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DISCUSSION 8

Chairman: S. B. Saul

Prepared comments: D. Landes

Landes: The coal and steel sections of the paper are not strictly comparable. The argument in the section on coal uses labour productivity, while that on steel uses total productivity. One question that comes to mind, then, is whether using labour productivity in steel might not give rather different results. In the section on coal McCloskey begins his argument by observing that 'average product fell, to be sure, in England, but it fell or stagnated everywhere in Europe before World War I, and therefore does not suggest any peculiar British failure.' This observation is based on Taylor's table of average labour productivity per man, and while McCloskey is, literally speaking, correct, his interpretation is a strange one in an otherwise carefully quantitative paper. The variations in behaviour brought out by the table are more striking than the particular uniformity he used. For example, in Germany labour productivity does level off after the 1880s, but over the whole period from the 1870s to the War there is a rise in productivity of one third. Over the same period, American productivity in bituminous coal doubles, while British productivity suffered a slight net decline.

In the subsequent calculations of the importance of the two geological factors in coal mining, thickness and depth of seam, a great deal depends on the particular elasticities chosen. In the argument on this point, McCloskey uses two small samples, which imply elasticities of output per man with respect to seam thickness ranging from 0.5 to 1.2. The calculation then proceeds on the assumption that the elasticity is 'around 1'. If the elasticity of 0.5 had been chosen instead, the significance of seam thicknesses in explaining output per man would be cut in half.

Having arrived at some estimates of the elasticities, the question becomes what the differences in the thickness and depth of seams actually were. Here McCloskey uses data from the 1920s, when they first became available. In applying these data to the Anglo-American comparison in 1907-9, however, the difficulty arises that British seams were becoming thinner and deeper as time went on, whereas American seams, it is argued in the paper, were not. The sharpness of the contrast in geological conditions, then, may not have been as great in 1907-9 as it was in the 1920s, and the power of the geological explanation is reduced, by an unknown amount.

The methodology underlying the calculations for coal raises some other questions. Taylor gives prominence to the increase in absenteeism in British mines. What one would like to see is some attempt to bring variables such as these, some of which are perhaps less quantifiable than absenteeism, into the analysis. The importance of other factors than the geological is suggested, too, by the great regional variations exhibited in one of Taylor's tables in the rate of growth of output per man in Britain in the late nineteenth century. By 1924, the paper notes, British output per man was uniform among districts, with mining concentrated on seams with similar geological characteristics. But the evidence from Taylor suggests that the correlation between geological conditions and output per man derived from the 1924 data might not hold at earlier times. That is, some factors other than geology were at work.

In the steel industry the argument is based on total productivity, measured, assuming that the industry was competitive, by the ratio of the prices of pig iron input and of steel output. The essential results are exhibited in Table 3. One problem with this procedure is that the ratio might fluctuate from year to year, leaving one in doubt as to which year to choose for the comparison. And, in fact, in McCloskey's Ph.D. thesis, from which the argument on the steel industry is taken, there appears a chart of the marginal product of pig iron in the production of steel, which does show substantial fluctuations from year to year. Another problem is that the measure focuses on steel alone: one might wonder, for example, whether similar results would emerge from a study of the industry as a whole, including pig iron.

There are a few larger issues suggested by the paper. Is it really relevant to compare British with American, rather than German, performance? The traditional story of the enormous superiority of American technology must certainly be revised in light of this and similar papers, but it remains to be seen whether the alleged German superiority was also illusory. Finally, McCloskey is troubled by the large residual gap in productivity between countries that Denison finds, and argues that such differences cannot be believed. If one starts from the other point of view, however, and believes in differences among people in different countries and the slowness of the transmission of technology that these differences imply, then the large residual gap in productivity is not troubling at all. This position, of course, is a matter of faith. But so, too, is McCloskey's position that the differences are unbelievable and must be explained.

McCloskey: On the issue of the view of the world or working

hypothesis with which one starts, his has the advantage that it has observable implications. If you suppose to begin with that technology is international, you have a concrete standard against which to judge the truth of the supposition, by seeing whether you can or cannot explain international differences in total productivity. This may have something to do with the way the burden of proof is left with these who doubt rather than with those who support the hypothesis of entrepreneurial failure: the working hypothesis of the latter group gives them few ways of proving the truth or falsehood of their position.

