Mines and Female Employment

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Abstract

We analyze the effects of mining on women's employment. Merging individual level DHS data for women in 29 countries in Sub Saharan Africa over 30 years with panel data production for all industrial mines in the region, we are able to investigate local spillover effects on employment using a difference in differences approach. We find that female employment increases once a mine opens and that women become more likely to work in services. We also show significant heterogeneity across women in the effects of a mine depending on their marital status. These results contrast previous literature arguing that natural resource wealth is harmful for female employment.

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Introduction

Africa's opportunities are transformed by new discoveries of natural resources and their rising prices (Collier 2010). Whether natural resources is a blessing or a curse to the overall economy and a country's citizens is still a contentious issue (see Frankel 2010 or van der Ploeg 2011 for an overview). In the present paper we investigate the effects of mineral resources on women's employment. Access to employment is believed to improve women's lives and is listed among the top five priorities for promoting gender equality in the World Development Report 2012 (World Bank 2012). While labor force participation is high in traditional agricultural societies it has been argued that as economies initially develop, women increasingly engage in home production (Engels, 1902; Boserup 1970; Goldin, 1995; Alesina et al. 2012). We link the development of a traditionally male dominated sector, mineral mining, to women's labor force participation in sub-Saharan Africa and test competing hypotheses regarding the effects.

Resource extraction may crowd out other tradable sectors and employment in other sectors may decline correspondingly with a booming resource sector. Ross (2008; 2012) argues that since women do not work in the resource sector they stand to lose as natural resources are exploited. At the same time, another strand of literature argues for local spillover effects of expanding sectors on other tradable and non-tradable sectors (e.g. Moretti 2010, Aragon and Rud 2012). In this paper we investigate the crowding out and the spillovers using novel data for around 620,000 women in 29 countries in sub-Saharan Africa (SSA). In particular, by connecting geocoded data from the Demographic and Health Surveys (DHS) from 1986 to 2011 and panel data starting in 1975 on production volumes for 839 industrial mines from the Raw Minerals Group (RMG) we are able to investigate local spillover effects on women's employment.

Most of the literature on the resource curse has focused on the national level. It is, however, unlikely that cross country differences in resource abundance are exogenous to factors such as institutions, civil wars, and growth (Brunnschweiler and Bulte 2008a, 2008b, 2009; Bruckner and Ciccone 2010; De Luca et al. 2012). Factors such as the efficiency of the economy in general (Norman 2009) and the protection of property rights are likely to be of importance for the search and exploitation of resources. Furthermore, national level strategies are employed and country specific knowledge is built up (Wright and Czelusta 2003). Using geocoded data we are able to have a more localized measure of resources as well as employment outcomes. We control for regional fixed effects and compare women living in clusters close to a mine to those living further away within the same region. We thereby control for time invariant differences between regions such as mining strategies, institutions, trade patterns, openness, sectoral composition and level of economic development. Exploiting within-country variation has been argued to lead to more robust causal claims in several other recent studies on the effects of natural resources (e.g. Angrist and Kugler 2008; Buhaug and Rod 2006; De Luca et al. 2012; Dube and Vargas 2008 on conflicts, Corno and de Walque 2012 on HIV in Lesotho, Swaziland and South Africa, Wilson (forthcoming) on HIV in Zambia, Aragón and Rud 2012 on the local economy in Peru, and Cust 2012 on the local economy in Indonesia) and controlling for region fixed effects is likely to enhance the robustness even further. Even though the local level measure has several advantages in terms of identification it also introduces a new set of concerns. This is so since the exact location of a mine within a region may still be influenced by factors other than abundance of resources such as access to inputs, transportation and agglomeration costs (Krugman 1991; Isard 1998). As our mineral data has detailed information on production over time we are able to account for the selection into being a mining area by means of a difference in differences estimation strategy.

We find that female employment increases once a mine opens and that women become more likely to work in services. The results are robust to a wide battery of robustness checks such as using different measures of distance (different distances and continuous distance variables as well as indicator variables), and to excluding migrants from the sample. We also investigate heterogeneous responses by marital status and find that divorced or separated women are particularly likely to increase their employment and to shift from agriculture to other sectors.

Conceptual framework and testable hypotheses

The extensive literature of natural resource curse and Dutch disease has been linked to various outcomes; institutions (e.g. Mehlum et al. 2006), corruption (e.g. Leite and Weidmann 1999), civil war and conflict (e.g. Collier and Hoeffler 2004, 2005), rent appropriation by an elite (e.g. Auty 1990, 2001, 2007, 2009), democracy (e.g. Barro 2000, Jenson and Wantchekon 2004, Ross 2006). Ross (2008) and Frederiksen (2007) have explicitly linked the resource curse to women's position in society.

