HM Treasury and DTI (2006) (Crown copyright).

recent years, there has been some catch-up with France, Germany, and the USA, though all three countries remain ahead of the UK. Two other comparator countries are also included—Japan and Canada. The UK has also improved against both of these countries and indeed its productivity per hour is now greater than theirs. Their introduction into the picture perhaps serves to remind us that not all is doom and gloom. Compared to a number of major countries the UK's productivity performance is healthy.

When measuring changes in productivity over time an important problem is how changes in output are

measured. Obviously inflation effects have to be stripped out of the time series for output. However, this does not mean that all price increases should be removed. If a price increase genuinely reflects an increase in the quality of the product, then that represents a real increase in the value of output and should remain in the calculations. This is well known, but how effectively official statisticians actually cope with this methodological issue is another matter. The article by Gustavo Crespi, Chiara Criscuolo, Jonathan Haskel, and Denise Hawkes (Crespi *et al*., 2006) considers this issue in the context of market services. We return to the significance of the measurement problem in the next section when we discuss the relationship between productivity and competitiveness.

III. THE SOURCES OF PRODUCTIVITY GROWTH AND ITS RELATIONSHIP WITH COMPETITIVENESS

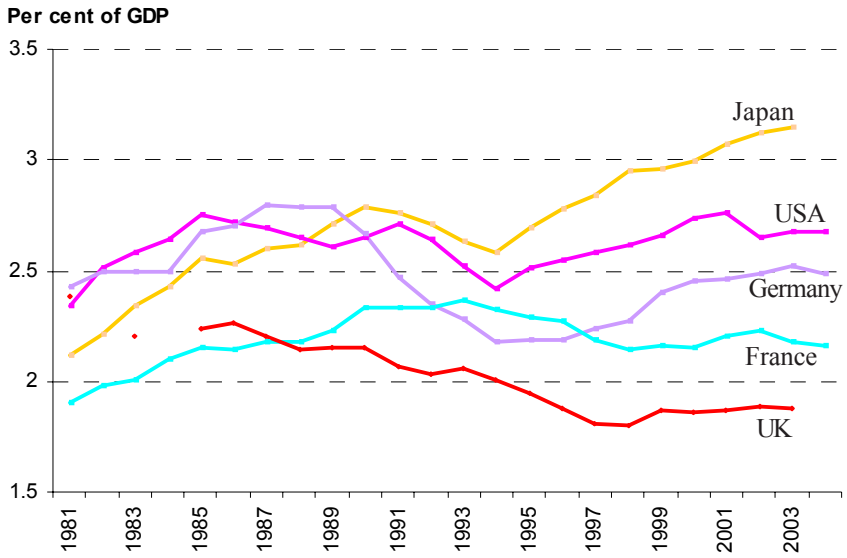
(i) The Five Drivers

In its official pronouncements the UK government emphasizes the five 'drivers of productivity growth' and, indeed, publishes periodic scorecards designed to indicate how the country is improving the strength of these drivers (DTI, 2006). They are investment, innovation, skills, enterprise, and competition. Before this particular terminology entered the policy discourse, researchers used to describe productivity growth as stemming either from gains in static efficiency or gains in dynamic efficiency. Achieving static efficiency is equivalent to what welfare economists would describe as achieving Pareto gains—that is using existing factors of production as effectively as possible. Arguably this is what much of Mrs Thatcher's 'supply-side revolution' was about—the introduction of measures to make markets operate more competitively and efficiently. Dynamic efficiency is all about investment. Physical investment in new machinery and the like may embody technical progress, in which case a new machine designed to perform the same function as the one it replaces will perform that function more effectively. Investment in knowledge (R&D), if successfully translated into organizational operations, allows labour and capital to be put to more productive use. Investment in human beings, whether in full-time education or in the workplace, increases human capital and—it is assumed—makes them more productive.

How do the five drivers fit with this typology? 'investment' and 'skills' are most clearly linked to dynamic efficiency. 'Competition' appears to be more closely related to static efficiency, while 'innovation' and 'enterprise' have both dynamic and static elements. But, of course, the picture is, in fact, more complex than that. Take the example of lean manufacturing. Presumably that would be classified as a 'static innovation'. Yet to adopt lean manufacturing techniques successfully a company might well have to make investments in technology and in skills. Or, take the example of investment in skills. Whether such investment is funded by the government or by the employer, the gains would only be fully realized if organizations actually deployed these new skills appropriately. In both cases the initial action is insufficient on its own and other actions (whether public or private) are necessary. In the first example a static 'improvement' requires accompanying investment. In the second example, an investment requires accompanying 'static' changes.

