Chapter 1

Overview

Introduction

Economic activity in Africa saw a remarkable upswing beginning in the mid-1990s. Growth of gross domestic product (GDP) across the region averaged 4.5 percent a year in 1995–2014, nearly double the pace in the previous two decades. Progress has been broad-based, with both resource-rich and non-resource-rich countries seeing brisk expansion, a turnaround that fueled the narrative of a “rising Africa.” Indeed, the region’s growth performance since the early 2000s has matched that of the rest of the developing world. The spurt in economic activity also reversed the region’s declining trend in average income per capita, although population growth kept gains for this measure at modest levels, averaging below 2 percent. Several factors—external and domestic—supported nearly two decades of sustained growth in Africa. The supercycle in commodity prices in the extractives sector that began in 2000 was notable on the external side, and this enabled the region’s resource-rich countries to grow at an appreciably faster pace than non-resource-rich countries (figure 1.1).

Another consequence of sharply elevated commodity prices has been a boost in the production of extractives and increased investor interest in the region’s abundant natural resources, ranging from hydrocarbons (oil and natural gas) to minerals (gold, diamonds, copper, and iron ore). Increased investor interest led to intensified resource exploration, a spate of new discoveries, and a surge in mine openings beginning in 2000 (figure 1.2). Devarajan and Fengler (2013) conclude that natural resource extraction is expected to be an important activity in all but five African countries in the coming years.

The heightened extractive activity has lifted the share of natural resources in Africa’s exports. During 2001–14, extractive industries made up nearly two-thirds of exports from African countries—oil and gas alone accounting for close to 50 percent of total exports—a substantial rise from the 48 percent share in the previous 10-year period. Rising exports of natural resources contributed significantly to government finances, providing much-needed funds for building human and physical capital. Fiscal dependence on commodity-based revenues is now well over 50 percent in major commodity exporters. Overall, the
Figure 1.1 GDP Growth by Country Groups, 2000–14


Figure 1.2 Mine Openings, 1870–2014

expansion of the extractives sector has enhanced its importance as a major source of income, raising hopes for sustainable growth in Africa. While the precipitous drop in commodity prices since June 2014 casts a pall on the region’s prospects, natural resources are expected to continue contributing a significant share to exports and public revenues.

Although Africa’s resource boom has underpinned growth in the region’s commodity producers, questions remain on whether natural resource wealth has substantially improved living standards. Did this growth raise incomes and reduce poverty at a fast enough pace? And moving beyond income poverty, did nonincome dimensions of poverty such as education and health improve? Overall, the conversion of growth into poverty reduction is considered to be much lower in Africa than in the rest of the developing world. At –0.7, Africa’s growth elasticity of poverty is one-third that of the rest of the developing world, excluding China (Christiaensen, Chuhan-Pole, and Sanoh 2013). This slow pace of poverty reduction is frequently attributed to natural-resource-led growth, the so-called natural resource curse. Examples abound of poor outcomes (on income poverty and social indicators) in African countries with abundant natural wealth. For example, in Zambia, a major copper producer, the incidence of poverty remained virtually unchanged, at 60 percent, during 2000–10, despite a doubling of economic output in this period.

Nonmonetary welfare indicators (controlling for per capita income) are also noticeably weaker in the region’s resource-rich countries, such as Angola, Gabon, and Nigeria, pointing to the unmet potential of natural resource wealth (figure 1.3). The data show a penalty for living in a resource-rich country compared to a non-resource-rich country in Africa: literacy rates are 3.1 percentage points lower, life expectancy is 4.5 years shorter, malnutrition among women and children is more prevalent (by 3.7 and 2.1 percentage points, respectively), incidence of domestic violence is higher (by 9 percentage points), and voice and accountability measures are weaker (Beegle et al. 2016).

The inability of millions of people living in poverty to benefit from natural resource wealth is a disappointment that is all too familiar at the national level. But interest is growing in going beyond the national or aggregate impact to understand whether mining communities benefit from a resource boom and, if they do not, what could explain this. Despite long-standing interest in these issues in relation to Africa, studies have been slow in coming and research remains underdeveloped. One reason for this is that, in general, African countries do not collect detailed subnational economic data. Therefore, it is often difficult to assess how much of the growth that is reported is happening at the local level, or how large-scale mining is affecting local economic activity. But increasing the availability and application of
remote sensing data collected by satellite is making these measurements possible.

The study’s focus on local impacts is motivated by the observation that, in general, the socioeconomic effects of large-scale mining are not well understood. But public opinion—to the extent there is one—on the impacts of mining on local communities is likely to be unfavorable. This is partly because, despite contributing substantially to countries’ export revenue and, in many instances, GDP, the total employment numbers generated country-wide by mines are generally modest. In Mali, for instance, large-scale mining accounted for about 7 percent of GDP in 2013, but less than 1 percent of the population was employed by the industry (Sanoh and Coulibaly 2015). Adding to the negative perception of the industry is the concern that it causes negative environmental and health impacts for which local communities feel they are not adequately compensated. Moreover, the end of a mining boom may leave communities with little capacity for alternate livelihoods. Compounding these perceptions
are the mining and oil companies that want government concessions. As a result, these companies tend to exaggerate the local and national benefits of their industries.

The objective of this study is to gain a better understanding of the socio-economic impact of resource extraction on local communities in Africa. Specifically, the study explores the effect of mining on the composition of employment, wages, access to infrastructure (water, electricity), child health outcomes, and agricultural production in communities where resource extraction takes place. The study also examines the extent of resource revenues received by governments in mining areas, and assesses whether the size and composition of fiscal spending on these communities are affected by mining.

