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Socioeconomic and Fiscal Impact of Large-Scale Gold Mining in Mali

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Abstract

This paper analyzes the socioeconomic, fiscal, and governance impact of gold mining in Mali. The analysis finds that, at the national level, mining plays an important role by contributing to export earnings and overall government fiscal revenue. In 2013, the mining sector represented 7 percent of gross domestic product, contributed 1.5 percent to growth in total gross domestic product, and accounted for 65 percent of total export earnings and 25 percent of total government budget revenues. At the local level, despite higher population growth, there is some evidence that outcomes (poverty and infrastructure services) are marginally better in mining communes compared with non-mining communes. Local governments receive fiscal windfalls that are spent significantly on education capital expenditures and current expenditures (salaries and non-salaries). Non-salary current expenditures are 10 times higher in mining areas. Analysis of the political economy of public service provision at the local level suggests that technical or absorptive capacities may be the bottleneck to increasing the local benefit of mining instead of corruption or accountability.

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Socioeconomic and Fiscal Impact of Large-Scale Gold Mining in Mali[1]

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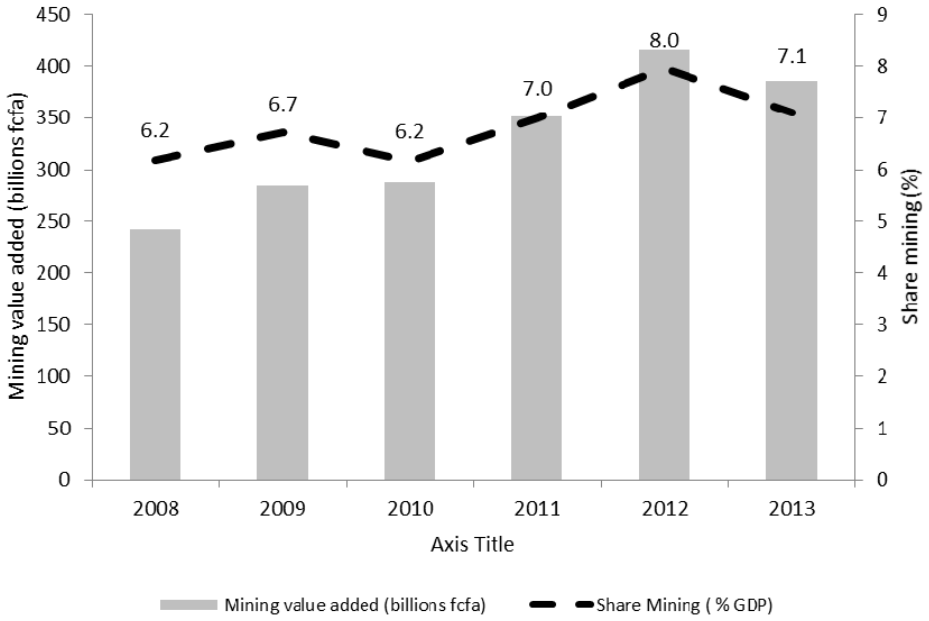
A. Mining and the National Economy

Mali has a long tradition of gold mining in the two regions of Kayes and Koulikoro. The traditional artisanal[2] gold-mining activity is still currently used, with an average annual production estimated at 10 tons (Chamber of Mines 2013). It has, of course, been superseded by industrial mining, which has quintupled the production capacity of the mining sector. Industrial mining took off in the late 1990s, and from 2003 to 2012, the sector produced more than 480 tons of gold, with an average annual production of 50 tons. In 2013, the total value added of the sector was estimated at 7 percent of total GDP, compared to 8 percent the preceding year. From 2008 to 2013, the value added of the mining sector increased, on average, 2 percentage points faster than the country's GDP. Total mining value added grew on average by 9.7 percent (figure 1).

Figure 1 Contribution of the mining sector to GDP, 2008–13 (in billion CFA francs and %)



Source: INSTAT (National Statistics Institute).

While mining is not the engine of the national economy, the sector plays an important role in overall economic growth. In 2012, it attenuated the drop of the secondary sector (manufacturing) and helped the country avoid a recession, in a context of strong growth in the primary sector (extraction of raw materials) and weak growth in the tertiary sector (services) and in industrial activities. It is curious that the years of strong growth in the mining sector did not affect the overall economic growth rate. In 2010, while the value added of the mining sector decreased by more than

[2] In this report, artisanal mining refers to the traditional gold-mining activities known in French as "Orpaillage." While this activity remains informal, it is starting to use the same means of production as in small-scale production.

14 percent, the GDP growth rate reached nearly 6 percent, mainly driven by the primary and the tertiary sector (table 1). Therefore, it is difficult to establish a clear causal link between overall economic growth and the strength of the mining sector given the small size of the latter in the economy.

Table 1 Sectoral contribution to GDP growth, 2008–13 (in %)

	2008	2009	2010	2011	2012	2013	Average
Primary sector	13.2	5.6	11.4	-1.3	8.6	-7.4	5
Secondary sector	-4.6	3.5	-2.1	8.1	-2.9	5.5	1.3
Mining	***-6.4***	***1.5***	***-14.3***	***0***	***9.2***	***1.5***	**-1.4**
Tertiary sector	4.3	3.5	4.5	3.8	-6.7	8.9	3.1
GDP growth	5.5	4.4	5.9	2.5	0.1	1.3	3.3

Source: INSTAT (National Statistics Institute).

Mali is Africa's third-largest gold producer (after South Africa and Ghana), and is ranked eighth in the world. Since the early 2000s, gold has become the highest export product of Mali, replacing cotton. In 2013, gold accounted for 65 percent of the total exports, including 7 percent for artisanal-scale mining (figure 2a). The growth in gold exports (annual average growth of 6 percent) is driven more by world prices of precious metals than volume of exports, which remained steady during 2008–13 (figure 2b). Thus, the increase in the price of gold (which grew on average 9.8 per year) resulted in a significant increase in the value of exports. The price of gold has been a bonanza for exporters quadrupling between 2003 and 2012, from US$416 dollar an ounce to between US$1,650 to US$1,720 dollars an ounce. However, it is feared that an over-supply may cause a drop in world prices, slowing the growth rate of gold's export value or, perhaps, even leading to its decline, in small countries like Mali.

Figure 2a Export values (billions FCFA)

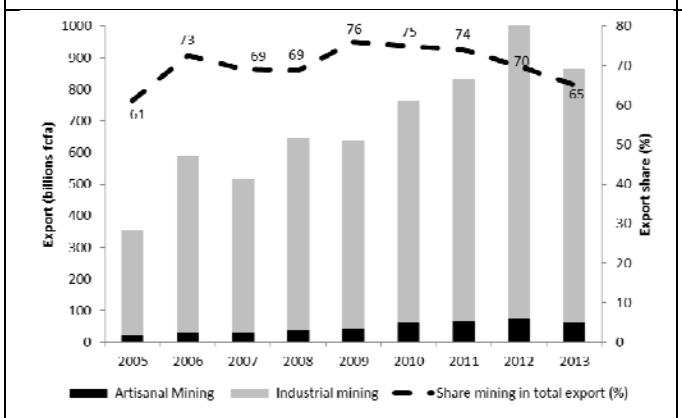
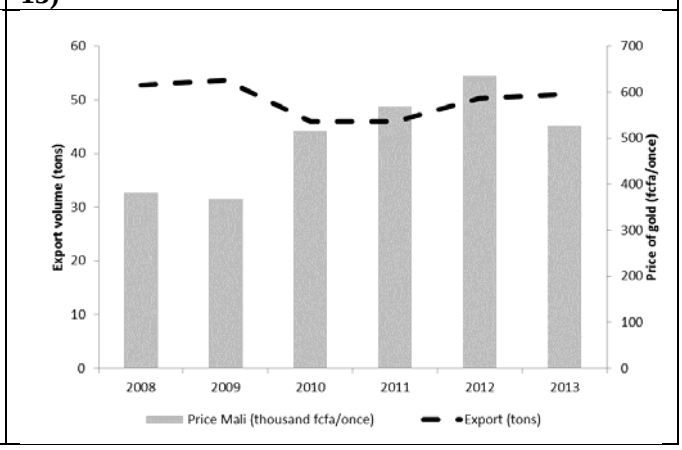


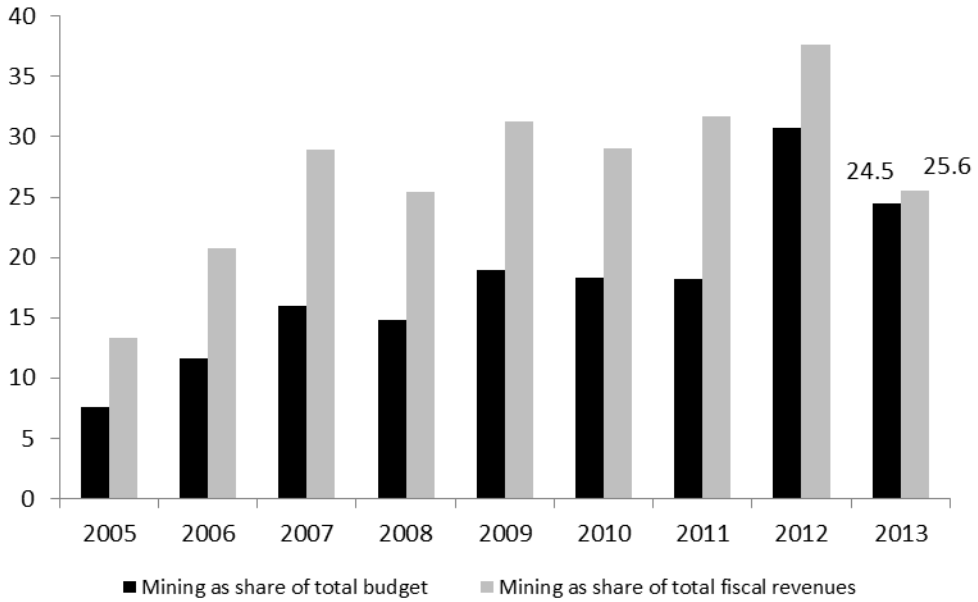
Figure 2b Export and price of gold in Mali (2008–13)



Source: CPS/SME (Mining and Energy Sector Planning and Statistics Unit), 2013.	*Source:* DNGM (National Geology and Mines Directorate).

Tax revenues from the mining sector increased steadily as a percentage of total government resources, rising from 10 percent in 2005 to 25 percent in 2013, having peaked at 33 percent in 2012, a year that was particularly difficult with regard to the mobilization of resources because of the war in the north of the country (figure 3). The strong growth of the mining sector's contribution to the national budget was driven primarily by revenues from customs duties, and secondly domestic taxes.

Figure 3 Mining's share of the government's budget and fiscal revenues (%)



Source: CPS/SME (Mining and Energy Sector Planning and Statistics Unit), 2013.