Clearly, a closer reading of government publications uncovers officialdom's awareness of this point and of the many complexities and interactions involved in the process of pulling a particular policy lever and observing the final consequences. However, in focusing the policy discourse on these drivers, we would argue that there has been insufficient attention paid to the interactions between the drivers, to the organization of work and production within organizations, and to the interaction between policy and what is actually happening within organizations. One dimension of this is the need to use more explicitly what has been termed an 'open policy framework'. This terminology is meant to reflect the fact that companies who are engaged in international competition, and particularly those who are actually or potentially internationally mobile when making decisions about the location of their production, are unlikely to be thinking specifically about how to make 'UK plc' a more a more productive or economically efficient place. Rather, they are concerned about their own competitive position, which might imply that they make decisions that are inconsistent with the government's declared strategy and rhetoric—specifically, their thinking may be much

Figure 3
GERD as a Percentage of GDP: UK vs Major Comparators



Source: OECD Main Science and Technology Indicators.

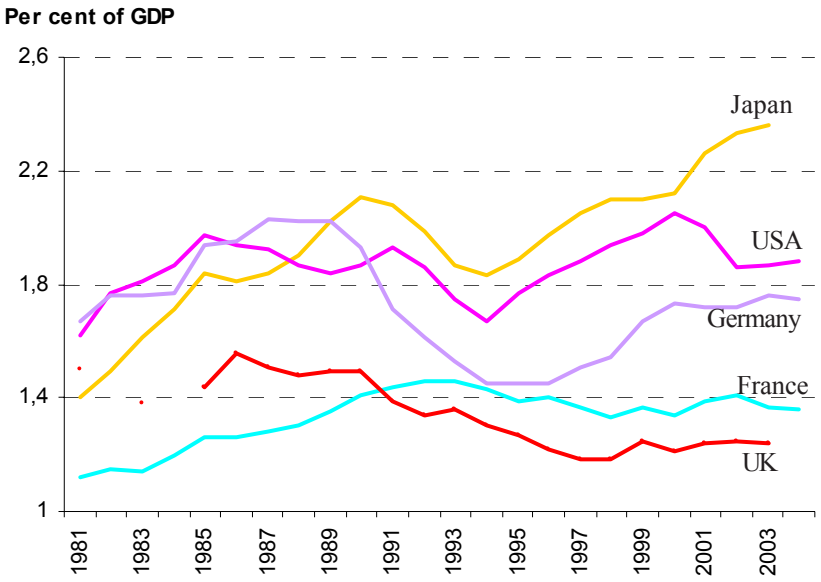
less UK-centric. In other words, there is a sort of principal–agent problem. The utility functions of the agents (individual organizations) are not the same as that of the government.

As suggested above, arguably UK policy under the Thatcher and Major governments concentrated on reforms to achieve static efficiency gains. This was the rhetoric of the supply-side revolution. Relatively little was done specifically to stimulate physical investment or investment in R&D. Or, at least, policies to improve physical investment performance and R&D performance did not, on conventional measures, appear to have had much success. Investment/GDP ratios did not improve significantly. Nor did R&D/GDP ratios. The big exception on the investment side was education and training. If anything, the post-1997 Labour government has put even more emphasis on measures to improve education and training provision. There have been significant increases in both public and private expenditure, while outcomes—at least in terms of qualifications—have improved. But more generally than this, the government has appeared to emphasize the investment/dynamic aspects rather more, as articulated in its five levers. However, investment/GDP ratios remain stubbornly low, as do R&D/GDP ratios. Figures 3, 4, and 5 illustrate the point. Figure 3 shows the significant differences in terms of inputs invested in R&D between the UK and its major industrial competitors. In the 20 years to 2003, the UK has invested, on average, 2 per cent of annual GDP in R&D. This compares with the 2.6 per cent for the USA and the 2.8 per cent for Japan. Even more striking, the UK investment as a proportion of GDP has fallen over this 20-year period, from 2.2 per cent in 1983 to 1.9 per cent in 2003, while the USA has remained stable in its commitments to R&D (from 2.6 per cent in 1983 to 2.7 per cent in 2003) and Japan has increased its investment (from 2.3 to 3.2 per cent, over the same period). Given these trends, it is difficult to see how the UK can conform either to the UK government's own target of 2.5 per cent of GDP by 2014 or the European Union target of 3 per cent by 2010.

