Food Abundance and Violent Conflict in Africa: Response to Marshall Burke's Comments

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In his comments on my article, Marshall Burke highlights the valid issue of effect size. First, note that as the reference points are very small given the number of annual grid cells and the rarity of conflict cases across all cells, the average number of annual cell-level conflicts is only 0.228, which ensures that a prediction of even one conflict per cell-year corresponds to an increase of $\sim 439\%$ from the baseline average conflict level across all cells. Hence, a 1,500% increase means a substantive increase of approximately 3.42 incidents. With that in mind, this note offers three possible explanations in response to Burke's critique.

1. *The data-generation process.*

   The time series used in the article was created by Ray et al. (2012), who relied on the methods developed by Monfreda et al. (2008, 9): "Yields are in metric tons per harvested hectare, and equal the annual total production in a political unit divided by the total harvested area." Ray et al. (2012) made a specific effort to measure not only large-scale production, but also food grown and harvested by individual households. This increases precision, and allows Ray et al. (2012) to identify production even in 0.08 $\circ$ pixels where other datasets could not. In doing so, these data also capture small-scale production

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quantities that are very sensitive to rainfall variations, and hence – when instrumented using rainfall-based indicators – can have large effects on conflict frequency.

2. *Aggregation choices*.

   When averaging yield levels to the 0.5 ∘ level, I divided the total annual yield for each crop by the total number of pixels within a given cell. This was done to construct an average annual yield per cell measure (metric tons per harvested hectare) that is unaffected by the size of each cell. While aggregation choices should not affect statistical significance, they can influence effect size. An alternative choice is to aggregate the data by dividing them by (log) area of a given grid cell (in kilometers). In this case, the wheat coefficients are 53.17 and 41.86, and the maize coefficients are 78.88 and 59.19 for the baseline and full models, respectively. All coefficients maintain their p values.

3. *The instrumental variable*.

   The coefficient sizes can also be explained by the reliance on drought as the instrument. The instrument might pick up shocks that are severe enough to lead some farmers to abandon their crop entirely. The reliance on a categorical rather than a binary drought measure (as done in the article) should help to alleviate this concern, but perhaps not entirely. Table 5 of the article shows that in the GMM models, which rely only on internal instruments, these effects are much smaller. Nevertheless, each crop's coefficient remains positive, statistically significant, and substantively meaningful, although to a lesser extent.

Beyond the immediate linkages between agricultural productivity and conflict, these findings highlight the importance of context. As McGuirk and Burke (2017) show, lower productivity might depress rural conflicts but increase the probability of urban violence. I therefore agree with Burke that "as with food prices, local-level shocks can push different types of conflict in different directions for different actors."

McGuirk, E., and M. Burke. 2017. "The Economic Origins of Conflict in Africa." National Bureau of Economic Research Paper No. w23056. http://www.nber.org/papers/w23056.

Monfreda, C., N. Ramankutty, and J.A. Foley. 2008. "Farming the planet: 2. Geographic distribution of crop areas, yields, physiological types, and net primary production in the year 2000." Global biogeochemical cycles 22.

Ray, D.K., N. Ramankutty, N.D. Mueller, P.C. West, and J.A. Foley. 2012. "Recent patterns of crop yield growth, stagnation, and collapse." Nature Communications 3:Article N. 1293.