The contribution of mining activities to employment is measured in terms of direct jobs in industrial mining, jobs generated by mining subcontractors, and jobs in the artisanal gold mining sector, but the latter has been harder to estimate due to its volatility (see Annex 1).[3] The total number of direct jobs on industrial mining sites was 3,341 in 2013, 300 jobs fewer than in 2012 and 2011. On average, between 2008 and 2013, there were 3,635 jobs per year, with a ratio of 14 national workers to 1 expatriate (figure 4a). On average, 78 percent of the national direct jobs are located in three communes (Sadiola, Sitakily, and Gouandiaka) (figure 4c). Five mine sites located in Sitakily and Sadiola communes have 82 percent of the indirect jobs held by subcontractors (figure 4d). Except for the mining company Wassoul'or, all mining companies subcontract some of their activities to other companies, resulting in indirect employment that reached 7,000 jobs in

[3] High gold prices provoke a 'gold rush' which, naturally, is reversed when the prices fall.

2013 compared to 8,000 in 2012 (figure 4b). On average, there are 6,000 indirect jobs per year, or a ratio of five subcontractor jobs for every three direct jobs.

Figure 4a Direct employment, 2008–13

Figure 4b Indirect employment, 2008–13

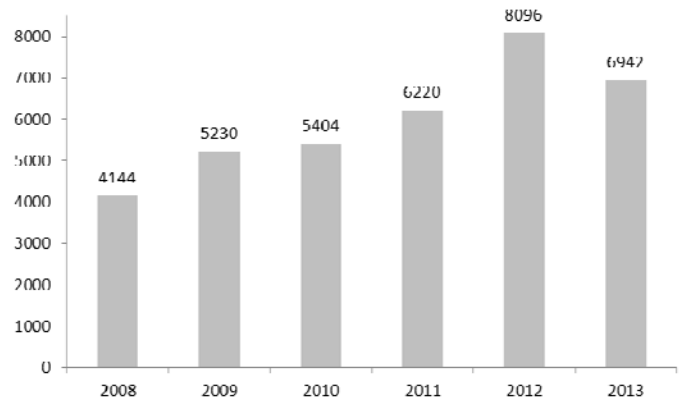


Figure 4c Share direct employment by communes, 2008–13

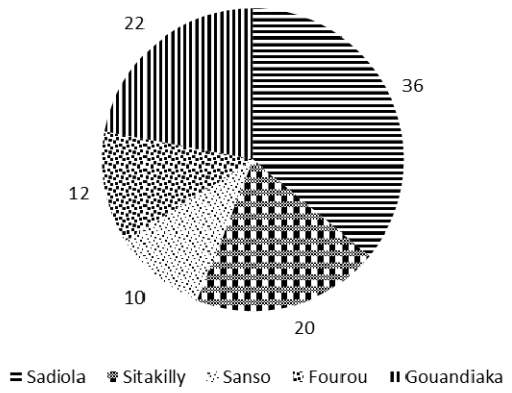
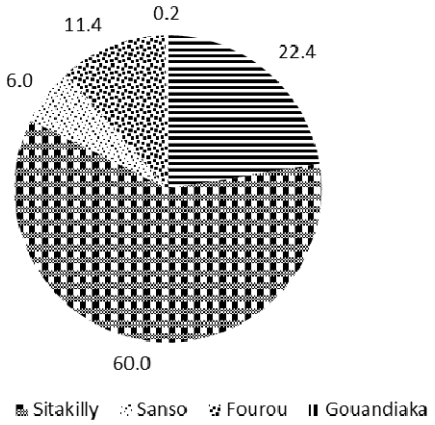


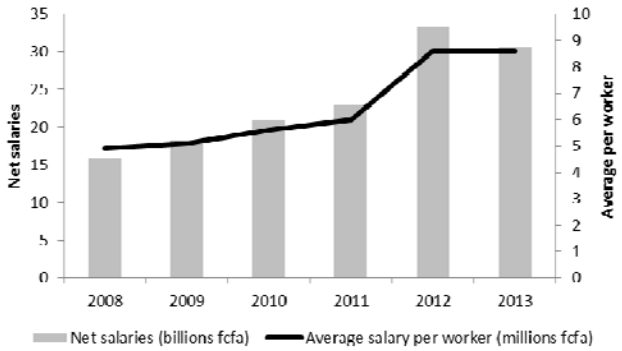
Figure 4d Share indirect employment by communes, 2008–13



Source: CPS/SME (Mining and Energy Sector Planning and Statistics Unit), 2013.

In 2012 and 2013, employees of the mining sector had on average, a net annual salary of 8.6 million CFA francs, or an average net monthly salary of slightly more than 700,000 CFA francs. The net wage bill has exceeded 30 billion CFA francs since 2012 (figure 5a). When we include payroll taxes and social security contributions, the total wage bill reaches 50 billion CFA francs, thus approximately 39 percent of the wage-bill goes to payroll taxes and social security contributions. Based on national labor survey data (EPAM 2010), it appears that mean income from mining activity for each active worker is higher than the average income for all other activities, especially the agricultural and industrial sectors in the Sikasso region. In Kayes region, other industrial and tradable service sectors have higher average income (figure 5b).

Figure 5a Evolution of wage bill and wage per worker, 2008–13



Source: CPS/SME (Mining and Energy Sector Planning and Statistics Unit), 2013.

Figure 5b Income ratios relative to extractives, 2008–13

	Kayes	Sikasso	Other regions	Total
Agriculture	6%	37%	60%	40%
Extractives	**100%**	**100%**	**100%**	**100%**
Industry	111%	50%	110%	85%
Construction	14%	75%	413%	214%
Services (tradable)	129%	68%	107%	84%
Services (non tradable)	76%	73%	183%	126%

Source: EPAM (Permanent Household Survey), 2010.

Agriculture remains an important activity in both mining and non-mining areas. In the communes that have industrial mining sites, only 13 percent of the active population works in the extractive sector. This proportion decreases considerably as we move away from the mining area, from 8 percent in the neighboring communes to 1 percent in the other communes of the same Cercle.[4] In four out of the five mining communes, more than 60 percent of the active population still works in agriculture (figure 6a). Relative to 1998, the share of agriculture has actually increased in the three mining communes of Sikasso. Only the mining commune of Sitakily experienced a substantial decreased in agricultural share, and it is also the commune with the highest share of subcontractors (figure 6b). The share of the population involved primarily in the extractive sector in 2009 is highest in Sitakily (30 percent), followed by Fourou (15.5 percent), and Gouandiaka (8 percent). In Sadiola commune, location of the largest and oldest gold mines, the share of population working in extractives increased from 1.2 percent in 1998 to just 3.2 percent in 2009.

[4] Mali consists of eight regions as well as the district of Bamako, the capital city. The regions are subdivided into 49 circles (*cercles*), which in turn are subdivided into 705 municipalities (*communes*).

Figure 6a Share of population working primarily in agriculture (%) in mining communes

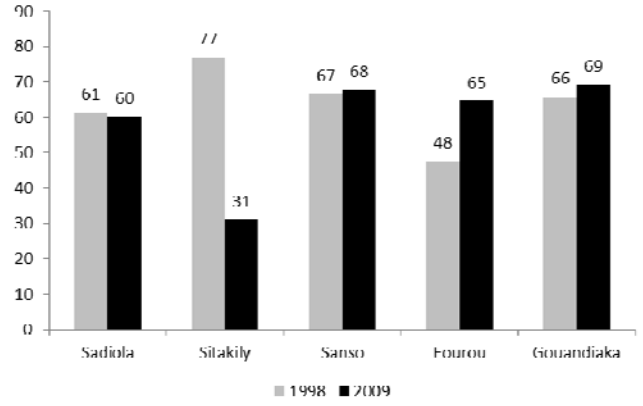
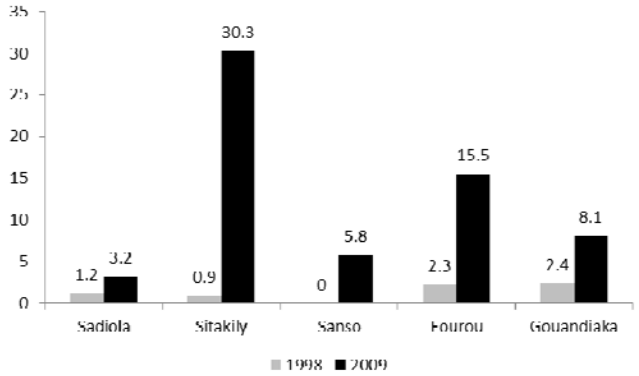


Figure 6b Share of population working primarily in extractives (%) in mining communes



Source: RGPH (General Population and Housing Census) 1998 and 2009.

Mali has one of the highest fertility rates in the world, at 6.1 children per women, which has led to an overall high national population growth rate averaging 3 percent annually between 1998 and 2009. But the population growth rate has been even higher in mining communes, where it is almost double the national rate. Mining communes grew on average 5.7 percent annually compared with 3.5 percent for neighboring communes and other communes within the same Cercle (figure 7a). The population growth rate is above 6 percent in all mining communes, except in Gouandiaka, where at 2.9 percent, it equals the national rate (figure 7b).

Figure 7a Population growth rate by group of communes, 1998–2009

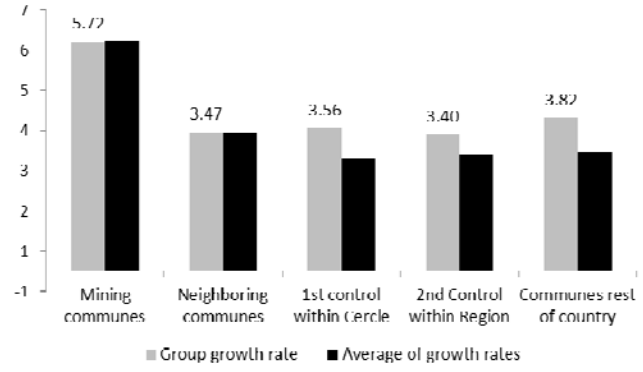
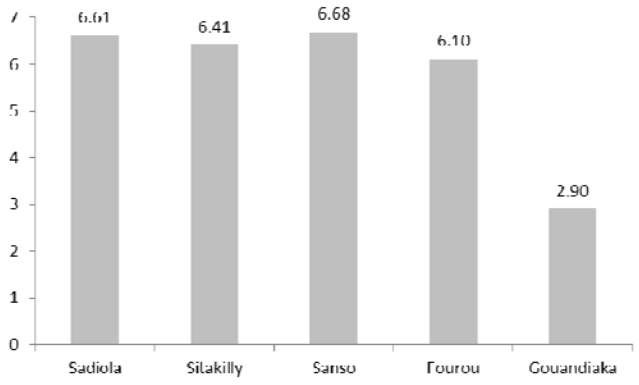


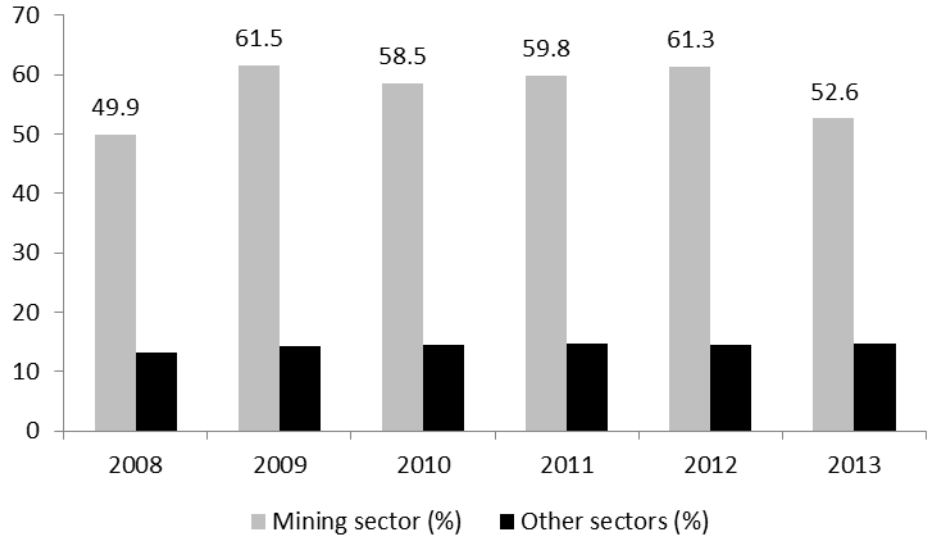
Figure 7b Population growth rate for mining communes, 1998–2009



Source: RGPH (General Population and Housing Census) 1998 and 2009.