The three significant contributors to gross domestic expenditure on R&D (GERD) are business enterprise (BERD), government (GOVERD), and higher education (HERD).[6] Figures 4 and 5 show the UK's performance on the first two of these in the last 20 years.

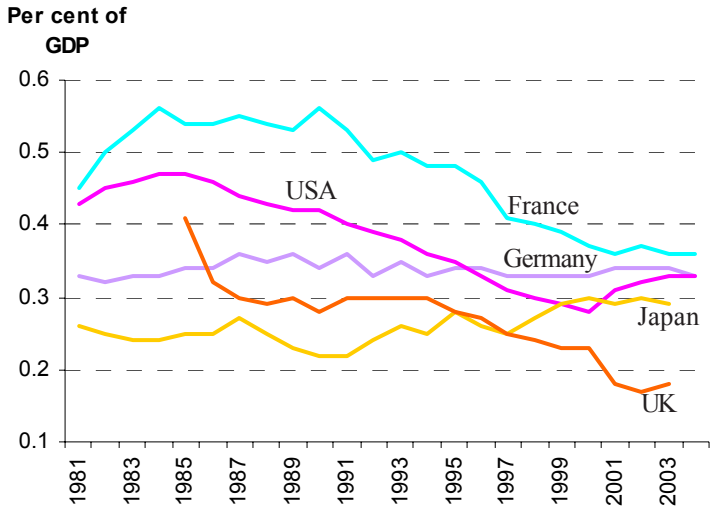
[6] There is a fourth contributor to GERD—private non-profit expenditure on R&D—but this tends to be marginal, typically less than 5 per cent of GERD.

Figure 4
BERD Relative to GDP: UK vs Major Comparators



Source: OECD Main Science and Technology Indicators.

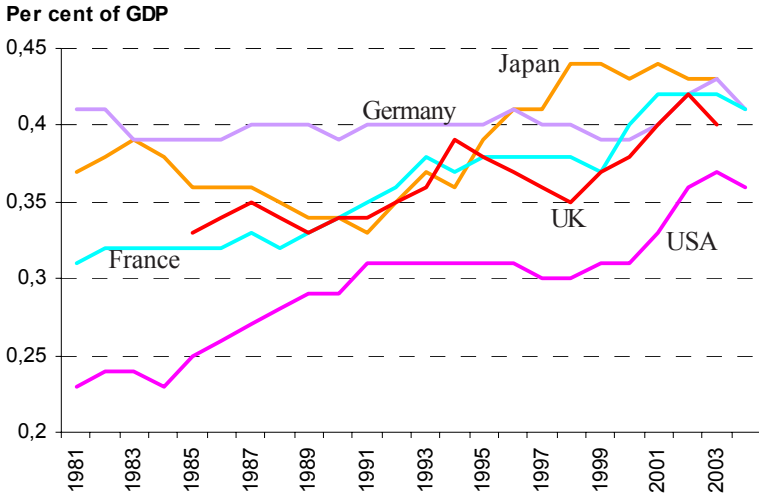
Figure 5
GOVERD Relative to GDP: UK vs Major Comparators



Source: OECD Main Science and Technology Indicators.

As Figure 4 shows, UK business expenditures on R&D relative to GDP have been decreasing (reaching a level of 1.2 per cent by 2003), while the investments made by the UK's major comparator countries have been increasing (in 2003 Germany was 0.5 per cent above the UK, while the USA was 0.6 per cent above the UK, and Japan 1.12 per cent). These differences are not a result of higher GDP growth rates in the UK relative to comparator countries, but a consequence of a lower volume of investment in R&D (relative to country size). When we look at the absolute levels of investment per capita (at constant prices), the annual growth rate in BERD per capita between 1981 and 2003 was 1.5

Figure 6
HERD Relative to GDP: UK vs Major Comparators



Source: OECD Main Science and Technology Indicators.

per cent for the UK, while the USA had an annual growth rate of 2.7 per cent and Japan had an annual growth rate of 4.5 per cent.