The study begins by laying out a simple framework of the potential channels through which extractive activity affects local livelihoods and communities. In many of them, the government, as the owner of subsurface resources on behalf of the people, is the conduit of the benefits to the rest of the economy, including to local communities. With this in mind, the study delineates three broad channels—market, fiscal, and environmental—through which local areas and regions may be affected (figure 1.4).

The study then applies this framework to a single extractive sector—large-scale gold mining—in three African countries: Ghana, Mali, and Tanzania. Gold was chosen because it is common in many countries and is found in areas that are fairly heavily populated, so the impacts on local communities will be clearer to identify. The aim of the research is to assess whether local communities benefit from mining or not. The focus is primarily on improvements in welfare, as measured by occupations for both women and men, asset accumulation, access to infrastructure, and children’s health outcomes. This is because gains in these dimensions are key to higher earnings as well as to more stable, less vulnerable livelihoods.

The study adopts a two-pronged approach to evaluate the local-level effects of mining. First, through descriptive analysis, including the results of

![Figure 1.4 Channels through Which Natural Resource Abundance Affects Local Communities](source: Aragón, Chuhan-Pole, and Land 2015.)
fieldwork, mining’s impacts are examined in a country-specific context for each of the three countries. Second, a statistical analysis is used to test whether welfare improves with proximity to a mine. The empirical approach adopted treats industrial gold mining as a quasi-experiment in which the start or restart of a gold mine is the “treatment” or shock. Here, the object is to discern differences in the outcomes of local communities in mining and non-mining areas.

To increase the benefits of mining to local communities, the study identifies general areas in which government and private sector initiatives can lead to improved livelihoods and an improved future for men and women working for and near large-scale mining operations and for their families.

A Framework to Measure How Local Communities Capture Benefits

The avenues for extractive industries to affect local communities and regions are somewhat restricted in developing countries since the national government is the guardian of this wealth on their behalf (see chapter 2). Thus, the study identifies three broad channels—market, fiscal, and environmental—through which local areas and regions may potentially be affected by extractive activity (figure 1.4). These three channels can affect local welfare through several broad paths, and three in particular: employment, income, and links with other sectors; public spending; and negative externalities from production.

Working through the market channel, resource extraction can affect income, employment, and links with other sectors. Extractive industries employ local workers and purchase some goods and services locally and regionally. Thus, a boom in this sector should raise nominal wages and other incomes, increase nonmine employment opportunities, and generally improve local welfare and reduce poverty. Negative spillovers could, however, occur from this increased activity. Often, the start of an extractive industry, say, the opening of a mine, will attract workers from other districts. This could temper wage rises, put a strain on local services such as health and education, and raise the price of nontradable goods and services, such as housing, which could reduce the real incomes of some local residents. Figure 1.5 illustrates an analytical framework of market-based transmission channels and possible outcomes from exploiting a potential natural resource boom.

Positive spillovers from the extractive industry, in addition to the employment and wage effects already noted, could include improved productivity through worker training and education, which often spread beyond the mine or oil field. Also, improvements to public goods may occur through investment
Figure 1.5  How Market and Fiscal Mechanisms Affect Well-Being

Market channel with strong backward linkages

Local labor demand and nominal wages increase

Attracts workers from other cities, population increases

Public services (for example, health and education) become congested

Nominal wages decrease, housing costs increase, with no significant effect on real wages

Agglomeration economies

Output from nontradable sectors increases with an ambiguous effect on tradable sectors’ output

Productivity increases

Fiscal channel: Increase in fiscal revenue

If local institutions are healthy

Public spending increases

Public services and infrastructure improve

Well-being improves

If local institutions are weak

Rent-seeking opportunities increase

Corruption increases

Violent conflict increases
in roads, bridges, ports, and similar facilities, which are required by the extractive industry.

On public spending, governments have a major role to play in transforming resource wealth into sustained development. The value chain of natural resource management encompasses the organization of the sector and the award of contracts and licenses; regulation and oversight of operations; the collection of resource rents through taxes and royalties; the allocation of revenues and management of public investment; and sustainable development practices and policies (Barma et al. 2012). The benefits from a natural resource will depend to a large extent on whether the revenues received are put to good use. But if history is a guide, there is ample reason to be cautious. A fiscal revenue windfall eases hard budget constraints on local governments, and supports higher public spending. The fiscal arrangements between central and local governments at various levels will, therefore, determine how much of the benefits from mining find their way back to mining areas.

If the revenue windfall is used to improve the quantity or quality of local public goods and services, the potential is there to improve human welfare, such as health and education outcomes. Moreover, to the extent that public goods are productive inputs or create positive spillovers (as in the case of transportation infrastructure), a resource boom could also increase local income and growth. The positive effect of revenue windfalls is underpinned by several assumptions: namely, local politicians are responsive to the broad population, which requires well-functioning local institutions; a healthy degree of political competition; and local bureaucracies having the technical capacity to provide public goods and services. As such, the general competence, honesty, and overall implementation capacity of local-level government are vital for enhancing welfare and development. Where these conditions are lacking, the positive effect of revenue windfalls on the provision of public goods and local living conditions will not be realized. Hence, both nationally and locally, the quality of governance and the influence of resource revenues on governance will be major determinants of the welfare impacts of resource exploitation. Figure 1.4 shows some of the paths discussed in the literature through which a revenue windfall could impact local welfare.

Mining and mineral processing can generate several types of negative externalities. These include pollution, pressure on other scarce natural resources, and social dislocation, which can affect local community welfare.

