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THE WARP AND WOOF OF PRECOLONIAL AFRICAN INDUSTRY

By Patrick Manning

John Thornton presents us with threads of evidence and a loom of analysis: he proposes to weave for us a tapestry of scholarly advance on the nature of precolonial African industry. His approach, however, draws us into knots of analytical confusion along the way.

His objectives are surely laudable: "a reexamination of the entire issue of precolonial African manufacturing and trade" and "a different approach to African choices in technology." He makes an eminently sensible choice of three productive spheres on which to concentrate — agriculture, metallurgy and textile manufacture. He has worked energetically to retrieve relevant passages from scattered and obscure early sources. Equally on target is his selection of productivity and technology as the factors to analyze.

Thornton's thesis, as I understand it, has three components. First he argues that, empirically, labor productivity in African agriculture was high by world standards, and that labor productivity was also high in African metallurgy and textile manufacture, despite the simplicity of African tools. He thus counters the deductions of previous scholars (notably Jack Goody), who have argued that the productivity of African labor was low because hoe agriculture did not permit as much output per labor-hour as did the plow agriculture of other continents.¹ Second, Thornton then theorizes that Africans did not adopt mechanized production techniques precisely because of the high productivity of labor under their existing system. Third, he asserts that the growth of precolonial African textile imports resulted not from the stimulation of new demand for textiles from unclothed Africans, but from the extension of an already lively African textile market.

I find the first two parts of the thesis to have been ineffectively presented and almost certainly incorrect; the third part is probably correct and verifiable, yet it is practically unrelated to the first two. My focus in this commentary, meanwhile, will be on the analysis of productivity.

¹ Jack Goody, *Technology, Tradition, and the State in Africa* (Cambridge, 1971), 24-26.

Thornton's careless analysis of productivity undermines his study on three related counts. First, the early authors on whom he draws were imprecise, not surprisingly, in their statements on African productivity. The key quote Thornton provides is from Giovanni Francesco da Roma, writing on Kongo in 1645: "their manner of cultivating the soil does not require much work. . . . In return for this little effort, they reap most abundantly" (quoted on p. 6 above). Then Thornton cites similar statements by Alvise da Mosto in 1455 and Pieter de Marees in the early seventeenth century, and asserts that all are statements of labor productivity. The point is not proved, however, because these vague statements in the sources encompass and confound a wider range of issues in productivity: labor, land, tools, and seed.

Second and more generally, Thornton utilizes many distinct definitions for the term "productivity," and creates confusion in his uses of the terms "technology" and "efficiency." Third, Thornton appears to be attempting, simultaneously, a long-term analysis of African technical change and a short-term analysis of African labor productivity, without distinguishing the concepts and definitions appropriate for each analysis.

By focusing on the term "productivity," and by associating it with the terms "technology" and "efficiency," Thornton has invoked microeconomic theory. This would seem appropriate for an article in an economic history journal. But having invoked the theory, he does not apply it, and leaves the reader *qua* economic historian in a state of analytic perplexity. Microeconomics provides a theory of short-term economic change; Thornton's discussion is both short-term (as in his discussion of annual agricultural output, when technology is fixed) and long-term (when technology is variable).²

The term "technology" has a special use in microeconomics. In everyday parlance and in studies of material culture, technology refers to the tools and machinery used in production. In microeconomic theory, however, the technology in any process of production is, most simply stated, the combination of the various inputs in the production of an output. (The more detailed statement of technology tells us *how* the inputs are combined, and gets us back to the tools and machinery.) Thornton's use of the term "technology" in this article is mostly restricted to the degree of mechanization of production: it could be thought of as a capital-to-labor ratio. When Thornton asserts that scholars have used technology as a "proxy" for productivity (p. 5), he is suggesting that this capital-to-labor ratio is used as a proxy for an output-to-labor ratio; he is of course right that the proxy would be a poor one.

² For these points and for much of the discussion below, I have relied on James M. Henderson and Richard E. Quandt, *Microeconomic Theory*, 3rd ed. (New York, 1980). Any other standard text will do as well.