A similar story emerges when we look at GOVERD. As Figure 5 shows, UK GOVERD displays a decreasing trend over the last 20 years. By 2003 the UK was the country with the lowest percentage of GOVERD to GDP (0.18 per cent). This compares to 0.33 per cent for the USA and 0.43 per cent for France. Moreover, in contrast with BERD, in the case of GOVERD there is also a decreasing trend in terms of volume of investment per capita over the whole period 1981–2003.

The one exception to these trends is HERD, where the UK has followed a pattern of investment similar to that of its major competitors, both in terms of investment relative to GDP and investment per capita (see Figure 6). It is worth noting that, regarding HERD per capita, the UK has the second highest annual growth rate over the period 1981–2003, behind only the USA (3.5 per cent and 4.3 per cent, respectively).

(ii) Productivity in the Short or Long Run?

Productivity is not an end in its own right. It is a means to an end. Of particular importance here is its relationship with competitiveness. The nature of this relationship depends on whether we are considering competitiveness in the short run or in the long run. In the short run, competitiveness is about price. Everything else (labour costs, profit margins, and exchange rates) being equal, faster relative growth of productivity means an increase in international competitiveness. As Boltho (1996) discussed, competitiveness in the longer run is a more complex matter and different authorities provide rather different definitions. Following the OECD, policy-makers would be concerned to help construct an economy where British firms as a whole could maintain their shares of international markets while the gains from trade were widely distributed across the country's population. This is not the same as maintaining short-run cost and price competitiveness. Indeed, for a country like the UK, competing simply on price seems not to be an option in the modern international community, not least because the cost base of the UK is considered too high to compete with cheaper foreign locations. Even if it were an option, the consequential squeeze on labour costs would have unfortunate distributional implications. Rather, the UK needs to compete on quality and product niche. In the context of this issue there are two implications. The measurement of productivity change which makes adequate allowance for quality changes over time takes on an added imperative, simply as a matter of knowing where we are now and where we are heading. Second, sources of productivity change which are consistent with maintaining or moving towards a higher value-added strategy are to be

preferred to those which simply involve maintaining a low value-added route. This is the *social* imperative. The *private* interests of individual firms may be different. Critically, we need to be wary of policy initiatives which (wittingly or unwittingly) provide signals and/or incentives to agents in the economy that discourage or militate against moves to the higher value-added route. Or, to put the matter more positively, we need to seek out policy initiatives which positively incentivize organizations to take the higher value-added road.

IV. WHAT GOES ON INSIDE THE FIRM?

(i) Education and Training

One of the five drivers is 'skills'. There has been a huge increase in the supply of educated and trained people. The article by Ewart Keep, Ken Mayhew, and Jonathan Payne (Keep *et al*., 2006) reminds us that simply increasing the supply of educated and trained people may be a necessary condition for increasing productivity, but that it may not be a sufficient one. The key questions are how effectively skills are utilized by employers and also how motivated individuals are to use their skills. The answers will depend on a complex of factors influencing the skill intensity of the production process. The demand for skills from employers cannot be neglected. This observation is consistent with the inconclusive microeconometric evidence on the relationship between work-related training and productivity. Until recently, most of this work has been inferential, reflecting problems of collecting reliable micro data on productivity. Much of this work finds a positive relationship between training and wages, assumes that higher wages reflect higher productivity, and therefore infers a positive impact of training on productivity. In a recent review article, Edwin Leuven (2004) makes some interesting observations about this approach. He concludes that the majority of these studies, which rely on fixed-effects modelling, probably overestimate the 'returns' to training. The main reason for this is the failure of such studies to allow adequately for other characteristics of those who receive training which would make them more productive and therefore higher earners. Dearden *et al*. (2006) claim to provide direct evidence on the relationship between training and productivity 'for the first time for the UK and for the first time anywhere over a long period'. They remind us that only in a strict neoclassical model would wages be a direct measure of productivity. However, they contend, since 'increases in wages have to be paid out of productivity gains, real wage increases should provide a lower bound on the probable size of productivity increases'. They argue that the few studies which investigate the relationship directly are flawed because the training is measured at only one point in time 'and could be picking up many unobservable firm specific factors correlated with both training and productivity'. Their own modelling suggests that 'a 1% point increase in training is associated with an increase in value added per hour of about 0.6%'. However, even their methodology may be picking up some spurious effects. For example, although capital per worker is included in their regressions, it is not clear whether this is adequate to pick up the impact of capital investment, its time profile, and the possibility of embodied technical progress.