Environmental pollution can adversely impact health, and this is a big concern, including in gold mining (see box 1.1). It can also lead to the loss of agricultural productivity (Aragón and Rud 2015) by directly affecting crop health and growth; by degrading the quality of key agricultural inputs, such as soil and water; and through the impact of air pollution on labor productivity.
Environmental and Health Issues in Gold Mining Areas

Like many other industries, gold mining (industrial and artisanal) is associated with environmental degradation and pollution, which have severe health implications. Environmental degradation is manifested through effects on the land and land use, the spread of gold ore-related heavy metals such as arsenic and lead to nature, the discharge of cyanide to nature, and the spread of mercury from artisanal mining or air pollution. In Ghana, air pollution around industrial gold mines has been linked to increased cough incidence (Aragón and Rud 2013).

Similarly, pollution from heavy metals contamination from 800 mines in 44 developing countries has been shown to lead to an increase of 3 to 10 percentage points in the incidence of anemia among women and 5 percentage points in the incidence of stunting among children living in mining communities (von der Goltz and Barnwal 2014). Yet, controversies surround studies linking environmental degradation around mines to health outcomes because of the possibility that exposure to these pollutions may be linked to individual lifestyle, which result in biasing the outcomes (Tolonen 2014).

A Ghanaian environmental impact assessment in 2008 of 61 major mines and several smaller-scale operations sites found that mining areas have relatively higher concentrations of arsenic, particularly within the areas of old, large mines such as Obuasi, Bibiani, and Prestea. For example, in Obuasi’s influence area, the mean arsenic concentration over one year of sampling was 25 millionths of a gram per liter, which is more than 50 times the World Health Organization’s guideline for drinking water (European Union 2008). High concentrations of cyanide are infrequent in Ghana because most companies stick to stringent procedures.

Environmental and health issues for artisanal scale miners focus on the use of mercury to cheaply separate gold from other minerals. Mercury usage tends to always exceed the World Health Organization limit for public exposure of 1 millionth of a gram per square meter. In southwest Ghana, artisanal and small-scale gold miners have a significantly higher burden of mercury than other people living or working in mining areas (Kwaansa-Ansah et al. 2014). In Tanzania, a review of several studies points to major health and safety risks for mining communities (Sanjay et al. 2015). In the artisanal mining areas of Matundasi and Makongolosi, the mean mercury level in hair samples of miners is 2.7 times higher than the U.S. Environmental Protection Agency’s reference limit of 4–5 millionths of a gram per liter. Approximately two-thirds of the hair samples exceeded this reference limit.

Another study in Tanzania looked at mercury levels in the breast milk of mothers living at artisanal and small-scale gold mining sites; it found that 22 of the 46 children from these mothers had a higher total mercury intake.
The loss of agricultural productivity can also have a negative impact on agricultural output, which, in turn, affects the incomes of farmers and rural populations. This externality is particularly relevant when extractive industries are located in populated rural areas, and where agriculture remains an important source of livelihood.

The Approach to Assessing the Local Effects of Mining

Sector Focus: Gold Mining in Sub-Saharan Africa

The mineral sector in Sub-Saharan Africa is large and diverse. This study selectively applies the framework of figure 1.4 to a single mineral: gold. The choice of gold for this study was predicated on the following factors:

- Gold mining is now an important industry in several countries in Sub-Saharan Africa, and is second only to crude oil as the region’s top export earner. In 2013, several countries in the region—including Ghana, Mali, South Africa, and Tanzania—were among the world’s top 20 gold-producing countries.
- Since the aim of the study is to assess the socioeconomic impact of mining on local communities, it is appropriate to select a sector that can have a potentially important local footprint. Because gold mining is onshore, unlike oil drilling, which is often offshore, it can be expected to have an impact on local populations.
- Conflict-affected countries were excluded from the study, to better capture the market channel through which extractive activity can affect local communities.

Three countries were selected for study: Ghana, Mali, and Tanzania. Gold mining operations in these countries have a number of common characteristics that make them suitable for this study. While industrial gold mining has a long history in Africa (especially in Ghana), gold production has sharply accelerated since the mid-1990s in each of these countries (figure 1.6), so that collectively they accounted for 35 percent of the region’s gold production in 2015.

Gold exports are an important component of exports in all three countries—for Mali, the annual average was 69 percent of exports between 2000 and 2013; for Ghana, 38 percent over the same period; and for Tanzania, 31 percent. Although the value of gold exports is substantial, the contribution of gold mining to GDP is less dominant. In Mali, the poorest of the three countries, about 7 percent of GDP comes from mining and quarrying. In Ghana it is 5.5 percent, and it is 4.0 percent in Tanzania.
Empirical Methodology for Measuring the Local Effects of Mining

The aim of the study is to assess whether local communities benefit from mining—specifically, industrial or large-scale gold mining—or not. To better understand how the benefits from the minerals sector are captured by local communities, this study measures the size of the impact of mining on local welfare by exploiting the “before” and “after” type of analysis using the opening and closing of mines. The focus is on improvements in welfare, as measured by four broad dimensions:

- **Occupations for men and woman.** Whether employment opportunities expand and incomes rise, and the impact on agricultural and nonagricultural activity.

- **Asset accumulation.** If there is a discernible increase in family asset accumulation (for example, a radio, bicycle, car, or toilet) with proximity to a mine, then one could conclude that the mine, at least in this respect, is welfare enhancing.

- **Access to infrastructure.** The key variables here are access to electricity and water, which are indicative of the provision of services by local governments.
Child health outcomes. The analysis tries to determine whether there are improvements in key indicators of child health. Specifically, infant mortality and fever, cough persistence, and diarrhea in children under age five.