Like other economic sectors in Mali, the tax system in the mining sector is complex. It includes, among other things, license fees of 10 percent of the gold sales turnover starting from the third year of production, an excise duty of 3 percent of the sales turnover, and a corporate income tax of 30 percent. The tax burden on the mining sector (the ratio of the tax revenues of mining companies to the value-added of mining activity) is more significant than the tax burden on the whole economy (the ratio of the total tax revenues to the country's GDP), an average of 57 percent compared to 14 percent (figure 8). In 2012, the seven mining companies and their subcontractors represented 45 percent of all corporate taxes in Mali. However, this average tax burden on the mining sector is within the range of taxation on the mining sector observed in other countries like Canada (60 percent), South Africa (45 percent) and Papua New Guinea (55 percent) (Bhushan and Juneja 2012). While in developed countries the tax burden is a reflection of the high environmental costs of mining, in Mali that is not the case.

Figure 8 Fiscal burden (%)



Sources: CPS/SME (Mining and Energy Sector Planning and Statistics Unit) 2013; and authors' calculations.

The gold reserves identified by mining companies are estimated at more than 500 tons in 2017 which represents 10 years of gold extraction at current extraction rates or nearly 12 years if production were to fall to 45 tons (figure 9a). The three communes of Sadiola, Sitakily, and Fourou represent 85 percent of the total volume of all these reserves, including 200 tons actually proven (figure 9b). The forecasted production for 2015 to 2017 is 137 tons, compared to 163 tons between 2011 and 2013.

Figure 9a Production and reserves, 2015–17

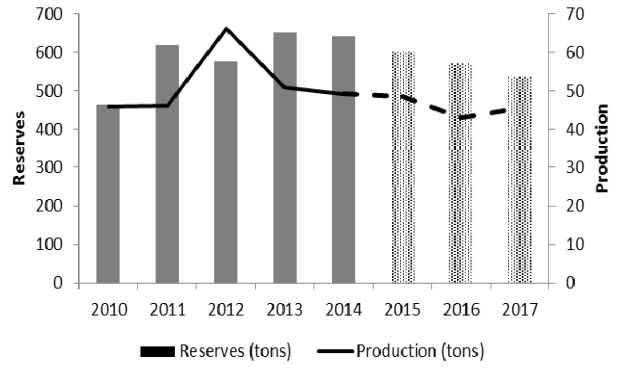
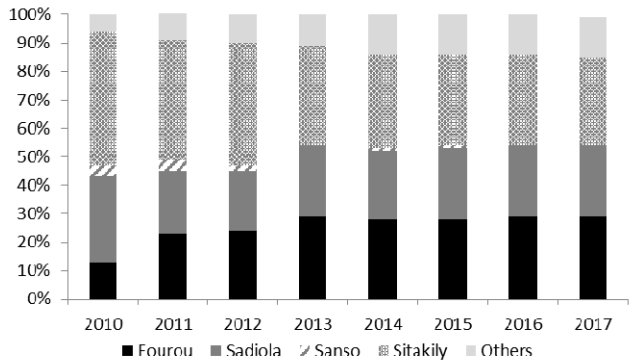


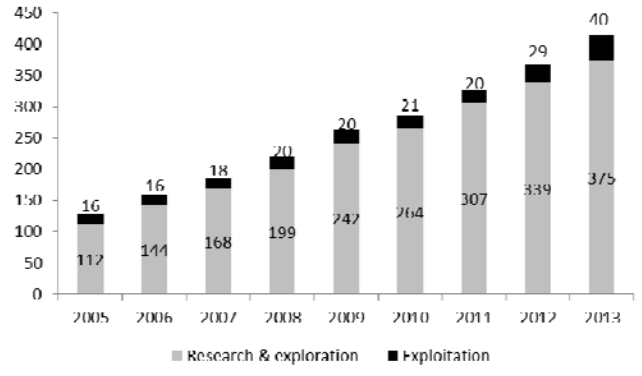
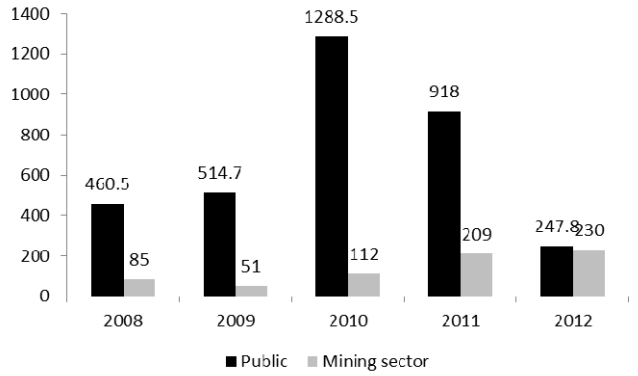
Figure 9b Communes' shares of reserves, 2015–17



Source: CPS/SME (Mining and Energy Sector Planning and Statistics Unit), 2013.

Many mining companies hold mining permits. With a few of the older mines scheduled to close soon, significant exploration activity is taking place**.** The number of these mining permits is estimated at more than 200 and they cover a few thousand square kilometers. The most active companies are Anglogold Resources, Avnel and Resolute. The most active exploration activity is conducted in Kayes region, mainly in the Cercle of Kéniéba; Bougouni and Yanfolila in Sikasso region; and the Cercle of Kangaba in Koulikoro region. In 2013, 375 mining research permits were issued, including six authorizations for prospecting (figure 10a). The same year, 40 extraction permits and authorizations were issued. Thus, the ratio of extraction permits to research permits is nearly 11 percent. Mining permits can be issued to either mining companies or individuals.

Investment by mining companies has been rising steadily. In 2012, the mining sector made a total investment of 230 billion CFA francs (or 89 percent of its planned 257 billion CFA franc investments). This is compared to an execution rate of 24.5 percent of public investment under the government Special Investment Budget, mostly due to the crisis in the north. During 2008–12, investments of 137 billion CFA francs were made by the mining sector at an execution rate of 114 percent compared to the planned investments (figure 10b).

Figure 10a Total number of valid permits	Figure 10b Investment (millions CFA francs)
	

Sources: CPS/SME (Mining and Energy Sector Planning and Statistics Unit), 2013; and DNDP (National Development Planning Directorate).

B. Mining and the Local Economy

In this section, we use the actual commune-level outcomes and focus on two sources of data to explore the differences over time between mining communes and other groups of communes. The best available data to compare outcomes at the commune level are the two censuses of 1998 and 2009, which also come close to capturing the pre- and post-outcomes (figure 11a). In 1998, only the mine in Sadiola was in operation for about a year. We construct three groups of controls taking advantage of geographic proximity to mining activities: (a) neighboring communes that share a border with a commune with an industrial mining site; (b) other communes within the second administrative-level Cercle where mining is taking place; and (c) other communes within the three mining regions (figure 11b). We acknowledge, however, that this methodology will not be able to tell us whether the differences are due to mining or not.

Figure 11a Gold production in tons, 1997–2011

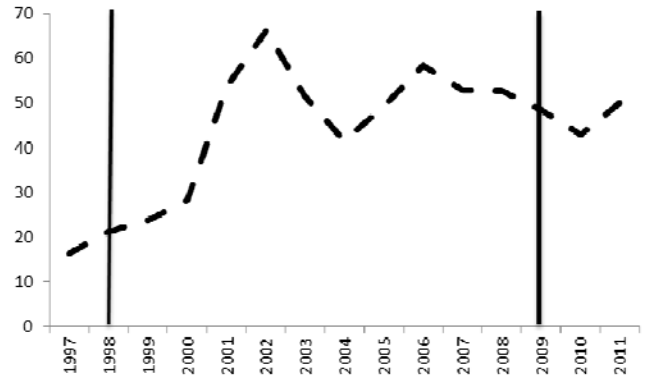
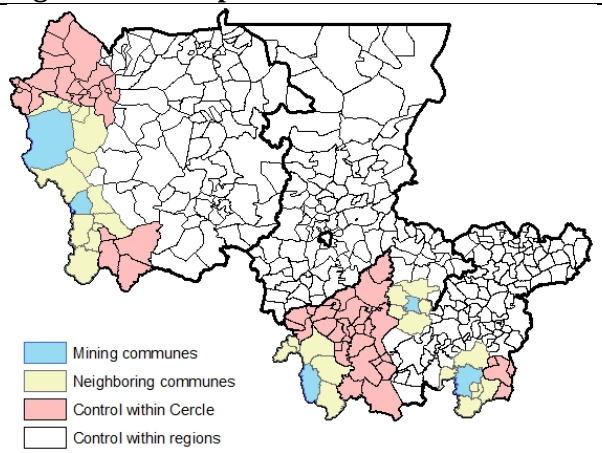


Figure 11b Group of communes



With regard to enrolment rates in primary schools, mining communes and their neighboring communes have net enrolment rates higher than other communes. This rate decreases as we move away from mining areas (figure 12a and 12b). Not only are the rates higher in the first two types of communes mentioned, but the rates in those communes also increased faster from 1998 to 2009, the two years being the years of the last two General Population and Housing Censuses in Mali.[5]

Figure 12a Net primary enrollment (%)

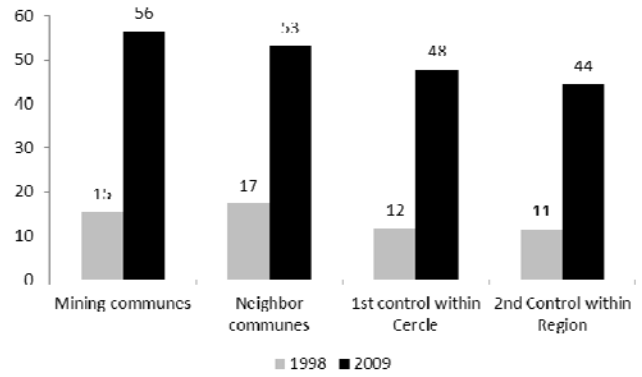
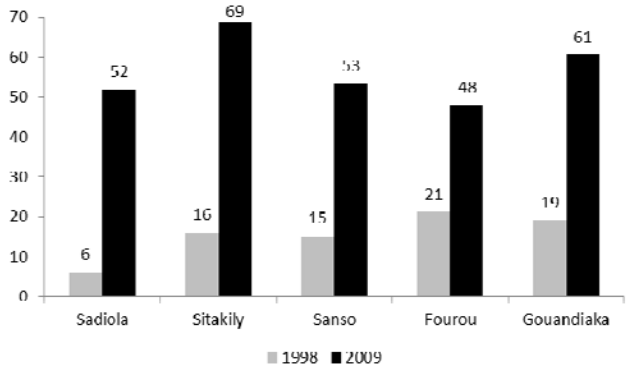


Figure 12b Net primary enrollment (%) mining communes



Source: RGPH (General Population and Housing Census) 1998 and 2009.