The most important point, however, is that even if some impact of training on productivity is detected, this is perfectly consistent with the argument that how much (if any) impact training has depends on the accompanying product and production strategies of the organization in which the training takes place. Thus particular increments in education and training provision cannot be guaranteed to have positive impacts on economic performance. A related issue is revealed by consideration of the adequacy of training data used. Generally, econometricians working in this area use identified training episodes as their independent variable. Of course, researchers can use only what is available, but in adopting this approach they may be only partially capturing training broadly defined. They are almost certainly neglecting on-the-job training and development, which are closely linked to the precise nature of the production process and of job design. Realization of this point, that the accumulation of human capital is in part endogenously determined, might slightly change the focus of policy.

(ii) Management Skills and Practices

Management skills and practices are analysed in great depth in this issue. In terms of the five drivers, we can think of these as falling under the general

heading of innovation and, more specifically, management innovation. Case-based data in management studies illustrate the many management innovations that have occurred in organizations, for example just-in-time production, total quality management, and business process re-engineering. One challenge for researchers is the faddish nature of these management innovations. While the underlying principles may be consistent, the persistent introduction of so-called management innovations makes their study problematic. One of the current innovations that is in vogue is Six Sigma, yet many have argued that Six Sigma is little more than a careful repackaging of quality tools and techniques that have been discussed in various guises since the 1950s. Even if tools and techniques were not constantly being recycled, it can be difficult to evaluate the real significance and impact of these developments as the same terminology can describe practices which differ greatly in their real content and appropriateness. Some data, which might allow researchers to probe more deeply into these issues, have existed within the firms for a long time, but many researchers have found it very difficult to access such data. There are a number of reasons for this. First, such data are usually proprietary and firms, not surprisingly, are concerned about the competitive implications of releasing them. Second, accessing the data requires researchers to build deep relationships with senior managers in firms, many of whom see little benefit in working with academics to explore intellectually interesting questions unless they have direct practical relevance. A number of papers in this issue make great strides to rectify this situation and allow us to start to open the black box and to investigate what actually goes on within organizations. In their article in this issue, Rachel Griffith, Jonathan Haskel, and Andy Neely (Griffith *et al*., 2006*a*), for example, look at management quality within a firm and conclude that it is a significant determinant of productivity differences between the firm's different establishments. Thus, even in a single organization which attempts to establish a common set of practices and procedures for all of its establishments, there is considerable heterogeneity of productivity outcomes. According to the data, management quality is a major factor in explaining this heterogeneity, although additional studies within the firm also highlight the heterogeneity of practice even within the same organization. Of course, the authors have to tackle the difficult, and only partially resolved, issue of how to measure quality. Eschewing input (for example, educational attainment) or process (management practices) indicators, they opt for a variety of 'outcome' indicators. Adopting a 'balanced scorecard' approach, they compare establishments on indicators such as customer satisfaction, stock availability, and operational standards. Importantly, the variables used in this study are those that have been defined as significant by the managers of the firm rather than the researchers. In essence, Griffith *et al*. (2006*a*) use data that the firm generates to manage its own performance to explore productivity variations. The great advantage of this is that the performance variables used are meaningful to the organization and its competitive context. This is something that is often overlooked in many academic studies, where more traditional, but arm's length—at least to the firm—measures of performance are proposed.