The analysis uses both descriptive analysis and robust econometric methods to evaluate local-level impacts. First, through case studies including the results of fieldwork, the impacts of mining are examined in a country-specific context for Ghana, Mali, and Tanzania (chapter 3). Second, a statistical analysis, combining mine-specific information and a rich dataset collected from various sources, is used to rigorously test whether the indicators of welfare improve with proximity to a mine (chapter 4).

The empirical approach builds on the earlier studies that used quasi-experimental events to estimate the impact of localized shocks on economic outcomes (Card and Krueger 1994). The identification strategy in these approaches is based on comparing outcomes in local units of observation (districts, municipalities, regions, and so on) affected by a particular event or intervention to units where such events or interventions are absent. The analytical approach adopted in this study views industrial gold mining as a quasi-experiment in which the vicinity of a mine can be thought of as the “treatment” area and areas outside of this as “nontreatment” areas. Because the areas chosen represent relatively recent gold mine starts (or restarts), it is also possible to compare outcomes “before treatment” and “after treatment”—the treatment, of course, being the start or existence of a mine. A difference-in-differences estimation strategy is used to test whether indicators of welfare improve with proximity to a mine, where proximity is defined in several ways (see box 1.2)

**BOX 1.2**

**What Is a Mining Community?**

Two broad measures of vicinity to a mine—that is, the treatment area—are used in the analysis: distance from a mine, and the administrative district where a mine is located.

**Distance.** How far the mine’s influence extends is an empirical exercise. The analysis includes households within 100 kilometers of a mine location, with the baseline treatment distance being 20 kilometers from a mine (figure B1.2.1). To allow for nonlinear effects with distance, the analysis also employs a spatial lag model, in which the area around a mine is divided into small concentric distances (or bins), such as 0–10 km, 10–20 km, 20–30 km, and so on, up to within 100 km of a mine.

**District.** Arguably, mining can have additional impacts beyond the neighborhood of the mine if mining royalties and revenues are spent on populations living in districts
where the mine is located. Injections of additional expenditures into the district could increase spending on welfare-enhancing services, such as schooling and health care. Thus, a second level of analysis is done with the treatment area as the district in which the mine is located. “District” refers to political or administrative units that have spending authority. Districts themselves are fairly arbitrary, and looking for impacts in only the districts that have a mine could miss the potential spillovers that result from mining. So spillover effects across districts are also considered, and the analysis compares outcomes in mining districts, neighboring districts, and nonmining districts. Outcomes in mining districts are also compared with those of a synthetic control group—a group which has no mines but has characteristics as similar as possible to those with mining districts.

Note: DHS = demographic and health surveys.
Are Mining Communities Seeing Welfare Gains?

The results suggest that mining communities on average experience positive but limited welfare benefits. Although the evidence leans toward improvements in welfare with proximity to a mine, this is not uniformly true across all the dimensions of well-being that are studied. There is little indication, however, of deteriorating outcomes with proximity to a mine. Moreover, most of the positive welfare effects are experienced through the market channel.

This analysis finds that large-scale mining can support a structural transition in the economy of a local community. The results for employment and occupation suggest a move from farm labor to nonfarm occupations. These are robust, especially for countries where gold mining started earlier, such as Ghana and Mali. The shift is especially evident for women, who are tracked by better data. Nonfarm employment opportunities, especially in sales and services, were substantially higher for women living closer to mines than those living farther away. Similarly, their employment in agriculture declined, while the probability of working throughout the year rises for women living closer to mines and those who live in mining districts. Thus, although mining is capital-intensive and its direct labor effects are quite small, some indications point to transformative indirect effects. Where wage data are available, such as Ghana, results indicate that wages for those in mining are higher.

Unlike the common perception that large-scale mines are economic “enclaves” that provide little economic benefit to local economies, the findings from an analysis using remote sensing data show that economic growth increases in the period surrounding the start of a mine. Over time, however, areas near mines are not significantly better off than areas farther away. The analysis also suggests that despite the risks mines pose to agricultural productivity—through environmental pollution or structural shifts in the labor market, for example—there is no evidence of a decrease in agricultural production, as measured by the Normalized Difference Vegetation Index. The results point to better access to assets and to infrastructure. The evidence of an increased share of household expenditures on housing and energy is considered a strong indicator of rising access to electricity and asset accumulation.

The health of children in local mining communities often improves with increased wages, electricity, and in some cases clean water, although child health outcomes between mining and nonmining areas have mixed results. Infant mortality decreases faster and is statistically significant in mining communities and districts in Ghana and Mali, but it is not statistically significant in Tanzania. Stunting (ratio of height to age) decreases for children who live close to mines in Mali, and the estimated effect is negative but insignificant for wasting. In Ghana and Tanzania, these outcomes appear worse for mining areas,
although the results are not always statistically significant. The incidence of cough declines in both Ghana and Mali, but not in Tanzania. Similarly, the incidence of diarrheal disease decreases in Mali but is positive and insignificant in Ghana. Migration patterns may explain some of the differences in child health outcomes across countries. For example, the increased incidence of diarrheal disease in Ghana appears to be driven by poor outcomes among migrants who live near mines.

Signs of Economic Transformation: Occupation, Income, and Linkages

The mining industry in Sub-Saharan Africa is generally associated with weak direct employment generation compared with its contributions to GDP and export revenue at a national level. Yet mining has the potential for large local impacts that can begin to bring about structural transformation in local economies. One key channel for transmitting benefits to a local community is through direct employment by the mining companies. However, gold mining is capital-intensive, and the country case studies show the linkages are likely to be modest. Only about 7,000 people were directly employed in gold mining in Tanzania in 2013, and the figures were similarly low for Ghana (about 17,100 in 2014) and Mali (averaging 3,635 during 2008–13). In many countries in the region, mining companies employ mostly nationals rather than expatriates, although managerial jobs often go disproportionately to foreigners. Sanoh and Coulibaly (2015) report a ratio of 14 national workers to each expatriate in Mali’s mining companies, and that on average 78 percent of mining jobs are located in the three communes (local government entities) of Gouandiaka, Sadiola, and Sitakily. National labor survey data suggest that the mean income from mining is higher than the average income for all other sectors, and considerably so when compared to agriculture and industry.