With regard to access to other basic social services, mining communes had low levels of access to electricity and improved cooking fuels before the mining boom started in 1998. For example, less than 2 percent of the population used electricity for lighting or improved cooking fuels. However,

[5] We could not use the 1987 census data because communes were not created at that time.

30 percent had access to an improved water source, and 50 percent to an improved sanitation facility (table 2). In terms of progress, between 1998 and 2009, mining communes had significant improvement with regard to services where they started from a lower base. However, in 2009, only the share of the population using an improved water source is far greater in mining areas. This may explain the better children's health outcomes in the vicinity of mining activity (Polat et al. 2014). Beyond indicators of access, infrastructure outcomes in 2013 are not better in mining areas. For example, while paved road per capita is slightly higher in mining areas, irrigation per capita[6] is lower than in other areas. Mining areas have also fewer nurses and midwives per capita than other type of communes (table 3).

Table 2 Use of infrastructure services, 1998 and 2009 (% of population)

	1998				2009			
	Electricity for lighting	Improved water source	Improved cooking fuel	Improved sanitation	Electricity for lighting	Improved water source	Improved cooking fuel	Improved sanitation
Mining communes	1.88	30.31	1.73	50.62	12.97	67.16	2.10	89.25
Neighbor communes	2.73	17.37	1.81	47.94	11.88	42.87	0.65	84.03
1st control within Cercle	7.71	23.45	2.48	48.97	13.31	42.08	0.61	83.20
2nd Control within Region	2.62	19.38	2.11	52.35	10.54	29.06	0.47	82.08

Source: RGPH (General Population and Housing Census) 1998 and 2009.

Table 3 Infrastructure outcomes by group of communes, 2013

	Paved road per 1,000 inh.	Irrigated area per 1,000 inh.	Local health centers per 10,000 inh.	Health doctors per 10,000 inh.	Midwives per 5,000 inh.	Nurse per 5,000 inh.	primari school per 1000 inh.	Net primary enrollement (%)
Mining communes	6.80	0.73	0.74	0.52	0.06	0.38	0.88	73.00
Neighbor communes	6.56	4.84	1.17	0.41	0.14	0.82	0.90	63.75
1st control within Cercle	6.16	5.19	1.03	0.42	0.18	0.58	1.02	61.59
2nd Control within Region	10.37	6.21	1.07	0.32	0.12	0.72	0.82	55.87

Source: ODHD (Sustainable Development Observatory) database 2013.

With regard to poverty,[7] although mining communes had lower levels of poverty than other communes in 1998 and 2009, poverty reduction remains slightly less significant between the two dates. Over 10 years, poverty declined by 17 percentage points in mining communes compared to 19 percentage points in neighboring communes and other communes within the same Cercle (figure 13a). Furthermore, the mining communes of Sikasso region experienced an increase in the monetary poverty rates between 1998 and 2009. Sadiola and Sitakily achieved by far the biggest

[6] However, this may reflect differences in rainfall or farming intensity.

[7] We use two poverty maps based on the General Population and Housing Censuses of 1998 and 2009. The poverty map for 1998 was developed by GREAT (Applied and Theoretical Economics Research Group) and combines the 1998 census and the household survey ELIM (Integrated Light Household Survey) of 2006. The poverty map for 2009 is the result of collaboration between the World Bank and INSTAT (National Statistics Institute) and uses data from the 2009 census and the 2010 ELIM. One major methodological difference between the two maps is that the map of 1998 is based on a consumption model that considers urban and rural areas inside each administrative region with a total number of 17 models, whereas the map of 2009 uses only 8 regional models. In addition, the gap in years between the census and the household budget surveys is much smaller for the 2009 map.

reduction in poverty rate (figure 13b), and they are also the sites of the biggest and oldest mine operations in the country.

Figure 13a Poverty headcount (%)

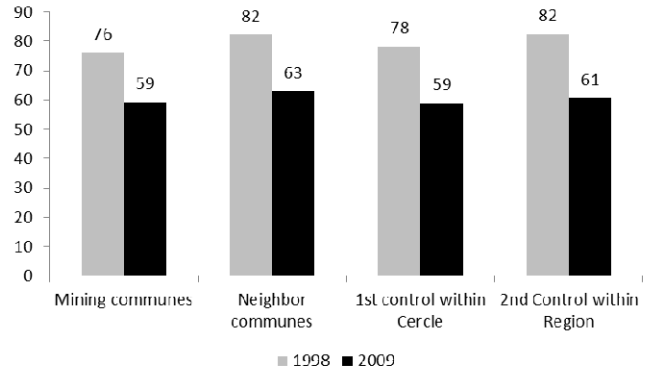
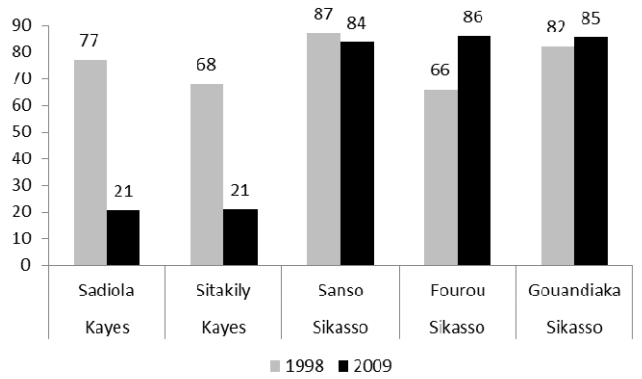


Figure 13b Poverty headcount (%) mining communes



Sources: GREAT 1998; World Bank 2013.

C. Mining and Fiscal Revenues

In this section, we explore whether the flow of financial resources to communes can be one explanatory factor of the differences or lack thereof between mining and non-mining areas.

From the literature review (Aragón et al. 2014), we found that resource extraction can impact local outcomes through two main possible mechanisms—market or fiscal. This section will examine specifically the fiscal channel by looking at the extent of resource revenues received by local governments in mining areas and assess whether the corresponding size and composition of fiscal spending in these communities is impacted by mining.

To better understand this nonmarket channel, this section first provides the context of the intergovernmental arrangements for the transfer of funds to local communities and how they are implemented, direct flows of revenues from the central government and mining companies, and indirect flows to the local authorities.

Decentralization

The decentralization process in Mali, which was initiated in the late 1990s, has resulted in the creation of 761 local authorities (including 703 communes, 49 districts, 8 regions, and the District of Bamako). The local authorities are recognized as autonomous, with specific responsibilities

related to the provision of public services.[8] From 1992 to 2009, five local elections have been held (1992, 1998 and 1999, 2004, and 2009). The next local elections, which were initially planned for 2014, are finally expected to take place in 2015 and, for the first time, they will be coupled with regional elections in the new context of regionalization,[9] under which all the deliberating bodies of local authorities (regions, cercles, and commune councils) must be elected directly by their governed citizens.

Despite some progress in the administrative and financial empowerment of local authorities, they are still to a large extent under the authority of the central government with regard to resources, and even acts and decisions related to their respective territories. The government seems to be more concerned about national unity and territorial integrity than the enhancement of the transfer of capabilities and public resources to communities. Importantly, the Malian decentralization framework includes an element called "deconcentration," whereby agents[10] paid by the central government are relocated within local authorities to provide technical assistance or even approve budgets.

Flows of resources to communes

From 2011 to 2014, central government transfers to local authorities accounted for an average of 2 percent of GDP. While the transfers to local authorities account for only 9 percent of the government's budget expenditures, local authorities additionally benefit from other public resources within the framework of "deconcentration." Data on transfers to local authorities in the last four years show that their share in the government total budget has varied significantly from year to year (table 4). In particular, there was a very sharp fall in direct transfers in 2012, whereas "deconcentration" transfers grew moderately each year. These transfers to all communes are much smaller than the contribution of the five mining communes to the national budget. In 2013, revenue from mining areas represented 25 percent of total government revenue. Tracking these transfers to individual communes is only a recent phenomenon in the budgeting framework of the central government. There are no clear rules for the transfers, and therefore it is not obvious whether they benefit certain groups of communes to the detriment of others.

[8] Responsibilities transferred are in the health, education, and water sectors.
[9] In previous elections, commune councils were directly elected by citizen's votes, while cercles and regional councils were indirectly elected.
[10] In practice, the agents interfere with local authorities even within their responsibilities in the areas of health, education, and water.

Table 4 Transfers to local governments, 2011–14[a]

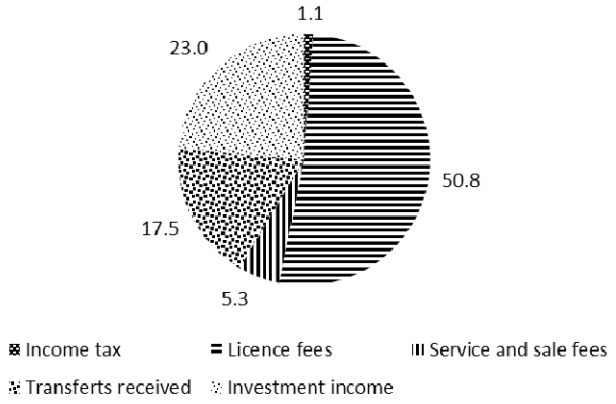
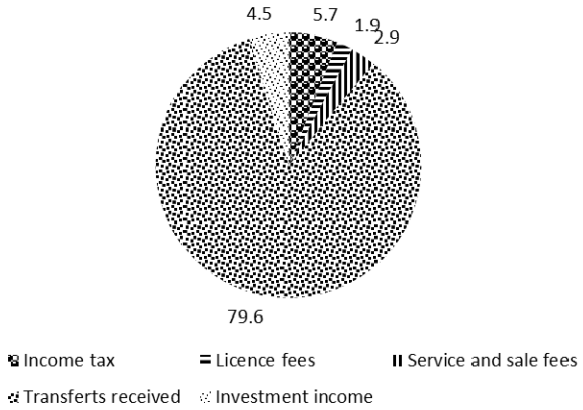
	2011		2012		2013		2014	
	10^9 fcfa	%	10^9 fcfa	%	10^9 fcfa	%	10^9 fcfa	%
Deconcentration transfers	157.1	12.4	163.1	17.7	173.7	19.6	202.5	11.2
Direct transfers	122.4	9.6	48.6	5.3	83.4	9.4	141.5	7.8
Total transfers	279.5	22	211.7	23	257.1	29.1	344	19
Total State budget	1 268.5		918.6		884.3		1 806.6	

Source: BOOST 2014.
Note: a. 2014 is based on partial execution of the budget.