Efficiency in technology, in these terms, refers to maximizing the amount of output produced with any given combination of inputs. Production can therefore be efficient, even at low levels of productivity, if the given inputs are used so as to maximize output at the given level of technology. Thornton, however, persists (for example, p. 8) in using the term "efficiency" as a synonym for "high productivity," referring, apparently, to the productivity of labor. In this and other cases, he is referring to comparisons of different levels of technical sophistication, and is therefore implicitly doing a long-term analysis in which the technology of production is variable.

Productivity is a trickier concept than technology or efficiency: it is a ratio of output to input, but the ratio can be constructed in several different ways. What is normally called *productivity* is the ratio of the quantity of total output to the quantity of a given input: thus, the labor productivity of textile production could be calculated as meters of textile output per hour of weaving labor. More precisely, this calculation is *average productivity* or *average physical productivity*. (The calculation assumes that the quality and quantities of all other inputs are held constant during the calculation, and it tends to assume that production is carried out with maximum technical efficiency.) Even in this formulation, therefore, a productivity may be calculated for each input in production of a given output. Thus, we may estimate the productivity of labor, land, tools, and seed in the production of grains. Further, if the productivity of improved land in agriculture is high, for instance, that is no guarantee that the productivity of labor in the same process is high.

The second formulation of productivity is in marginal terms: *marginal productivity* is the additional quantity of output resulting from the addition of a given unit of an input, with all other inputs held constant. (In general, marginal productivity may be higher or lower than average productivity.) At times the reader may be unsure whether Thornton is discussing average or marginal productivity (see, for example, p. 16). A third formulation of productivity is in terms of revenue product: assuming the output is marketed, the *marginal revenue product* is the additional revenue gained from the addition of a unit of input, with all other inputs (and prices) held constant. Thornton utilizes this notion of productivity without signalling it when he suggests that "No matter how good African steel was, if it could not be produced in sufficient quantity to meet demand, its price would inevitably rise and allow inferior foreign iron to be imported" (p. 9). Still other formulations of productivity have been developed, and may be of relevance to this topic.³

³ A related but more complex issue, relevant to goods sold in the market, is profit maximization. Under conditions of perfect competition, and with all other inputs held constant, the producer should continue to add more of an input until the price of the input, divided by its marginal productivity, equals the price of the output: this relationship shows that output price and input productivity tend to be inversely proportional. Another formulation of profit maximization

Meanwhile, productivity calculations are virtually always based on the assumption that the *quality* of both inputs and outputs remains unchanged. Logically, one might suggest that productivity increases when a given combination of inputs creates a higher quality (but unchanged quantity) of output. The lack of sound measures of quality, however, means that such calculations are almost never made. Thornton's discussions of the quality of African manufactures, while of interest, have little to do with productivity in the usual economists' sense of the term.

After this detour through some standard definitions, let us return to the threads of Thornton's analysis. Thornton asserts, as I noted above, that da Roma's assessment of Kongo agriculture in 1645 reported a high labor productivity (p. 6). In the next paragraph, he reports that da Mosto and de Marees made similar statements, then paraphrases Muller as saying that "fairly light work in agriculture resulted in yields of maize and local millet that gave a hundred-fold increase" (p. 7). While the statement includes a reference to light work, the hundred-fold increase sounds like an increase over seed, and refers in that case to the productivity of an input other than labor. In the next paragraph we get references (for Gold Coast) to the agricultural productivity of land, yet another input (p. 7). Thornton's case for high productivity in agriculture ends with figures for Angola, where these again are land productivity (p. 8).

It would be heroic to conclude from these six statements that African agriculture was generally high in its labor productivity. Yet on page 16 Thornton asserts that, "If agricultural productivity is high (and we have seen that it clearly was higher in Africa than in Europe), moreover, the amount of time that part-time workers can devote to manufacturing is greater than when agriculture demands more time and effort." But his attempted demonstration of high African productivity, as I have just noted, is as much in yields per hectare as in output per hour of labor: high productivity of land (or of seed) could just as well mean low labor productivity, since the inputs may substitute for each other in part. Further, Thornton does not propose a detailed picture of the alleged high labor productivity in African agriculture: how physically was it that an hour of African labor with a hoe could produce more calories than an hour of European labor with a plow?⁴

Thornton's discussion of productivity in metallurgy (p. 9) is remarkable in that it includes no statement on ratios of output quantity to input quantity. The only

conditions is that the producer should expand all of his inputs (in their most efficient combination) until the marginal cost of purchasing more inputs just equals the marginal revenue obtained from sale of the product.

