

DECEMBER 2017 | NUMBER 93

The Arrival of Fast Internet and Employment in Africa

BY JONAS HJORT, COLUMBIA UNIVERSITY; AND JONAS POULSEN, HARVARD UNIVERSITY

Traditional trade theory predicts a decrease in inequality in developing countries during periods of integration in the global economy. The slow economic progress of poor workers in many parts of Africa, Asia, and Latin America in the last few decades therefore surprised economists. Two potential explanations were proposed and compared: skill-biased technological change and features of international trade—such as outsourcing and quality upgrading—that could alter the logic underlying expectations of job growth and greater equality in unskilled labor-abundant countries postintegration. Two decades of research led to wide agreement that both explanations play a role, and that they probably interact. But this conclusion was built on studies of trade-induced technological change. To date, there is no direct evidence on how the average and distributional economic effects of the spread of the modern information and communication technologies (ICT) in poor countries help explain the increasing

inequality in the labor markets of rich countries.

In our work, we estimate how fast internet—as some might say, the greatest invention of our time—affects the economies of poor countries. To do so, we compare individuals and firms in locations in Africa that are on the terrestrial network of internet cables to those that are not. We compare these two groups during the gradual arrival in coastal cities of submarine cables from Europe that greatly increase speed and capacity on the terrestrial network. We show how employment rates, occupational employment shares, job inequality across the educational attainment range, and the underlying extensive (internet take-up) and intensive (internet speed) margin respond. We also show evidence on three particular mechanisms through which take-up and speed may affect employment: changes in firm entry; changes in productivity in existing firms; and changes in exporting. Finally, we show how average incomes and wealth respond in locations that see changes in employment patterns with the arrival of fast internet.

It has been difficult to study skill-biased technological change directly because, other than in local experiments, ICT technologies are not randomly allocated but are introduced where economic benefits are expected. Although this manner of introduction is true everywhere, developing countries additionally tend to lack systematic and detailed labor market and firm-level data, especially in the poorest regions of the world, where the economic environment differs the most from the West. We overcome the first obstacle by interacting time variation generated by the gradual arrival of submarine internet cables in landing point cities on Africa's coast in the late 2000s and early 2010s with cross-sectional variation in whether a given location is connected to the terrestrial "backbone" network that starts at the landing point cities. The fact that a given submarine cable reaches different countries at different times and in a geographically determined order and the fact that we consider 10 different cables lowers concerns about nonparallel prior trends in economic outcomes in locations on versus off the backbone network. The collection of datasets we use enables an extensive battery of tests that support a causal interpretation of our results.

We overcome the second obstacle by combining employment data from representative household surveys from 12 African countries with a combined population of roughly half a billion people with firm-level datasets from Ethiopia, South Africa, and a group of 6 African countries. We use the firm-level data to show evidence on three especially important mechanisms—firm entry, productivity, and exporting—through which fast internet may affect employment. We also use data on internet speed and take-up of the internet to tie the reduced firm estimates to the intensive and extensive margin of use. Finally, we use individual-level data on wealth and data on light density at night from satellite images to study how fast internet ultimately affects average incomes and wealth.

Our approach differs from much of the related literature in that employment rates, rather than wages (among the employed), are our primary outcomes of interest. This difference in approach is partly for data availability reasons, but it is also a sensible choice in the context of a developing region. "Job inequality" captures inequality in human capital accumulation, future labor market prospects, and income that is due to current (un)employment—a component of first-order importance in Africa that focusing on wage inequality would miss—and the "quality" of the individual's job (if any). Moreover, changes in the probability of a worker being employed in a position belonging to a given type of occupation are informative not only of demand for qualified workers, but also of

trends in "structural change" in developing economies.

Our three main sets of results are as follows. First, we find that the probability that an individual is employed increases by 4 percent or more when fast internet becomes available. We show that the increase in employment in connected areas in the first group of countries covered by our household survey datasets and in South Africa is not due to displacement of jobs in unconnected areas, but that such displacement may explain some (though not all) of the especially large estimated effect in connected areas in the second group of countries.

Second, we find that the probability of being employed in a position belonging to a skilled occupation increases and the probability of holding an unskilled job decreases when fast internet becomes available in Africa. Although the impact on overall trends in structural change is likely modest, fast internet appears to shift employment shares somewhat out of low-productivity occupations (such as small-scale farming and elementary work) and toward higher-productivity ones.

Third, inequality in employment outcomes falls when fast internet arrives in Africa. In South Africa, it is those individuals who completed primary or secondary school who see an increase in any employment and skilled employment. In other African countries, the employment rate increases for those individuals with primary, secondary, or tertiary education, but skilled employment increases most for those individuals with secondary or tertiary education.

To compare these results with the existing evidence on recent skill-biased technological change in developed countries, we distinguish between the skill level of jobs and workers. Our findings suggest that fast internet in Africa affects employers' relative demand for skilled and unskilled positions similarly to "computerization" and broadband internet in rich countries, although the increase in employment in skilled occupations is notably bigger in Africa. In contrast, while ICT tends to increase inequality across the educational attainment range in rich countries, fast internet decreases (un)employment inequality in Africa. In South Africa, the technology also enables workers of low and intermediate educational attainment to shift into higher-skill jobs to a greater extent than highly educated workers. These results underscore the idea that the factor bias of new technologies varies by context.

The changes in employment patterns that are observed when submarine internet cables arrive in Africa occur through a combination of extensive margin (new users) and intensive margin (different use of the internet by existing users) responses. We find a significant increase in firm entry (in South Africa), especially in sectors that use ICT

extensively (e.g., finance), and in the productivity of existing manufacturing firms (in Ethiopia). The latter finding comes from a procedure in which we first estimate how factor output elasticities change with fast internet, controlling for a possible simultaneous change in firm-level productivity to uncover the technology's (positional) skill bias in Ethiopia. In the last step of the procedure, we impose additional structure to estimate how firm-level productivity responds and find a significant increase. We also use firm-level data from World Bank Enterprise Surveys to show that exports, website communication with clients, and on-the-job training increase among firms in Ghana, Kenya, Mauritania, Nigeria, Senegal, and Tanzania after they get access to fast internet.

In sum, the evidence we present indicates that greater and cheaper access to information and communication due to availability of fast internet increases employment rates in Africa, and that in at least some countries, this happens in part because of the technology's impact on firm entry, productivity, and exports.

NOTE:

This research brief is based on Jonas Hjort and Jonas Poulsen, "The Arrival of Fast Internet and Employment in Africa," National Bureau of Economic Research Working Paper no. 23582, July 2017, <http://www.nber.org/papers/w23582>.