In 2000 new legislation mandated 60 percent of local taxes[11] paid by commercial mining firms and 80 percent of license fees paid by small-scale miners to the local authorities, be paid to the communes where gold production takes place. Producing Cercles should receive 25 percent and 15 percent of these taxes, respectively, while producing regions retain 15 percent and 5 percent, respectively. Commercial mining companies are exempted from paying these taxes during the first three years of operations. Unfortunately, local authorities have little possibility of determining the actual level of the license fees that are supposed to be distributed among them. License fees from mining companies are actually not distributed as required by the above-mentioned law. The share actually allocated to communes represents 73 percent of the total amounts collected instead of the 60 percent according to the law. As a result, all the other levels of local authorities receive less than the percentages required by the law, 17 percent at the Cercle level (while the law requires 25 percent) and 1 percent at the regional level (while the law requires 15 percent).

In general, Malian local authorities have a low rate of revenue collection and therefore a low level of self-financing capacity. As a result, the transfers and subsidies from the government represent the main source of revenue to support current and especially investment expenditures. The analysis of the budgetary accounts from 5 mining communes and 24 neighboring communes reveal indeed a low level of tax collection. Mining communes have an emphasis on the resources generated by license fees paid by mining companies. These license fees represented more than 50 percent of their revenues between 2011 and 2013 compared to just 2 percent for neighboring communes (figure 14a and 14b). Although mining communes are less dependent on the transfers from the government, they still remain exposed to the risks related to the closing of mines or the drop of production in this sector because license fee payments are a function of turnover.

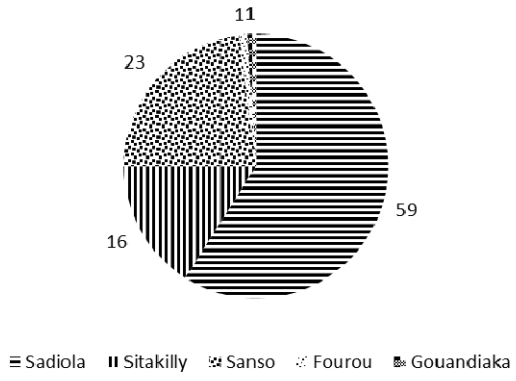
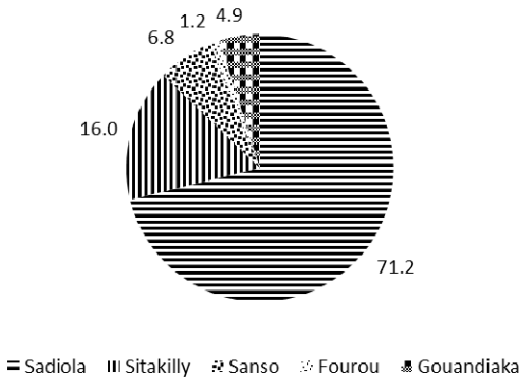
[11] All other mining taxes are paid to Bamako and consolidated in the national budget.

Figure 14a Source of budget revenues for mining communes, 2011–13	Figure 14b Source of budget revenues for mining neighboring communes, 2011–13
	
Source: DNTCP (National Directorate of Treasury and Public Sector Accounting).	

In 2013, the five mining communes of Sadiola, Sitakily, Sanso, Fourou, and Gouandiaka had more than 2 billion CFA francs of mining-related revenues, nearly 58 percent of which was derived from license fees and 20 percent from government transfers (about 400 million CFA francs, or 87 million CFA francs per commune). The two communes—Sitakily and Fourou—received 231 million CFA francs while Sadiola received only 45 million CFA francs. In 2013, transfers from the government still accounted for the largest share of financial resources of the mining communes of Fourou (86 percent) and Gouandiaka (nearly 55 percent), compared to 1 percent and 18 percent, respectively, for license fees.

In addition to paying license fees, mining companies also contribute substantially to local development funds. These are funds[12] that may not be controlled by local authorities. During 1994–2010, the contribution of mining companies to the financing of local development amounted to more than 7 billion CFA francs resulting from license fees and nearly 20 billion CFA francs from special development funds, or a total contribution of more than 25 billion CFA francs. In general, the amount of license fees from each mine is lower than the amount of special development funds, except for the three mine sites of Yatéla, Loulou, and Morila, which represent 57 percent of the total license fees but only 17 percent of total special funds. Sadiola commune is by far the biggest contributor, at 59 percent of license fees and 71 percent of special development funds. This is because that mine has been operating for the longest time (figures 15a and 15b).

[12] The amounts of contribution decided are not based on any standard formula but are decided mine by mine or as specified in the mining convention. These funds should be seen as another direct form of compensation for some of the costs imposed by mining activities.

Figure 15a Mining communes' share of license fees, %, 1994–2010	Figure15b Mining communes' share of development fund, %, 1994–2010
	
Source: ODHD (Sustainable Development Observatory) 2011.	

The sectoral distribution of the development fund within mining communes depends largely on their needs and the complementarity with their own budget spending. In Sadiola, more of the funds have been spent on agriculture (23 percent), while in Fourou, almost 83 percent of the fund has been spent on education. In Sanso and Gouandiaka, the focus has been on infrastructure spending (31 percent and 50 percent, respectively). The largest part of the development fund in Sitakilly was spent on relocating the local population (table 5). Because these funds are controlled by mining companies, they have more sway on how the funds are spent. The government considers these funds to mining communes as de-facto transfers, because they come as a deduction from equity returns to be paid to the governments (ODHD 2011).[13]

Table 5 Sectoral spending of the mining development fund, 1994-2010

	Sadiola	Sitakilly	Sanso	Fourou	Gouandiaka
Health	10.9	5.4	2.0	5.4	0.9
Education	13.9	4.6	26.9	82.7	33.4
Infrastructure	17.9	10.0	30.9	11.6	50.8
Agriculture	23.0	9.7	14.0	0.0	0.2
Others	34.4	70.4	26.3	0.3	14.7

Source: ODHD (Sustainable Development Observatory) 2011.

Effects of mining on fiscal revenues and spending patterns

It is possible that revenue windfalls and public spending by local government drive the difference in observed outcomes across mining and non-mining areas. But we only observe a marginal difference in outcomes among the groups of communes. Is this because mining areas are not

[13] The state of Mali owns 20 percent equity in all mines.

benefiting financially from these operations? Or is it due to their spending patterns? We investigate these questions by looking at budget outcomes without controlling for any other factor.

Figure 16a shows that gold mining brings revenues to mining communes. Own fiscal revenues on average are five times higher in mining communes than the neighboring communes and 4 times higher than other communes in the same Cercle. In terms of both total capital and current expenditure (and their itemized components), mining communes have more per capita expenditures than all the other types of commune, especially much more than their neighboring communes with respect to investment spending (figure 16b). For capital expenditure, the biggest gap is in education, where mining communes spend five times more than their neighbors (figure 16c). For current expenditures, both salaries and non-salary current expenditures, such as transport expenses, are higher in mining communes by factors of 2 and 11, respectively (figure 16d).

Figure 16a Own revenues (CFA francs/capita), 2005–08

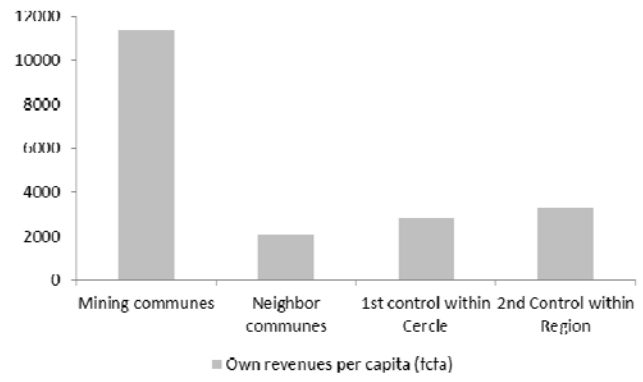


Figure 16b Capital investment and Current expenditures (CFA francs/capita), 2000–08

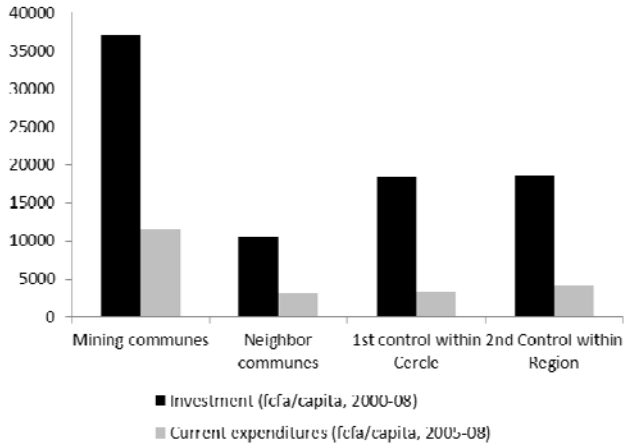


Figure 16c Capital investment by sector (CFA francs/capita, 2000–08)

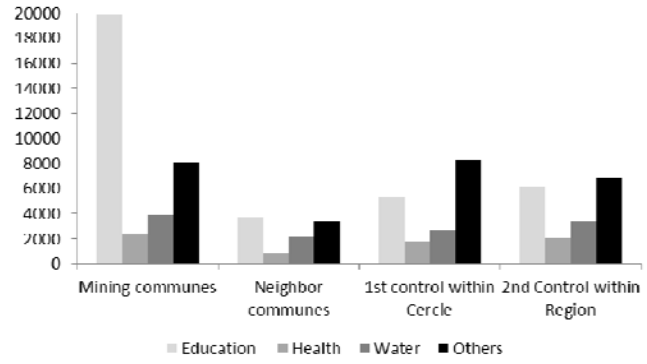
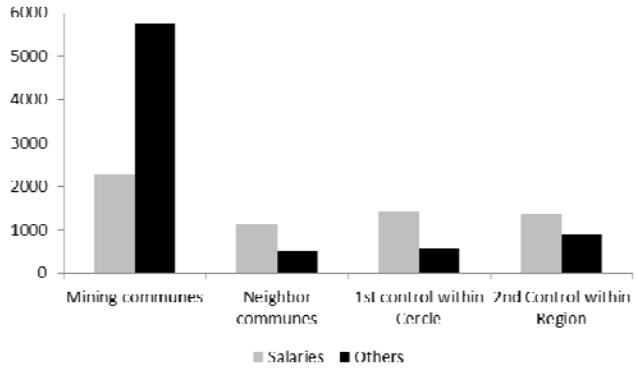


Figure 16d Components of current expenditures (CFA francs/capita, 2006–08)



Source: Authors' calculations from ODHD (Sustainable Development Observatory) data 2003, 2006, 2008.

We estimate these differences in budget outcomes within a regression framework to control for other factors that matter for these outcomes. The identification strategy follows (Loayza, Teran, and Rigolini 2013), which here consists of just comparing budget outcomes in *communes* where mines are located with neighboring *communes* with similar characteristics while controlling for other factors. This is based on the presumption that at the lowest administrative level, location of mines is determined by exogenous geological factors. Therefore, comparing nearby similar *communes* will minimize the issue of omitted variables biases. While gold mining is taking place in only three regions of Mali, our sample includes all 705 *communes*, including those in the capital city, which allows us to control for a range of factors such as urbanity and rainfall.