⁴ Here I should be frank with the reader and note that I have proposed an interpretation of slave trade based heavily on the assumption of low labor productivity in African agriculture and industry. Manning, *Slavery and African Life* (Cambridge, 1990), 33.

figures invoked refer to quantities of steel output in Togo, with no reference to inputs. The argument rests entirely on the high quality of African metal goods and on African reliance on small furnaces or the "non-technological approach to steel making."

Turning to textiles, Thornton again emphasizes the high quality of output — a valuable point, but not readily amenable to discussion in terms of productivity. His estimates of the quantity of textile production in Momboares are imposing, but they tell us little of average labor productivity.⁵ Still speaking of textiles, Thornton argues that, "One of the principal reasons that hand workers . . . could compete with machine produced goods is that the labor offered by part time workers was cheaper than that of full-time specialists" (p. 15). But the implication here is that the wages of these workers were low because their productivity was low. Other and more complex arguments could be constructed, but Thornton has sought to use this statement in support of the notion of high labor productivity in Africa when, on the face of it, it does the opposite. By the same token, Thornton feels free to assume a low labor productivity in textiles right beside a high labor productivity in agriculture: a situation which, if it existed, ought to bring rapid labor migration.

Taken together, Thornton's empirical and analytical observations on productivity are disconnected, incommensurate, and occasionally erroneous. To clarify the history of precolonial African industry, Thornton should formalize his reasoning. When attempting to show that productivity of precolonial African labor was high in the short run, Thornton should use the framework of microeconomics, and should sort out, in each of his three industries, the productivity of labor, land, tools, and other inputs, with attention to the various formulations of the term "productivity." In particular, as I suggested above, his scenarios of high labor productivity in agriculture and textiles should include some specific — even if imaginary — examples of how production with African levels of labor and machinery could have resulted in high output per hour and a high implicit wage level. When attempting to show that high labor productivity inhibited development or adoption of mechanization in production, he should refer explicitly to one of several economic theories of technical change and investigate the relevant variables.

Happily, the flaws in Thornton's analysis of productivity do not invalidate his concluding suggestion on trade (pp. 17-19). In agreement with Thornton, I believe that African imports of textiles and metals supplemented local commerce rather than opening markets where none existed before. In contrast to Thornton, however, I do not see how his reasoning on productivity and technology — even

⁵ Thornton does construct a very broad index of average labor productivity when he estimates that 250,000 people in Momboares produced 300-400,000 meters of cloth per year, where 250,000 people in Leiden produced about 100,000 meters of cloth per year. This is a start; it would be better to have estimates of the number of textile workers in each region.

presented in the best light — gives any additional support to the commercial observations in his conclusion.

Because of the limits of his analysis, Thornton has pulled the threads of his materials neither into a neat bow for each topic nor into a fabric broadly interpreting precolonial African industry, but into an unwieldy set of knots. It may be true, of course, that other scholars will find Thornton's knots to be a more attractive target for their energies than neat bows or elegant fabrics, and that the field will benefit from such wider involvement: such is the implicit suggestion of this symposium.

I was once told, and have often repeated, the story of the math teacher who taught two sections of a given course. In one section he presented his derivations and examples clearly and correctly; in the other he made endless errors, large and small, so that the students frequently had to interrupt and correct him. When it came to exam time, of course, the students in the second, error-ridden class did better than those in the first because they had been thinking more critically.

I always used to end the story by asking my listeners (often they were teachers) which way they thought the mathematician taught the class the next time. Now, in addition, I want to know whether he cleaned up the thinking in his articles before sending them off for publication.