Where mining takes place, food production takes a hit in Ghana

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The device you are using to read this blog contains at least a dozen different types of minerals, many of which most likely come from modern large-scale mines in developing countries. As these mining operations tend to be located in poor rural locations, the question of how neighbouring populations are affected by their expansion becomes an interesting one. The answers can be varied and very policy-relevant.

A good starting point is to identify the several channels that can be at play. The local economy can benefit from market interactions (e.g. employment or procurement of locally produced goods and services) or from profit redistribution (directly, through dividends, or indirectly, if local governments receive a budget windfall from royalties or other taxes). On the other hand, the local population can suffer if mining operations are associated with land grabbing, the displacement of population, armed conflict, or exposure to environmental pollution.

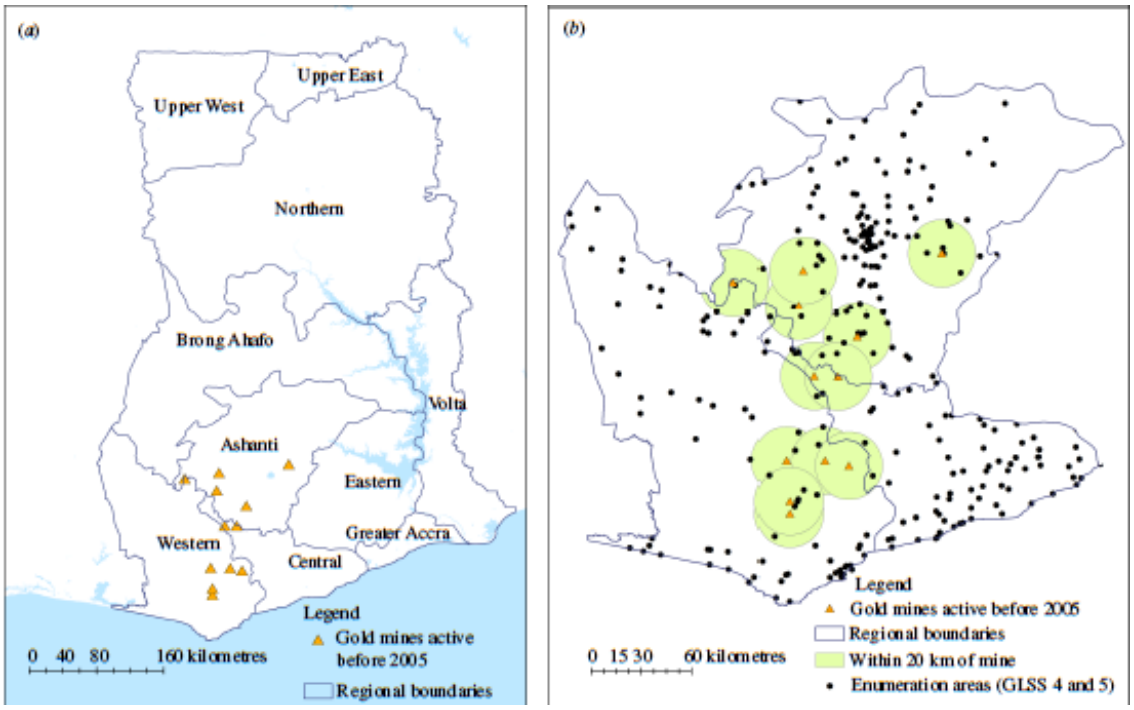
To explore these issues, we investigate the effects of the expansion of modern gold mining activities in rural Ghana between 1997 and 2005. Our study shows that in some cases, the negative effects may offset the benefits from extractive industries, and hinder the ability to compensate affected populations. Consequently, mining activities may have substantial redistributive effects. In particular, we find that farmers within 20 km of mines saw their agricultural productivity reduced by almost 40 per cent. There was also a reduction in agricultural output, and an increase in rural poverty. While the central government has benefited from windfall revenues coming from royalties, affected populations have not seen much of that money.

How can we explain the negative effects? We explore potential mechanisms and conclude that environmental pollution is the most plausible explanation. Other channels, such as changes in farming activities or in the composition of agricultural workers, cannot account for our results.

Figure 1 shows the location of gold mines and households we use in our study. We use data for the regions of Ashanti, Central and Western (panel a). Gold mines are located near fertile agricultural lands where important cash

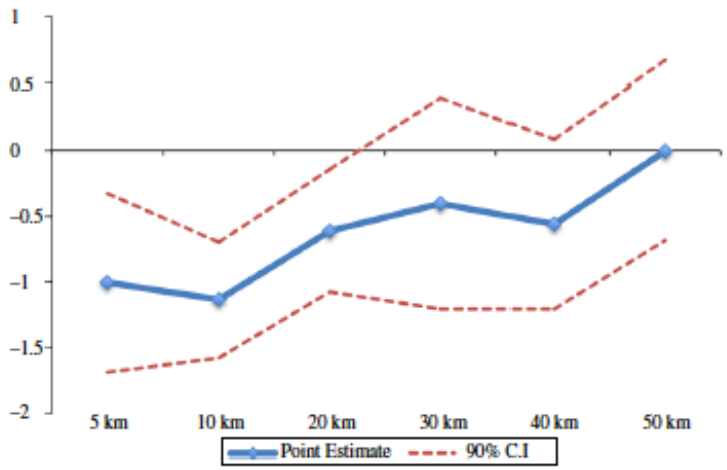
crops, such as cocoa, are cultivated and where traditional farming is the main source of livelihood. We highlight households that are exposed to mining activities in green circles of 20km radius (panel b). A key aspect of our methodology consists on comparing a number of economic outcomes, such as agricultural productivity and poverty, for households inside and outside the green circles in 1997 and 2005.