A clean econometric identification of the impact of mining activities on local government budget outcomes would require data on budgets for both mining and non-mining *communes* during pre- and post-mining. However, we have annual budget data available for only 2006 to 2008, during which most of the mines had already opened. Industrial gold production started with the first site in Sadiola in 1996, just two years before the second population census of Mali. Fortunately, we are able to use the 1998 population census to fully control for some initial differences across communes, such as poverty and education levels prior to the mining boom. We also test whether larger mines have bigger impacts on budget outcomes by using the cumulative level of production measured in metric tons as an alternative measure of mining activity.

The baseline specification considers three groups of communes: *communes* where mines are located and their neighboring *communes* within the same region, which are the "treatment" because of their spatial proximity and possible institutional similarities. The control group is all other communes located in the rest of the country. The regression equation is as follows:

$$Outcome_{rc} = \beta_0 * mining_{rc} + \beta_1 * neighbors_{rc} + \alpha X_{rc} + \varepsilon_{rc}$$

Our outcome variables are communes' fiscal revenues, capital, and current expenditures, all in per capita terms. Per capita capital expenditures is further broken down by education, health, water, and others, while per capita current expenditures has salaries and others as components. The variable *mining* is an indicator equal to 1 if the commune has an industrial mine site within its boundaries, and 0 otherwise. It can also represent the continuous cumulative gold production levels within the producing communes. The variable *neighbors* is an indicator equal to 1 if the commune directly shares a border with a mining commune, and 0 otherwise. X_{rc} controls for pre-boom differences such as poverty and education, as well as for average rainfall within the *communes*. Without-region fixed effects, β_0 and β_1 give the difference between mining and neighboring *communes* with all other control *communes*. We expect β_0 to be positive and significant and β_1 not

to be significant, because neighboring communes do not receive license fee payments from mining companies.

Table 6 focuses on the cross-sectional effect of mining on revenues and composition of spending. In column (1), we observe that mining communes have significantly more revenues than other communes after controlling for initial levels of poverty and education. The coefficient implies that the mean difference is about 8,500 CFA francs per capita. Note that the coefficient on the variable neighbors is not significant, confirming that mining activities cannot affect these communes through the fiscal channel. Average commune rainfall and being urban both positively and significantly affect revenue levels. From column (2) to column (6), total capital expenditure per capita is 25,000 CFA francs higher and significant in mining communes, but this is solely driven by the capital spending on education in column (3). Here, higher average rainfall negatively affects spending levels consistently. There are no significant differences between mining communes and other communes in terms of spending on health, water, and other sectors. Urban communes spend more than their rural counterparts only in terms of other capital expenditures column (6). From column (7) to column (9), total current expenditures, as well as its components (salaries and non-salaries), are significantly higher in mining communes. These results suggest that when mining communes benefit from windfall revenues in Mali, capital expenditure on education and current expenditures including salaries go up.[14] In the next section, we investigate why higher levels of reported revenues and spending have not led to far better outcomes in mining areas by focusing on aspect of governance, and technical and absorptive capacities.

D. Mining, Governance, and Public Goods Provision

The literature review by Aragón et al. (2014) shows there is an emerging body of empirical research on the effect of resource windfall transfers on political corruption at the local levels—that is, the political resource curse (Brollo et al. 2009; Caselli and Michaels 2013; Ferraz and Finan 2008; Morgandi 2008). These papers show that in environments of weak institutions and bad governance, resource revenue windfalls can foster corruption and rent-seeking behavior among politicians, and promote competition over funds among citizens and elite groups, all of which can impact socioeconomic outcomes by worsening inequality and poverty.

For the presence of mining activities to have any positive effect on economic welfare through the fiscal channel, it needs first to lead to an actual increase in the fiscal space and spending levels of local governments. We have shown that this has been the case in Mali, where gold mining *communes* report both higher levels of revenues and spending per capita. Within the context of infrastructure gaps in developing countries, the literature review also tells us that more revenues

[14] These results do not change when using intensity of production in mining communes instead of a dummy indicator. The results are available upon request.

are necessary but not sufficient for better provision of public goods and better local infrastructure, which ultimately will improve human welfare. What matters is whether the increased revenues are used in an efficient manner to deliver these public goods, and this is not a given in the developing-country context. For example, Caselli and Michaels (2013) show that in Brazil, revenue windfall to oil-rich municipalities significantly failed to improve public good provision due to corruption and rent-seeking. Also in the same vein, Monteiro and Ferraz (2012) show that a revenue windfall to the same Brazilian oil-rich municipalities affects spending levels in education and health only through an increase in payrolls.

In this section of the paper, we focus on the political economy issues of translating more revenues into better outcomes in gold mining communes by investigating the relationship between governance (trust in public institutions, responsiveness or accountability to citizens, and corruption) and quality of public services. We test hypotheses related to the two most important factors—that is, political responsiveness and the technical capacities of local government that may undermine the positive effect of revenue windfalls on public good provision, and local living conditions. In the absence of objective measures of these factors at the commune level, we leverage the Afrobarometer[15] surveys to investigate at the individual level the effect of the proximity to gold-mining activities on perceptions of governance and quality of public services.

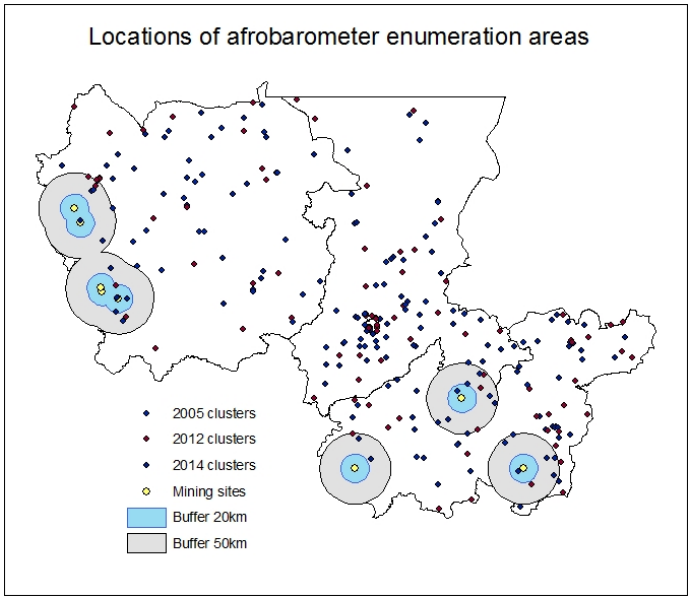
We use the 2005, 2012, and 2014 rounds of the nationally representative Afrobarometer survey in Mali. We focus on variables of political responsiveness, corruption, and quality of public services that are similar across the three rounds. Geocoded enumeration areas are combined with location of industrial mine sites to construct our treatment variable, which is the cumulative gold production within 20 kilometers of the mine at the time of the survey. This assumes that both distance to mines and intensity of production matter for the effect. We then estimate the following logistic regression of the form:

$$Pr(Outcome_{ij} \mid Production20km_{ij}, \mathbf{X_{ij}}) = logit^{-1}(\alpha + \beta * Production20km_{ij} + \lambda * \mathbf{X_{ij}})$$

Figure 17 shows the location of the enumeration areas on a map of Mali. We restricted our sample to the three regions were industrial and artisanal mining are taking place. The outcomes variables and their coding are defined in Annex 3. Our individual-level control variables X_{ij} include the respondent's opinion of their own living conditions ($Poverty_{ij}$), their education ($Education_{ij}$), age (Age_{ij}), gender ($Male_{ij}$), and living area ($Rural_{ij}$). We also include year dummies for the survey rounds, and the standard errors are clustered at the enumeration area level.

[15] Data and codebook are available at www.afrobarometer.org/data/data-by-country/mali.

Figure 17 Locations of Afrobarometer enumeration areas



Our sample summary statistics are reported in table 7. The trust variable is an indicator of the legitimacy of a local government, which here shows the confidence that people have that local government can be relied upon to do what it is supposed to do in terms of statutory laws. Respondents were asked how much they trust elected local government councilors. The accountability or responsiveness variable tries to capture the extent to which elected local government councilors are politically responsive to the needs of their citizens. The survey question used here asks: "How much of the time do you think elected local government councilors try their best to listen to what people like you have to say?" Corruption is assessed at two levels: perception of the number of local government officials involved in corruption, but also an objective measure related to the experience of making illegal payments to access public services, such as school and health. After recoding these variables, results show that 80 percent of respondents in the sample trust their elected local government councilors; 80 percent of respondents perceive most elected government councilors to be involved in corruption, but 60 percent found them to be responsive to citizens.

Local capacity measures focus on both the technical and financial dimensions. For technical capacity, we look at local government performance on a range of visible public works: maintaining local roads, maintaining local markets, keeping the community clean (for example, street cleaning or collection and disposal of refuse), and maintaining health standards in restaurants.

Collecting taxes and making spending decisions (for example, allocating budgetary resources) capture the local government financial management capacity. In our sample, technical capacity of local government is perceived to be low. Only 30 percent of respondents think local governments are doing well in terms of maintaining roads or markets. About 40 percent of respondents perceive local government to be doing well in keeping the communities clean and maintaining health

standards in restaurants. In contrast, perceptions of financial management capacity are higher, with 70 percent of respondents approving of local government performance in revenue collection and 50 percent for spending decisions.

Regarding provision of quality education, 40 percent of respondents found public schools lacking textbooks or other supplies, and classrooms overcrowded. Regarding the quality of health services, 40 percent of respondents found the services to be too expensive, experienced lack of medicines or other supplies, and long wait time. Only 20 percent of respondents had direct experience with corruption related to illegal payments to access education or health services.

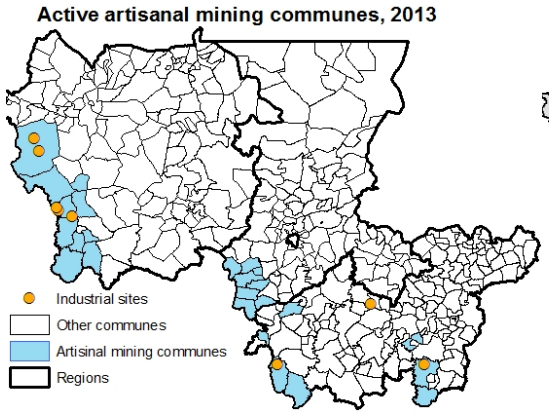
Table 8 shows the results for the governance indicators. In column (1), respondents living within 20 kilometers of an industrial mining site are significantly less likely to trust their elected local government councilors. But they are also significantly less likely to view their local councilors as widely involved in corruption (column 2), and they see them as more accountable (column 3). More-educated respondents significantly view local councilors as less trustworthy, more corrupt, and more accountable. The coefficients of the variable poverty imply that richer respondents significantly view councilors as more trustworthy and more accountable. As table 9 (columns 1–4) indicates, respondents in mining areas are significantly less likely to view local government as performing well in terms of maintaining roads or markets, keeping the communities clean, and maintaining health standards in restaurants. They are also significantly less likely to perceive local government as performing well in revenue collection (column 5), but more likely to perceive them as performing well in spending decisions (column 6). Table 10 shows that respondents in the vicinity of mining are less likely to have experienced public schools as expensive, lacking textbooks or other supplies, having poor teaching, or having facilities in poor condition (columns 1–6). But they are more likely to have experienced illegal payments (column 7). Table 11 shows that respondents in the vicinity of mining are more likely to have experienced lack of medicines (column 2) and illegal payments (column 7) in public health services.[16]

The above results are consistent with the emerging literature on the role of governance within local jurisdictions in moderating the effect of resource booms. Our results confirm those found in oil-rich Brazilian municipalities in Caselli and Michaels (2013) and Monteiro and Ferraz (2012). Mining communes in Mali receive higher revenues and report higher capital and current expenditures spending. Capital expenditure is driven by spending in education. Reported non-salaries current expenditure increased tenfold in mining areas. However, the differences in welfare outcomes in general are only marginal. The Afrobarometer data reveal that technical capacity and not corruption or lack of accountability may be the reason local governments are not successful in transforming revenues into better public goods and services for better welfare outcomes.