The increase in employment, wages, and real income of local populations can bring about additional economic changes that can improve livelihoods. Yet, because of data limitations, it is difficult to estimate the wider local economic linkages to a mine. Although the description of large-scale mining as an enclave is not accurate (it does not, for one thing, mesh with the larger economy), it is also fair to say that the backward linkages are not large. For example, for South Africa, where better data are available, gold mining is estimated to have a multiplier of about 1.8; in other words, for every one mining job, an additional 1.8 jobs are created elsewhere through backward linkages and expenditure effects. Sanoh and Coulibaly (2015) report a ratio of 1.67 in Mali. However, these multiplier effects are limited, mostly because of a lack of local, cost-effective procurement opportunities but also partly because of the capital intensity of the mining industry.
The potential for more local procurement could increase as mining companies become better acquainted with local markets and suppliers, and if local entrepreneurs learn to take advantage of these emerging opportunities. This is happening in Tanzania, where efforts have been made to improve the potential for local procurement, including in services such as catering, vehicle repair, machine shop services, welding, metal work, electrical work, and plumbing. However, the proportions of inputs sourced locally remain low, as they are in Ghana and Mali.

One mechanism through which mining can have large impacts is agglomeration economies—gains in productivity unleashed with the clustering of economic activities around mines. The first sign of such a change would be the movement of labor and other factors away from traditional sectors to new sectors. For the three case study countries, that would mean a change in the structure of the local economy, from being dominated by “traditional” farming to a more balanced local economy.

In Ghana, Mali, and Tanzania, the influx of jobs, income, and infrastructure from large-scale mining appears to bring benefits, and research shows incipient signs of structural transformation. Both the individual- and district-level results find that employment in agriculture declined, while employment in nonfarm occupations—such as services, manufacturing, and mining—rose. These results are robust, especially for countries where gold mining started earlier, such as Ghana and Mali. Where wage data are available, as in Ghana, there is evidence that wages in mining areas are higher.

The nascent structural shift has also brought improvements in women’s nonfarm employment opportunities. Employment in sales and services for women was substantially higher for women living closer to mines than those living farther away. In the same vein, their employment in agriculture declined, while the probability of working throughout the year rises for women closer to mines and those who live in mining districts.

Results from the spatial lag model using demographic and health survey data—which allow for nonlinear effects with distance—show that service sector employment for women is significantly higher close to active mines (figure 1.7). In fact, the effects are stronger 0–10 kilometers from a mine than at 10–20 kilometers. In Mali, the probability that a woman works in services and sales increases by 30 percentage points, and in Ghana by 17 percentage points, at the least distance. For Ghana and Mali, agricultural participation drops close to mines, at roughly 10 to 20 percentage points, respectively. Tanzania shows no evidence of a clear change either in services and sales or agricultural employment.

For Ghana, the results show there is an increase of 10 percentage points in the likelihood that a man living close to a mine works in mining (figure 1.8, panel c). This contrasts with the findings for women, who are not benefiting
Figure 1.7  Spatial Lag Model Illustrating the Geographic Distribution of Effects on Services Sector and Agricultural Employment for Women in Ghana, Mali, and Tanzania

Source: Authors’ estimates from survey data.
Note: Spatial lag model illustrating geographic distribution of effects on service and agricultural sector employment. Results are from demographic and health surveys. Shaded area along lines represents 95 percent confidence interval. km = kilometers.
**Figure 1.8** Spatial Lag Model Illustrating Agriculture, Manual Labor, Mining, and Wage Earnings for Men in Ghana and Mali

(a) Husband working in agriculture, Ghana

(b) Husband working in manual labor, Ghana

(c) Man working in mining, Ghana

(d) Log wages (man), Ghana

(e) Husband working in agriculture, Mali

(f) Husband working in manual labor, Mali

**Source:** Authors’ estimates from survey data.

**Note:** Spatial lag model illustrating geographic distribution of effects on agriculture, manual labor, mining, and wage earnings for men. Results are from demographic and health surveys, except for those in panels c and d which are from the Ghana Living Standards Survey. Shaded area along lines represents 95 percent confidence interval. km = kilometers.
(or are benefiting very little) from direct employment in mining. Ghana Living Standards Survey data also show that men have (marginally) significantly higher wages. The demographic and health survey data for Ghana and Mali reveal that men are less likely to work in agriculture if they live within 10 kilometers of a mine (statistically significant in Mali). A pattern in the data indicates a propensity for distance-related occupational specialization: less engagement in farming activities from very close to a mine to slightly farther away (20–30 kilometers), especially in Ghana. The findings also show that men are not more likely to do manual labor in Ghana or in Mali.

District-level analysis, which compares outcomes between mining and non-mining districts for all three countries, confirms the finding that agricultural employment decreases in mining districts. For Ghana, the results indicate that, compared with nonmining districts, this decreases by 5.2 percentage points for men and 8.5 percentage points for women. In addition, the probability of a woman working all year increases by 5.4 percentage points, as does the probability of doing manual work. No such significant increases in employment in other sectors are discernible for men (the demographic and health surveys have no information on employment in mining for men).