Griffith *et al*. (2006*a*) is representative of a new area of research—micro studies within firms and econometric case studies. Their study is grounded in the UK. Derek Jones, Panu Kalmi, and Antti Kauhanen (Jones *et al*., 2006) are representative of a similar approach in a different national context—Finland. They describe a series of microeconometric studies of branches within the same (retailing) firm. They find that different interpretations and implementations of a given firm's human resource management (HRM) policies by managers at individual establishments have an effect on productivity. What they describe as 'on-the-job participation' and 'information sharing' are found to be of particular significance. Thus, in contrast to Griffith *et al*. (2006*a*), they use process as opposed to output indicators. But what both studies demonstrate is the elusiveness of the concept of management quality, at least when it comes to taking external action to improve it. Managers who have the same level of training and education and who are subject to the same head office guidelines, policies, and constraints, produce very different performances and outcomes. This serves to remind us that the government's levers can have weak or uncertain purchase.

Changing management practices may be designed to extract greater productivity but they carry the danger that the actual or perceived welfare of

workers suffers as a consequence if they involve work intensification, loss of discretion, or intense supervision. This could imply indirect, harmful consequences for productivity because of the damage caused to worker morale. Nick Bloom and John Van Reenen (2006) give us partial, but not full, reassurance here. Analysing a sample of over 700 medium-sized manufacturing firms in the UK, the USA, France, and Germany, they find that management quality is associated with higher productivity, but that, contrary to the perceptions of some commentators, good 'work–life balance' practices are associated with higher management quality. Thus, they argue, this route to better productivity performance is not inimical to the quality of working life. This gives us only partial reassurance for two reasons. First, their sample is confined to manufacturing; we need to know more about other sectors. Second, their research discusses work–life balance largely in terms of family-friendly policies. While these are important, they do not cover important dimensions of modern employment—work intensification and discretion at work. Both of these dimensions are particularly important in the context of the declining influence of unions. The work of Green and others[7] suggests strongly that recent years have witnessed significant loss of discretion in a whole variety of respects—for example, the allocation of time to different tasks, the way a task is performed, and the time allowed to complete it. This development has been a feature of jobs across the whole spectrum and not just among the less skilled. The consequences for productivity are uncertain and will depend on each specific workplace setting.

(iii) Innovation and Corporate Restructuring

Moving on from management skills and practices, but still falling under the heading of innovation, we turn to some questions concerning structural change of various types within organizations. Mari Sako (2006) discusses one aspect of structural change in her article on productivity in business services. She contrasts this sector with manufacturing. Manufacturing has seen productivity growth, and the gap with the USA has been largely closed. In part this is because unproductive firms have closed in the UK. Thus productivity growth has been accompanied by a decline in employment in the sector. By contrast, in business services productivity growth has been accompanied by employment growth. It is also a sector which has witnessed substantial outsourcing and offshoring. The state of knowledge is such that we cannot precisely disentangle the various sources of productivity growth. But Sako points out that, in general terms, productivity growth can come from two sources. The first is from 'standardizing and consolidating processes'. The other is from 'moving into higher-value-added activities'. Either can occur when a firm restructures via vertical disintegration or via the unbundling of corporate functions. As far as offshoring and outsourcing are concerned, Sako raises at least three (not necessarily mutually exclusive) possibilities. The first is that offshoring allows companies to engage in a variety of forms of work intensification and HRM practices which extract greater 'effort' from the workforce. The second is that the tendency of companies to outsource certain activities to specialist business service firms allows the latter to obtain economies of scale from a variety of sorts from specialization. The third, which could be linked or not to outsourcing (or for that matter offshoring), is improvement in the 'quality' of service which allows an increase in price to reflect this higher quality and thus an increase in productivity measured on a value-added basis. She emphasizes that at the moment we do not have enough data to pin down the precise nature of these phenomena. For instance, we are surprisingly ignorant of the relative skill content of functions which are offshored. However, her article does serve to remind us of the need to think in terms of the open policy framework mentioned earlier. Organizations are not necessarily confining their thinking to the UK when considering how to improve productivity, or whether they will cut costs and maintain existing product specification, or move to higher-value-added production.

(iv) Innovation and R&D

Again exploiting firm-level data, Rachel Griffith, Elena Huergo, Jacques Mairesse, and Bettina Peters (Griffith *et al*., 2006*b*) explore another dimension of innovation for four countries—France, Germany, Spain, and the UK. They make the point that expenditure on R&D is one thing, while its implementation and exploitation is another. They set up a four-equation model to describe four stages of the

[7] See, for example, Felstead *et al*. (2002) and Green (2006).

process: the amount of effort directed towards innovation; the extent of investment in R&D; the influence of this investment on knowledge leading to process and product innovation; and the impact of this knowledge on output. Their results suggest that, in terms of productivity, Germany has little more to gain from innovation, France could gain from both product and process innovation, while Spain and the UK could gain from product innovation.