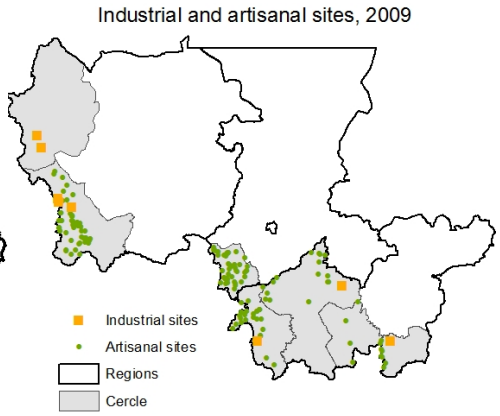
[16] Sensitivity of the results is consistent with a declining size effects as distance from mine site increases. These results are available upon request.

Annex 1 Artisanal Gold Mining

Map A.1.1



Map A.1.2



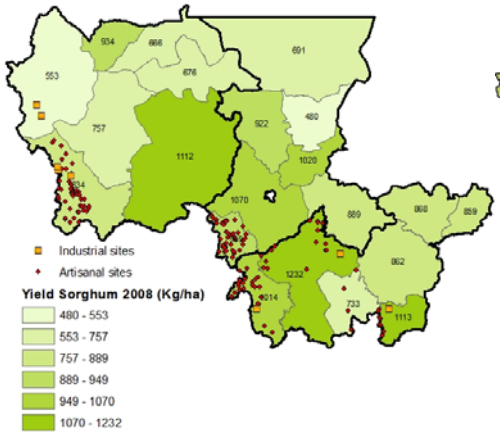
Mali has an old and significant tradition of artisanal mining, which dates back to the emperor Kankou Moussa, who went on pilgrimage to Mecca in 1324 with 8 tons of gold. Currently, the exact number of artisanal mining sites is unknown, but was estimated by the government to be around 350 sites in 2009. In addition, the number of communes reporting artisanal gold mining as an important economic activity has been on the rise from 9 communes in 2006 to 17 in 2008 and 25 in 2013. As shown in Maps A.1.1 and A.1.2, artisanal and industrial mining activities are taking place within close proximity to each other. This is a big concern for econometric estimations of the effects of mining, particularly those relying on individual-level regressions using distance to mine sites. Because there are no time series data on the active artisanal-scale mining sites, it is almost impossible to quantitatively estimate separately the effect of these two very different types of activity. For industrial sites, years of mine openings and production levels are known, but for artisanal mining sites, they are not known. Combining industrial mining communes and their neighboring communes as treatment will come close to capturing the combined impact in an econometric specification at the district level.

Employment estimates in the artisanal gold-mining sector vary considerably—from 6,000 according to a Sustainable Development Observatory (ODHD) survey (2011) to 1 million in the three active mining regions, according to the Chamber of mines (2013), and 200,000 according to a survey by Central Bank of West African States (BCEAO 2013). The latest population census estimates the number of people involved in artisanal gold mining at 25,000. The national labor survey (the Permanent Household Survey, EPAM) of 2010 estimates that 28,000 people are involved primarily in extractives. In addition, 14,000 people work in extractives as a secondary activity, with farming being the primary activity of 76 percent of these people. The difficulty in estimating the number of people employed in artisanal gold mining arises from the fact that the activity is sometimes practiced in a "rush" manner, which may not coincide with a census or survey

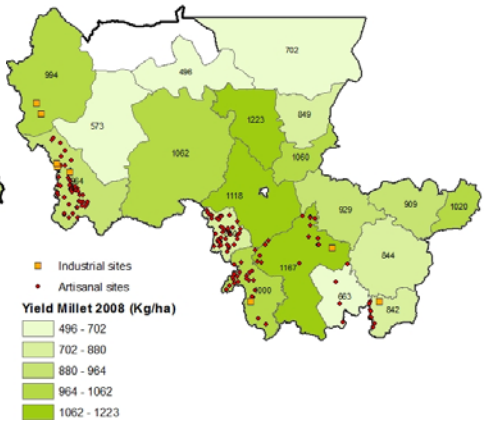
year. The ODHD (2011) estimate is clearly an underestimation, because it is based on a sample of 150 artisanal gold-mining sites, with an average of 42 gold washers per site, which seems extremely small with regard to the rush observed during the recent years toward artisanal sites. In general, artisanal-scale miners continue to combine mining activity with their former activities such as agriculture and livestock breeding, or even with informal activities such as services and production of craftwork. The ODHD survey (2011) found that about 7 in 10 gold washers practice agriculture in parallel, and about 1 in 10 of them practice a trade. The higher estimates of 200,000 to 1 million consider the possibility of artisanal gold mining being practiced as a secondary or temporary occupation.

Annex 2 Mining and Agriculture

Map A.2.1



Map A.2.2



Rainfall is probably the most important factor affecting agricultural yield and production in Mali. The most productive agricultural zones are in the south, where all mining (artisanal and industrial) activities also take place. The main crops grown are cereals (sorghum, millet, and maize), cotton, and fruits. Mining can negatively affect agriculture in two ways. First, if mining leads to an increase in local wages that reduces profit margins in agriculture, then some farmers may abandon farming or migrate out of mining areas. Second, pollution and health problems due to mining activities could dampen land and farmer productivity. For example, Aragón and Rud (2013) find that in Ghana, gold mining has reduced agricultural productivity by 40 percent in mining areas through pollution spillovers.

On the positive side, mining could create a mini-boom in the local economy—that is, higher employment and higher wages leading to an increase in local aggregate demand for food crops. However, due to lack of geocoded agricultural modules in censuses and household budget surveys,

none of these hypotheses can be easily tested in Mali. At the higher aggregate level (Cercle), which may not necessarily capture the local dimension of mining, yields are only slightly higher, on average, in mining areas (Cercle) for the major cereals crops (sorghum and millet) (figure A.2.1). During 1990–2008, average yields of sorghum and millet were 881 kilograms (kg) and 791 kg per hectare in mining Cercles compared to 824 kg and 735 kg per hectare for nonmining Cercles. The yields gaps are much higher for maize and rice, and were so even before the advent of mining activities.

Figure A.2.1 Average cereal yields (kg) in mining compared to non-mining Cercles, 1990 – 2008

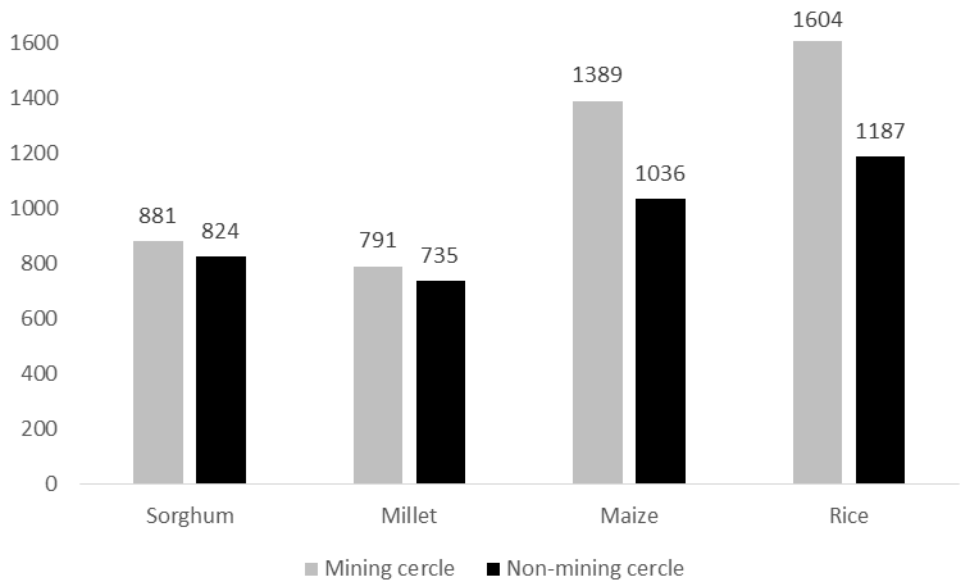


Table 6a Effect of mining on revenues and spending patterns (Indicators for mining communes and neighboring communes)

	Revenue	Capital expenditures					Current expenditures		
	(1) Revenue	**(2) Total**	**(3) Education**	**(4) Health**	**(5) Water**	**(6) Others**	**(7) Total**	**(8) Salaries**	**(9) Others**
Mining communes	8,480***	25,331**	14,450***	1,124	2,422	4,583	8,416***	1,092***	5,168***
	(1,430)	(10,818)	(3,455)	(1,273)	(4,759)	(6,878)	(1,158)	(403)	(431)
Neighbors	-791	-2,484	-1,836	-669	188	-198	14	-61	-86
	(676)	(5,117)	(1,634)	(602)	(2,251)	(3,253)	(548)	(190)	(204)
Poverty (%) 1998	-1	72	16	37***	46	-46	-7	1	-1
	(12)	(94)	(30)	(11)	(41)	(59)	(10)	(3)	(4)
Enrollment (%) 98	-22	121	7	11	41	35	-8	7	-2
	(18)	(138)	(44)	(16)	(61)	(88)	(15)	(5)	(6)
Rainfall (mm) 1998–2008	1*	-37***	-6***	-2***	-10***	-20***	0	0	-0**
	(1)	(5)	(1)	(1)	(2)	(3)	(0)	(0)	(0)
Urban	1,455**	8,064	-1,066	17	1,771	7,418**	2,287***	1,164***	530**
	(703)	(5,316)	(1,698)	(626)	(2,338)	(3,380)	(569)	(198)	(212)
Observations	692	692	692	692	692	692	692	692	692
R-squared	0.063	0.109	0.050	0.041	0.043	0.089	0.102	0.087	0.185

Note: Standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 6b Effect of mining on revenues and spending patterns (continuous production intensity in mining communes)