District-level analysis for Mali shows that, overall, agricultural employment decreases for men and women, although the results are not statistically significant. At the same time, there are significant increases in the likelihood of mining employment; men are almost 10 percentage points more likely to work as miners, and women are 2.3 percentage points more likely, compared with before a mine opening. Note, however, that these changes can also be due to increases in small-scale mining in these districts over the same period. For Tanzania, no recorded information on mining employment exists; but, as in Mali, we see a decrease in agricultural employment (8 percentage points for men and 11 percentage points for women), though these estimates are not statistically significant.

Wages for men and women are on the rise in Ghana, but those for men are not precisely estimated (figure 1.9). Household total wages are also on the rise, but household expenditures are decreasing. Because wage earnings are recorded for those who are in wage labor, what happens to total earnings in households without any wage labor is not clear.

**Does Mining Reduce Agricultural Growth?**

Agriculture is an important sector throughout Africa. Some 65 percent of workers in Sub-Saharan Africa are farmers, and agriculture accounts for 32 percent of the region’s GDP. Most people in rural villages are farmers, and agriculture accounts for the largest share of economic activity in the countries studied in the analysis—Burkina Faso, Ghana, Mali, and Tanzania—on whether mining reduces agricultural growth. Because mines are land intensive, they open mostly
in rural areas, where land is relatively cheaper and where agricultural participation is often higher before a mine opens.

Mining can affect agricultural production in several ways. It can lead to a rise in local wages, reduce profit margins in agriculture, and lead to the exit of many families from farming—something akin to a localized Dutch disease. Negative environmental spillovers such as pollution or local health problems can dampen the productivity of the land and of farmers, reducing the viability of farming. Conversely, mining can also create a miniboom in the local economy through higher employment and wages, which can lead to an increase in local area aggregate demand, including for regional crops.

To understand how large-scale mining impacts local economic activity, this study uses georeferenced data collected by satellite to estimate changes in agricultural and nonagricultural production in mining and nonmining localities in Burkina Faso, Ghana, Mali, and Tanzania (box 1.3).
Unlike the common perception that large-scale mines are economic enclaves that provide little economic benefit to local economies, the findings using remote sensing data show that economic growth increases in the period surrounding the start of a mine. The night lights data show strong increases in night lights in mining communities within 10 kilometers of a mine in the years immediately before a mine opening.

Further, the data indicate that in the years following a mine’s opening, the nearby areas (within 10 kilometers) have significantly higher levels of economic activity (figure 1.10, panel a). However, over time, the areas near the mines are not significantly better off than areas farther away. This may partially indicate that with time, the economic benefits from mining spread over a larger area from a mine’s center point.

The results also suggest that the opening of a large-scale mine may not decrease local farming, in contrast to recent studies showing that mining increases urbanization rates or leads to decreased local farming. Using the Normalized Difference Vegetation Index, the findings show that areas close to mines have higher levels of greenness (figure 1.10, panel b). This could be indicative of mining areas being more rural in general, but this study found little change in the index with the onset of mining. Despite the risks that mines pose to agricultural productivity (for example, through environmental pollution or structural shifts in the labor market), there is no evidence of a decrease in greenness, which is the measure of agricultural production.

**Box 1.3**

**How Remote Sensing Informs Agricultural Production**

Night lights data gathered by satellite can depict human settlement and development, and are sensitive enough to detect streetlights and even the lights of vessels at sea. One of the central uses of the night lights data set is as a measure of and proxy for economic activity. However, night lights, while certainly informative of human activity, do not exhaust economic activity in all places. For instance, in countries that are mostly rural and where the mainstay of the economy is agriculture, an overreliance on night lights might miss a big fraction of economic activity.

Remote sensing technology that captures the type of light reflected by vegetation can be used for estimating the production of agricultural commodities. This study investigates the spatial relationship between mining and local agricultural development by using the Normalized Difference Vegetation Index. This is used as a proxy for agricultural production to learn whether the opening of a mine has spillover effects on agriculture. To estimate the level and composition of agricultural and nonagricultural production at the local level, the study selected a radius around 32 large-scale gold mining areas in Burkina Faso, Ghana, Mali, and Tanzania.

Unlike the common perception that large-scale mines are economic enclaves that provide little economic benefit to local economies, the findings using remote sensing data show that economic growth increases in the period surrounding the start of a mine. The night lights data show strong increases in night lights in mining communities within 10 kilometers of a mine in the years immediately before a mine opening.

Further, the data indicate that in the years following a mine’s opening, the nearby areas (within 10 kilometers) have significantly higher levels of economic activity (figure 1.10, panel a). However, over time, the areas near the mines are not significantly better off than areas farther away. This may partially indicate that with time, the economic benefits from mining spread over a larger area from a mine’s center point.

The results also suggest that the opening of a large-scale mine may not decrease local farming, in contrast to recent studies showing that mining increases urbanization rates or leads to decreased local farming. Using the Normalized Difference Vegetation Index, the findings show that areas close to mines have higher levels of greenness (figure 1.10, panel b). This could be indicative of mining areas being more rural in general, but this study found little change in the index with the onset of mining. Despite the risks that mines pose to agricultural productivity (for example, through environmental pollution or structural shifts in the labor market), there is no evidence of a decrease in greenness, which is the measure of agricultural production.
Welfare Improvements: Asset Accumulation, Access to Infrastructure Services, and Child Health Outcomes

Asset Accumulation
The analysis finds some variation in how the opening of a mine close to a community affects the probability of a household owning or having access to assets such as improved flooring, radios, and cars. The results for the three case study countries show that households in Mali are 30 percentage points more likely to have floors made of cement, tile, wood, or materials other than earth, sand, or dung, and 5 percentage points more likely to own a car (but 11 percentage points less likely to own a bicycle) (figure 1.11). Households in Ghana are 14 percentage points more likely to own a radio. In some cases, there are differences for migrants and never-movers in the same communities. For example, in Mali, the positive effects on household assets seem to be driven by migrant households. In Tanzania, decomposition by migrant status shows that radio ownership in fact increased among non-migrant households. In Ghana, however, radio ownership increases for both migrant and nonmigrant women.
Access to Infrastructure Services