Figure 1: Location of gold mines and households



Our first set of results shows that households close to large mines experienced, relative to the performance of other households, a reduction in agricultural production and in agricultural productivity. On average, a farmer near a mine would be 40 per cent less productive than another farmer with the same amount of land and labour, but located far from any mine. The blue line in Figure 2 shows that agricultural productivity is lower when households are closer to a mine, relative to households that are more than 50km away from a mine. The red lines show that the effects are not distinguishable from 0 after 20 km. Similarly, we find a knock-on effect in rural poverty levels: a farming household in the vicinity of a mine is 18 per cent more likely to be poor than a similar household further away.

Figure 2: The effect of mining on agricultural productivity, by distance to a mine

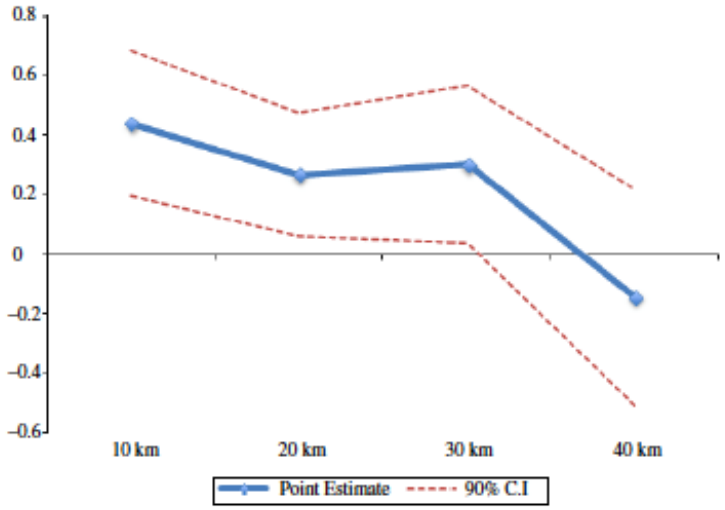


What could be driving these results? We argue that a plausible channel is the presence of mining-related pollution. Modern mines can pollute air with exhausts from heavy machinery and processing plants, and particulate matter from blasting. In low concentrations, these pollutants are dispersed and absorbed by the environment. In larger concentrations, however, they can deposit on the ground in the form of acid rain and thus have long-term cumulative effects. This is in addition to other industry-specific pollutants, such as cyanide, heavy metals and acidic discharges, which may also have cumulative effects but are mostly dispersed through surface water.

To explore this issue further, we use satellite imagery with information on nitrogen dioxide (NO_2). The main source of NO_2 is the combustion of hydrocarbons such as biomass burning, smelters and combustion engines and is likely to occur near large urban centres, industrial sites and heavily mechanised operations, such as large-scale mines.

Using the satellite evidence in a regression analysis, we find that mining areas have a significantly greater concentration of NO_2 and that the presence of these pollutants can be linked to lower levels of agricultural productivity. Figure 3 shows that the concentration of NO_2 varies with distance to the mine in a similar fashion to agricultural productivity in Figure 2. This finding points out to air pollution as a plausible explanation for the decline of agricultural productivity in mining areas.

Figure 3: Average concentration of NO2, by distance to a mine



We subsequently explore alternative stories that could link mines to lower productivity. For example, mines can directly appropriate some inputs, for instance by diverting water sources or the appropriation of farmland. Also, mines could be hiring local workers or fostering a local demand boom. This may attract workers away from agriculture towards mining or other sectors and change the composition of agricultural workers. A similar phenomenon could occur in the presence of selective migration, for instance if more productive farmers migrate away from mining areas. However, our evidence does not support these alternative explanations.

Our findings have an important implication for the academic and policy debate on the local economic effect of extractive industries. This debate focuses on the benefits these industries could bring in the form of jobs, taxes or foreign currency and weigh these benefits against environmental costs such as loss of biodiversity, or human health risks. However, it neglects important economic costs such as loss of agricultural productivity and farmer's income.

A simple back of the envelope calculation using the Ghanaian case illustrates this argument. In 2005, mining-related revenues amounted to US$ 75 million, which represent around 2– 3 per cent of total government revenue. Most of this revenue (around 80 per cent) was channeled to the central government. In contrast, the average annual loss by farming households in mining areas, according to our main results, is in the order of US$ 97 million. These approximate numbers show that the amount of tax receipts might not be enough to compensate those farmers negatively affected by mining and that this situation is even worsened by the fact that only a small proportion of the tax receipts go back to affected localities.

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Notes:

- *This blog post is based on the authors' paper Polluting Industries and Agricultural Productivity: Evidence from Mining in Ghana, The Economic Journal (November 2016), Volume 126, Issue 597, pages 1980–2011 (doi:10.1111/ecoj.12244)*
- *The post gives the views of its authors, not the position of LSE Business Review or the London School of Economics.*
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