		Capital expenditures					Current expenditures		
	(1) Revenue	**(2) Total**	**(3) Education**	**(4) Health**	**(5) Water**	**(6) Others**	**(7) Total**	**(8) Salaries**	**(9) Others**
Cum. gold produced	116***	327***	190***	13	33	57	124***	19***	71***
	(12)	(94)	(30)	(11)	(42)	(60)	(9)	(3)	(3)
Poverty (%) 1998	-3	65	11	36***	46	-47	-8	1	-2
	(12)	(93)	(29)	(11)	(41)	(59)	(9)	(3)	(3)
Enrollment (%) 1998	-20	125	8	9	42	36	-4	7	-0
	(18)	(137)	(43)	(16)	(60)	(87)	(14)	(5)	(5)
Rainfall (mm) 98-08	1*	-37***	-6***	-2***	-10***	-19***	0	0	-0**
	(1)	(5)	(1)	(1)	(2)	(3)	(0)	(0)	(0)
Urban	1,393**	7,878	-1,159	23	1,743	7,377**	2,207***	1,156***	482***
	(676)	(5,284)	(1,670)	(625)	(2,334)	(3,374)	(527)	(195)	(176)
Observations	692	692	692	692	692	692	692	692	692
R-squared	0.129	0.117	0.078	0.040	0.044	0.089	0.227	0.115	0.434

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 Summary statistics

	Observations	Mean	Std. Dev.	Min	Max
Governance					
Trust	2176	0.8	0.4	0	1
Corruption	2103	0.8	0.4	0	1
Accountability	1167	0.6	0.5	0	1
Local Capacity					
Road	1148	0.3	0.5	0	1
Market*	615	0.3	0.5	0	1
Health*	547	0.4	0.5	0	1
Cleaning	1146	0.4	0.5	0	1
Revenue*	511	0.7	0.4	0	1
Spending*	446	0.5	0.5	0	1
Education Services					
Expensive	2201	0.3	0.5	0	1
Manuals	2207	0.4	0.5	0	1
Learning	2194	0.3	0.5	0	1
Absenteeism	2204	0.3	0.5	0	1
Crowded	2200	0.4	0.5	0	1
Equipment	2186	0.3	0.5	0	1
Corruption*	573	0.2	0.4	0	1
Health Services					
Expensive	2207	0.4	0.5	0	1
Pills	2207	0.4	0.5	0	1
Care	2209	0.2	0.4	0	1
Absenteeism	2207	0.3	0.4	0	1
Long line	2205	0.4	0.5	0	1
Clean	2199	0.3	0.5	0	1
Corruption*	567	0.2	0.4	0	1

Note: *Variable not available in all three rounds.

Table 8 Proximity to mining and governance

	(1) Trust	(2) Corruption	(3) Accountability
Cum. gold within 20km	-0.004**	-0.006***	0.135***
	(0.002)	(0.001)	(0.015)
Education	-0.171***	0.265***	0.125*
	(0.056)	(0.056)	(0.071)
Age	-0.008*	-0.001	0.025***
	(0.004)	(0.004)	(0.006)
Male	-0.423***	-0.061	0.421***
	(0.120)	(0.108)	(0.143)
Poverty	0.137**	-0.072	0.116*
	(0.053)	(0.050)	(0.064)
Rural	0.498***	-0.402*	0.623**
	(0.183)	(0.225)	(0.294)
Observations	2,170	2,097	1,160

Note: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 9 Proximity to mining and local capacities

	(1) Road	(2) Market	(3) Health	(4) Cleaning	(5) Revenue	(6) Spending
Cum. gold within 20km	-0.066***	-0.103***	-0.119***	-0.076***	-0.694***	0.241***
	(0.020)	(0.012)	(0.013)	(0.012)	(0.077)	(0.077)
Education	-0.015	0.044	0.133*	0.043	0.073	0.018
	(0.055)	(0.077)	(0.077)	(0.063)	(0.133)	(0.092)
Age	-0.002	-0.002	0.010	0.005	-0.013**	-0.001
	(0.003)	(0.007)	(0.007)	(0.005)	(0.006)	(0.005)
Male	-0.226*	-0.123	-0.159	-0.183	0.360*	0.414***
	(0.129)	(0.185)	(0.192)	(0.115)	(0.217)	(0.158)
Poverty	0.057	0.160**	0.155*	0.106*	-0.214***	0.164*
	(0.067)	(0.073)	(0.086)	(0.055)	(0.082)	(0.090)
Rural	-0.279	-0.490	-0.208	0.097	0.255	0.298
	(0.190)	(0.367)	(0.329)	(0.207)	(0.388)	(0.305)
Observations	1,142	615	547	1,139	505	440

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10 Proximity to mining and quality of public education services

	(1) Expensive	(2) Manuals	(3) Learning	(4) Absenteeism	(5) Crowded	(6) Equipment	(7) Corruption
Cum. gold within 20 km	-0.012***	-0.010**	-0.005***	-0.030	0.000	-0.003***	0.197**
	(0.004)	(0.005)	(0.002)	(0.033)	(0.001)	(0.001)	(0.080)
Education	0.013	0.047	0.211***	0.181***	0.106**	0.087*	0.003
	(0.043)	(0.042)	(0.040)	(0.045)	(0.046)	(0.045)	(0.086)
Age	0.001	0.004	-0.004	-0.000	0.004	0.001	-0.022***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.008)
Male	0.172*	0.165**	0.416***	0.387***	0.332***	0.335***	0.207
	(0.096)	(0.082)	(0.094)	(0.099)	(0.083)	(0.088)	(0.181)
Poverty	-0.136***	-0.137***	-0.169***	-0.063*	-0.065*	-0.093**	0.018
	(0.038)	(0.039)	(0.040)	(0.037)	(0.038)	(0.041)	(0.079)
Rural	0.130	-0.057	-0.021	-0.163	-0.278*	-0.031	-0.346
	(0.178)	(0.146)	(0.168)	(0.179)	(0.150)	(0.183)	(0.262)
Observations	2,193	2,199	2,186	2,196	2,192	2,179	565

Note: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 11 Proximity to mining and quality of public health services

	(1) Expensive	(2) Pills	(3) Care	(4) Absenteeism	(5) Long line	(6) Clean	(7) Corruption
Cum. gold within 20km	-0.003	-0.007*	-0.001	-0.009	0.001	0.001	0.245**
	(0.002)	(0.004)	(0.001)	(0.006)	(0.001)	(0.001)	(0.107)
Education	-0.109***	-0.007	0.072	0.126***	0.055	0.076	-0.214**
	(0.040)	(0.044)	(0.048)	(0.048)	(0.044)	(0.047)	(0.102)
Age	-0.006**	-0.005	-0.007*	-0.007*	-0.007*	-0.003	-0.015**
	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.007)
Male	0.075	0.073	0.186*	0.249***	0.140*	0.221**	0.207
	(0.079)	(0.087)	(0.099)	(0.093)	(0.078)	(0.087)	(0.233)
Poverty	-0.161***	-0.107***	-0.157***	-0.083*	-0.094**	-0.188***	-0.084
	(0.039)	(0.038)	(0.045)	(0.043)	(0.038)	(0.040)	(0.085)
Rural	-0.262*	-0.165	-0.699***	-0.131	-0.272*	-0.480***	-0.671*
	(0.135)	(0.166)	(0.166)	(0.166)	(0.152)	(0.172)	(0.360)
Observations	2,199	2,199	2,201	2,199	2,197	2,191	559

Note: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Annex 3 List of outcome variables

Governance	Afrobarometer Question	Coding
Trust	How much do you trust each of the following, or haven't you heard enough about them to say: Local council? (Not at all, just a little, somewhat, a lot, don't know/haven't heard enough, and missing)	Equals to 1 if "somewhat" and "a lot" and zero otherwise
Accountability	How much of the time do think the following try their best to listen to what people like you have to say: Local Government Councilors? (Never, only sometimes, often, always, don't know, and missing)	Equals to 1 if "often" and "always" and zero otherwise
Corruption	How many of the following people do you think are involved in corruption, or haven't you heard enough about them to say: Elected Local Government Councilors? (None, some of them, most of them, all of them, don't know/haven't heard enough, and missing)	Equals to 1 if "most of them" and "all of them" and zero otherwise
Local Capacity		
Maintaining roads **Maintaining markets** **Keeping community clean** **Maintaining health standards** **Collecting taxes** **Spending decisions**	What about local government? How well or badly would you say your local government is handling the following matters, or haven't you heard enough about them to say: Maintaining our roads? Maintaining local markets? Keeping our community clean? Maintaining health standards in restaurants? Collecting local taxes? Deciding how to spend local revenues? (Very badly, fairly badly, very well, fairly well, don't know/haven't heard enough, and missing)	Equals to 1 if "very well" and "fairly well" and zero otherwise
Quality of Services		
School	Have you encountered any of these problems with your local public schools during the past 12 months? Services are too expensive / Unable to pay, lack of textbook or other supplies, poor teaching, absent teachers, overcrowded classes, poor conditions of facilities, demand for illegal payments? (never, once or twice, a few times, often, no experience, don't know, missing data)	Equals to 1 if "once or twice", "a few times" and "often" and zero otherwise
Health	Have you encountered any of these problems with your local public clinic or hospital during the past 12 months? Services are too expensive / Unable to pay, lack of medicines or other supplies, lack of attention or respect from staff, absent doctors, long waiting time, dirty facilities, demand for illegal payments. (never, once or twice, a few times, often, no experience, don't know, missing data)	Equals to 1 if "once or twice", "a few times" and "often" and zero otherwise

Appendix 4: the tables below show the treatment effect of mining with varying cut-off distance (0-20 to 0-50km)

Table A: Varying the cut-off distance for the effect of mining on governance

	(1) Trust	(2) Corruption	(3) Accountability
0-20km	-0.004**	-0.006***	0.135***
0-30km	-0.006*	-0.004*	0.009
0-40km	-0.004**	-0.001	-0.001
0-50km	-0.002	0.0000	0.002

Table B: Varying the cut-off distance for the effect of mining on local capacities

	(1) Road	(2) Market	(3) Health	(4) Cleaning	(5) Revenue	(6) Spending
0-20km	-0.066***	-0.103***	-0.119***	-0.076***	-0.694***	0.241***
0-30km	-0.008***	-0.016***	-0.017***	-0.013***	0.009***	-0.011***
0-40km	0.002	0.000	0.004	-0.001	0.005**	-0.003
0-50km	0.002	0.001	0.002	0.0000	0.005**	-0.003

Table C: Varying the cut-off distance for the effect of mining on the quality of public education services

	(1) Expensive	(2) Manuals	(3) Learning	(4) Absenteeism	(5) Crowded	(6) Equipment	(7) Corruption
0-20km	-0.012***	-0.010**	-0.005***	-0.030	0.000	-0.003***	0.197**
0-30km	-0.001	-0.002	-0.002	-0.003	0.0000	-0.003	-0.002*
0-40km	0.002	0.001	-0.002	-0.002	-0.001	-0.002	0.002
0-50km	0.000	0.000	-0.002*	0.0000	-0.001	-0.002	0.002

Table D: Varying the cut-off distance for the effect of mining on the quality of public health services

	(1) Expensive	(2) Pills	(3) Care	(4) Absenteeism	(5) Long line	(6) Clean	(7) Corruption
0-20km	-0.003	-0.007*	-0.001	-0.009	0.001	0.001	0.245**
0-30km	0.001	0.0000	0.001	0.0000	0.003	0.004	0.009***
0-40km	0.003	0.001	0.004*	0.002	0.003*	0.002	0.009***
0-50km	0.001	0.0000	0.002	0.002	0.001	0.001	0.009***

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