Does the opening of a mine close to a community affect the probability of households having better access to some types of infrastructure services? Overall, the results on access are weak. The study finds that households close to a mine are generally more likely to have access to a private toilet in the three case study countries. For example, households in mining communities in Tanzania are 24 percentage points less likely to share a toilet facility with other households (figure 1.12). There are differences for migrants and never-movers in the same communities. Thus, migrants in Ghana are seemingly less well off than never-movers and have less access to electricity. In Mali, the relationship is reversed, with migrants having better access to electricity. District-level analysis shows very small insignificant effects on access to electricity in mining districts in all three case study countries, and on access to sanitation in Mali and Tanzania. Ghana shows a large positive, yet insignificant, effect on access to water in mining districts.
Large-scale gold mining can affect children’s health in different ways. For example, in households close to mines, it could positively affect outcomes through an improvement in household income and negatively through environmental degradation. Therefore, a priori, how a mine affects child health remains theoretically ambiguous.

In Mali, the study finds positive effects from a mine opening on access to health care and health outcomes (figure 1.13). Pregnant mothers receive many more prenatal health visits; infant mortality decreases by 5.3 percentage points (although it is not estimated with statistical significance); and stunting decreases by 27 percentage points, which is equivalent to a 45 percent decrease in the prevalence from the pre-mine average rate of stunting. The estimated effect is negative but statistically insignificant for wasting, but negative and statistically significant for being underweight, which is a composite measure of acute and chronic malnourishment.
The results also show the prevalence of cough, fever, and diarrhea decrease in Mali, although this is not statistically significant for fever. The significant drop in diarrheal incidence of children in Mali’s mining communities is a welcome development since diarrhea remains a serious threat to children in developing countries, even though it is easy to cure and prevent. Opening or improving access to safe water and sanitation are ways in which Mali’s mines can reduce diarrheal incidence.

Unlike Mali, the effects on child health are ambiguous in Ghana and Tanzania. The likelihood that a child is stunted increases by 12.3 percentage points in Tanzania, and being underweight increases in mining communities in Ghana and Tanzania. However, some positive effects of mine openings are evident. Ghana has seen a large decline in infant mortality and a decrease in cough prevalence. The effect of a mine on diarrheal incidence is positive but statistically insignificant in Ghana. When this outcome is disaggregated by groups, it reveals that migrants experience higher rates of diarrhea and never-movers lower rates.
It is not clear why child health outcomes at the local level differ across the three countries. Stunting, which is a measure of long-term nutritional deficiency, may decline for children living closer to mines because their families may have higher incomes, which can be used to buy more nutritious food for their children. By contrast, wasting is a short-term measure of nutritional deficiency and can be strongly explained by access to health services.

Migration patterns may also explain some of the differences in child health outcomes. For instance, Mali, which shows the most positive changes, is also the country with the lowest level of migration around the time of mine opening, and migrants in mining areas in Mali seem less vulnerable than in Ghana or Tanzania. Tanzania, which shows weak evidence for structural transformation and few gains in child health, appears to have the largest increase in migration flows after a mine opens.

Some positive effects on access to health services for children are discernible in Ghana’s gold mining districts. District-level analysis for five measures of child health care and access shows that mothers in gold mining districts have 0.759 more prenatal visits per child, and are 12.5 percentage points more likely to be attended to by a trained midwife (figure 1.14). Moreover, infant mortality is

![Figure 1.14 Access to Health Services for Children in Mining Districts in Ghana](image)

Source: Authors’ estimates from survey data.

*Note:* Reported coefficients are the coefficients of the interaction variable for districts with active mines in the survey year. Robust standard errors are clustered at the district level.
District-level results for Mali and Tanzania also show improvements in children’s nutrition in mining and neighboring districts compared with control districts (using a synthetic control method), although not as dramatic as in Ghana.

**Assessing the Role of Government**

In many countries in Africa, most benefits from extractives will clearly be fiscal and national, because the government is the conduit of the benefits to the rest of the economy, including to local communities. The empirical evidence shows that the size of resource-related intergovernmental transfers to local communities has so far been modest. As such, there is considerable potential to improve welfare at the local level through larger transfers that can support investment in much-needed infrastructure and the development of human capital.

Government revenues increased considerably in each of the three case study countries from 2001 to 2013, although levels reportedly dropped in 2014 following a decline in international gold prices (figure 1.15). During 2005–13, gold mining provided Mali’s government with $362 million a year (annual average), Ghana’s with $300 million, and Tanzania’s with $137 million. This revenue windfall could have been used to build health clinics and schools, enhance the quality of local services, and potentially improve human welfare for the country’s poor. By creating positive spillovers, as in the case of transportation infrastructure, a resource boom could also increase local income and growth.

The fiscal arrangements between the central and local governments at various levels are important in determining how many of the benefits from mining find their way back to mining areas. Fiscal arrangements varied across the three case study countries. Mali has the highest degree of fiscal decentralization and, therefore, local authorities there received the largest proportion of the revenues compared to the other two countries. Ghana is in the middle, but its decentralization efforts are fairly new, so it may be premature to evaluate them. Tanzania has a centralized system, with all revenues collected and controlled by the central government, and transfers from the central budget fund 90 percent of local government. The funds are allocated according to criteria and priorities unrelated to the location of mines or the source of the funds.