The coal and steel sections of the paper do not really use different methodologies. The one uses average product and the other marginal product, but there is between these two what mathematicians call a relationship of 'duality'. The simplest way to see that this is true is to consider the simple case of one input, call it 'L', which is purchased at the wage 'w', and one output, call it 'Q' which is sold at a price 'p'. In competitive equilibrium there are no supernormal profits, so $PQ-wL = 0$. That is, $pQ = wL$, or $Q/L = w/p$. This last says that the average product of labour (Q/L) is the same as the marginal product (w/p). A change or difference in the average product would therefore equal a change or difference in the marginal product. In the general case, in other words, a measure of productivity based on quantities (a generalized average product) would give the same result as one based on prices (a generalized marginal product). The first part of the paper uses a quantity measure and the second part a price measure, but there is no difference in principle or in the results that they would give between the two.

It might be useful to mention the economic assumptions that lie behind productivity measures in this paper and in the others concerned with productivity at the conference. First, the industry is assumed to be perfectly competitive, so that no monopoly profits are being earned and, in the one-factor case, $pQ = wL$. Second, to make certain of this last result, long-run equilibrium is assumed. No Marshallian quasi-rents are being earned: entrepreneurs have had time to adjust their employment of each factor to the desirable level given the prices of the factors and the price of the output. Third, to facilitate the calculation given the difficulty of finding yearly data on the shares of the factors of production in costs, the shares are assumed to be constant. An equivalent assumption is that the production function of the industry is of the Cobb-Douglas form.

Feinstein: Returning to one of Landes's points, it was not helpful to

make comparisons in the British coal industry with the United States. Conditions were so different there that one learns very little from the comparison. Germany would be a more sensible choice. Furthermore, the argument of the paper is that by 1907 the British industry could do no better. But in fact in later years it *did* do better. The question is, then, were there improvements that were achieved after the War that could have been achieved before it?

McCloskey: Feinstein's question was identical to the one he had asked in the paper. The question that is answered by a productivity calculation is precisely: was some other technique of production (in this case the American) superior to the one used in Britain? And the calculation involves the same logic, too, if the question is one of profitability, as in the paper by Lindert and Trace. The comparison with the United States is relevant (although, of course, it would be desirable to bring Germany, Belgium and France into the comparisons as well) because the United States had so much higher labour productivity in coal that contemporaries and historians have taken it for granted that technology there was superior, while conceding that geological conditions were better in the United States. The point of the paper is that the geological conditions can explain the entire large difference in labour productivity. Although some doubt is cast on the calculations for 1907-9 that used post-war data on geological conditions, the change in conditions in fifteen years are not enough to alter the results significantly.

Trace: There would have been pressure to open up new fields, as in Kent and the Midlands, which may indeed have altered the results.

McCloskey: These fields were known very early, and were in fact exploited when it became profitable to do so. As was argued in the paper, the British industry was geographically concentrated by comparison with the American industry and there was therefore strong pressure to open up new fields gradually as the balance of geological conditions warranted. This point answers one of Landes's questions as well. The paper did not say that geological conditions were uniform, but only that in all mines the increment to labour productivity from exploiting thickness was carefully balanced against that from exploiting shallowness. In the United States, by contrast, mining was widely scattered and many mines that worked seams that were both thin and deep could survive: there was more deviation possible from a single line of equal average product as a function of depth and thickness.

Thomas: It is not clear how the physical conditions could be separated from entrepreneurial performance in the explanation of average product per man.

McCloskey: The purpose of the paper is to estimate the magnitudes of the geological effects. The argument, then, is that once these have been properly measured there is no residual productivity difference to be explained by entrepreneurship.

Landes: He objected to precisely this residual procedure. If one started with the entrepreneurial explanation, one could exclude geological conditions just as well.

Lindert: Landes's point could be made in another way: even if 100 per cent of the difference was explained, it would still not follow that the one factor, entrepreneurship, was unimportant, so long as there were still other factors to be taken into account.

McCloskey: The point he began with was relevant here: if one does start with the entrepreneurial hypothesis, there are no guides as to how to put the argument in quantitative form.