V. IMPLICATIONS

Good productivity performance is a means to an end. From the perspective of the national economic interest, it is a route towards achieving a more internationally competitive economy. Our arguments suggest that it is competitiveness in the long run that should be of more vital interest to any government than competitiveness in the short run. This has implications for both policy and research. For the policy-maker the message is to beware of measures which might encourage organizations to adopt short-run productivity-enhancing measures at the expense of 'moving up market'. In other words, productivity gains can be achieved either by increasing 'efficiency' of production for any given quality of product or by increasing quality and therefore the value-added price. There can be little doubt as to which is the preferable route. Otherwise, significant proportions of British workers will be confined to low-rewarding jobs and possibly to jobs of high work intensity and low discretion. For researchers, the message is to put more effort into getting the right measures of productivity growth which accurately reflect quality improvements. Without this, it will be difficult to monitor exactly what progress is being made.

The government realizes that it is important to be aware of the *relative* importance of the different factors that might influence productivity. This is evident, for example, in HM Treasury and DTI (2006, ch. 4), where various estimated effects of particular variables are mentioned, such estimates being typically derived from the econometric application of growth-accounting techniques. However, it is equally important for researchers to help make the government more acutely aware that the ultimate impact of, for instance, any given increase in training or education or in spending on R&D depends critically upon complex, interwoven strings of causation which are not necessarily constant over time. Getting within the black box of the organization will help us unravel some of these strings. We see significant variations even within a very homogeneous set of branches of an individual organization. This is where micro case studies and micro-econometric case studies are starting to be of assistance. But these are very early days.

It is also important to consider the role of national policy in light of globalization and the trends towards offshoring and outsourcing. Today's global businesses are choosing to source support from a wide variety of geographical locations. India and China are rapidly emerging as significant centres—both of this support and of knowledge production more generally. The challenge for the UK is to consider whether the country should adopt a competitive or cooperative stance with regard to these economies. The traditional model of policy formulation asks *what should the UK do*. An alternative model would ask *how can the UK leverage developments in other countries*. Does the UK need to encourage concentration on all five of the Treasury's drivers to close the productivity gap, or would it be better advised to explore how it might collaborate with other countries to share the burdens of investment. This is tantamount to policy-makers adopting an 'open policy' framework in the same way that many firms are now describing their innovation activity as 'open innovation'. Firms recognize that they do not have the monopoly on good ideas and innovations. Instead, they have to build the capability to access the innovations of others and, in return, allow others to access their innovations. If the same thinking process were adopted for policy, then the challenge for the UK would be how the country can access the investment, innovation, skills, enterprise, and competition developed by other economies.

Such thinking requires a significant shift towards joined-up policy. Yet one of the constraints that hinders this is the fact that different arms of government have responsibility for different policy drivers. The Department for Education and Skills, for example, is charged with increasing the stock of educated and trained labour. The Department for Trade and Industry lays claim to innovation policy and business regulation, which clearly links to enterprise and

competition. Yet who is responsible for trying to ensure that these policies are aligned and their impacts adequately exploited? The DfES might worry about increasing the stock of educated and trained labour, yet which government department worries about whether this trained labour has the right skills and whether these skills are being adequately utilized in the workplace? If the DTI 'owns' innovation policy, who ensures that it is enacted? In every recent innovation policy paper there has been a call for the government to use its significant purchasing spend more strategically to stimulate innovation. Yet there is little evidence that this call is ever heeded, either by government departments or by those that they are trying to influence.

Perhaps this is the key point made in this issue—namely, that simplistic attempts to pull policy levers as if they were independent of one another and of other global developments is naïve. It is high time the UK moved to a more nuanced policy debate that recognizes the heterogeneity of practice and implementation, the importance of globalization, and the fact that simple thinking in terms of policy drivers is unlikely to result in sustained and sustainable success. On balance, the research evidence clearly suggests that it is investment in its many forms that is most likely to secure productivity gains in the long run. The challenge for policy and practice is how to ensure that such investments are coordinated and integrated to maximize their value and impact.

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