The positive effect of revenue windfalls is underpinned by several assumptions. Key among them are that local politicians are responsive to the preferences of the broad population, local institutions function well, and local bureaucracies have the technical capacity to provide these public goods and services. As discussed in the section in this chapter on a framework to measure
how local communities capture benefits, an absence of these mediating factors may undermine the positive effect of the natural resource extraction revenues. The quality of governance—at national and local levels—and the influence on it of resource revenues are important determinants of the welfare impacts of resource exploitation. However, these are not assessed here.
Mining companies have made arrangements with many countries to provide funds directly to governments for supporting infrastructure and other projects to benefit families living near mines. Direct investment in community development has traditionally been labeled corporate social responsibility, and, in the case of mining companies, typical projects supported include building secondary schools, clinics, and water infrastructure. For example, Newmont Ghana Gold has supported Ghana's Ahafo region through a partnership in the health sector by building housing for resident nurses and three community health compounds in local villages, and by equipping 60 local health volunteers with bicycles and medical equipment.

Similar to almost all foreign aid and government interventions, particularly where implementation capacity is limited, these types of projects have had mixed success across the board and have generally taken a long time to implement. Even so, a growing trend is discernible in the three case study countries for more sustainable projects that offer alternative livelihoods to mining, such as brick-making and fisheries, in communities around mines. This reflects the widespread recognition that positive impacts from mining on local communities have so far come in below expectations, and that interest is rising in helping these communities diversify their economic activities and so prosper after a mine closes.

Multinational mining firms still rarely improve infrastructure, although it does happen. While this study does not separately assess the impact of corporate responsibility efforts, the benefits are likely to be captured in the overall impact of mining on jobs, health outcomes, and the like.

As discussed earlier, all types of mining can pollute and cause environmental damage, which is injurious to health, unless carefully managed. But even when carefully managed, there are still substantial risks to local communities. Mercury is typically used in artisanal and small-scale mining, although it is not used in large-scale gold mining. Cyanide, which is highly toxic, is used in large mines, although its use is typically better controlled. Another possibly important pollution externality is the loss of agricultural productivity from degraded water and soil. Because of the negative externalities from mining, it is important to properly measure the social costs of this mining, and have a regulatory framework that addresses the environmental challenges of mining and compensates communities affected by these externalities.

**Policy Priorities for Addressing the Local Impacts of Mining**

The empirical analysis reveals little evidence that local mining communities suffer a resource curse because of resource abundance. If anything, these communities experience on average positive, albeit limited, welfare benefits
in the near term. Most of these positive effects are experienced through the market channel.

One question is whether the market effects can be enhanced. There is always a temptation to increase backward linkages using local content laws, which implies replacing some imported inputs with costlier domestic ones. As with all protection, resources are pulled into activities in which they do not have a comparative advantage. Alternatively, local entrepreneurs could develop these inputs to become more productive as they acquire new technology and skills or learn by doing. Other positive spillovers from these linkages, such as increased managerial skills and experience, could also raise the productivity of other sectors. For these reasons, adopting local content laws has become widespread in Africa, and ubiquitous in the oil and natural gas sector.

But there are problems associated with local content laws. For one thing, many are too vague to be workable. In the end, governments may be well advised to focus on developing the conditions for improved procurement rather than mandating them. This could entail improving business conditions, such as better power and transportation infrastructure, access to finance, and regulatory reforms to spur competition to better stimulate linkages between the opening of a large-scale mine and the economy of mining communities as well as those located nearby.

Broadly, it is clear that most benefits from extractives in an African context are likely to be fiscal and national. But the empirical evidence shows that the size of resource-related intergovernmental transfers to local communities has so far been modest. Even so, considerable potential exists to improve welfare at the local level through larger transfers that can support investment in much-needed infrastructure and the development of human capital. By improving worker productivity, the public sector can help strengthen the impact of market forces unleashed by extractive activities. It will also help diversify the local economy, which will be important in sustaining growth after a large-scale mining boom ends.

Both nationally and locally, the quality of governance and its influence on how resource revenues are used will be key determinants of the welfare impacts of natural resources. Enhancing the capacity of local jurisdictions—that is, both bureaucrats and policy makers—to deliver public spending programs needs to be high on the policy agenda. More research is needed to understand the main technical and political constraints facing local governments, their effect on the ability of communities to benefit from revenue windfalls, and the best policies to alleviate them.

All change in an economy brings both costs and benefits, and gainers and losers. So it is with gold mining. There is little evidence of economic decline from gold mining at the local level in the three case study countries, but negative externalities such as pollution can affect communities close to gold mines.
The impacts in some cases are evident over a long time, and even after a mining boom is over. While the national benefits most likely outweigh these costs, the negative externalities need to be fully understood, minimized, and managed.

Realizing a brighter vision for Africa’s future will require a clearer understanding of how to benefit from its endowment of natural resources. Meeting the natural resource extraction challenge in all of its dimensions (governance, economic, and social), as well as understanding the forces that created the challenge, can open channels toward better outcomes and prospects for local communities.

Notes

1. Migrant communities may be economically and politically weaker and have less access to health services and infrastructure.
2. Data are available on mining employment from the Ghana Living Standards Survey data set.
3. Chuhan-Pole et al. (2015) find that, using Ghana Living Standards Survey data, women are 7.4 to 10.4 percentage points more likely to work in services or sales if they live close to a mine, and 2.5 to 2.6 percentage points more likely to work in mining.
4. However, the insignificant point estimates indicate that men might be shifting toward service sector employment and manual work.

References


Sanjay et al. 2015. Socio-economic and Health Implications of Mercury Use in Artisanal and Small-scale Gold Mining. Unpublished manuscript.