Ross (2008, 2012) argues that exploitation of natural resources likely hurts women's employment via both demand and supply channels. A household income effect, spurred by higher male incomes and/or increased government transfers, is argued to reduce female labor supply. At the same time, demand for female labor is argued to decrease as export oriented and female dominated manufacturing is crowded out in favor of an expansion of the non-tradable sector. As Ross (2012) readily admits, if women can find jobs in the service sector they will perhaps not be pushed out of the labor force. This, however, is something that he deems more likely in Western countries than in the developing world. Frederiksen (2007) expands a theoretical model by Torvik (2001) explaining how resources can affect productivity differently across sectors. She adds an all-female household sector to an economy characterized by different degrees of gender segregation in the other sectors. Three different scenarios are modeled and labor is only shifted to household production if women only work in the traded sector.

Whether the assumptions in Ross (2008, 2012), that women work in the traded manufacturing sector before the resource boom and that women substitute market work for housework or leisure if the husband gets more income, hold for the mostly rural households where mining takes place in sub-Saharan Africa (SSA) is an empirical question. Nonetheless, there are several factors that make us skeptical. First of all, there is not much of a manufacturing sector in rural SSA and there is a vast literature devoted to explaining this absence (see Bigsten and Söderbom 2006 for an overview). Furthermore, the manufacturing sector that exists is not female dominated. Fafchamps and Söderbom (2006) use data from 9 sub-Saharan African countries covering almost 18.000 workers from randomly selected manufacturing firms and find that the proportion of female workers is only 12 percent. Finally, data from ILO's Key Indicators of the Labour Market (KILM) database (ILO 2012) shows that women in Sub-Saharan Africa are overrepresented in sales and services but grossly underrepresented in production and manufacturing. Even if manufacturing would have been female dominated in SSA it is not clear that manufacturing would be hurt. The traded and non-traded sectors differ across regions of the world and hence across different natural resource rich countries. Most SSA countries have had import restrictions on manufactured goods in an attempt to boost industrialization through import-substitution. This has led to the manufacturing sector being largely a non-traded sector (Torvik 2001). Similarly Isham et al. (2005) classify the export structures of different countries in 1985, i.e. just before the period we analyze, and none of the countries in SSA are classified as manufacturing exporters.

The effects of natural resource extraction on the local economy are often described in terms of linkages and multipliers. Backward linkages are demand changes in locally supplied food, electricity and transportation, and forward linkages are processing and manufacturing of the primary resource. Final demand linkages relate to the spending of miners' income and fiscal linkages relate to government tax and royalty incomes (Eggert, 2001). This is important since while it has been found that women do not work directly in the mines, they dominate provision of goods and services around the mines (Hinton 2005). Local multipliers describe what effect an employment increase in one sector has on employment in other sectors and Moretti (2010) argues that the multipliers for tradables depend on local changes of labor costs, since tradable goods have prices set nationally or internationally. Increase in production of tradable goods lead to increased local demand for non-tradables as the number of workers and their salaries increase. The magnitude of the multiplier will depend on changed labor costs, local demand for intermediate products and agglomeration economies with positive effects on productivity.

In guiding our hypotheses we build on the following simple framework. Let A be a vector of traded goods, i.e. goods that are sold outside the area of the local labor market where the mines exist, and let B be a vector of nontraded goods with the characteristic that prices are determined within the mining area. Ai to Ak are the minerals and they comprise a subset of the traded goods within an area. The prices for these goods are set at the international level and are hence exogenous to the areas we look at. Guided by the discussion above, let us assume that only men work in the mines.

If industrial mining of mineral Ai starts in area j, due to the discovery of an exogenously placed mineral deposit or a shock to international prices, there will be a direct positive effect on the employment of men in sector Ai. The employment shock in sector Ai is likely to affect employment in the other tradable sectors A and nontradable sectors B. Wages will rise in all sectors (at least for men) due to general equilibrium effects. The increased wages combined with the increase in employment will increase the budget constraint of the area which increases the demand for nontradable goods B and hence employment in these sectors rises accordingly. Again based on the discussion above we assume that women work in nontradable sectors such as services around the mines. How large the spillover effects per job in the expanding tradable sector on the relatively female dominated nontradable sectors are will depend on the preferences for these nontradables, if they are labor intensive, the earnings increase in the expanding tradable sector, and the earnings increase in the nontradable sector which in turn depends on the elasticity of female labor supply.

Let us here add a third sector C, which is the household sector, producing goods completely consumed within the household. This sector is dominated by women across the world and the transition between home production and labor force participation is particularly salient for women. It has been argued that female labor force participation is u-shaped in relation to economic development (Goldin 1995). Women shift from agriculture to home production when household income rises (income effect), and when the demand for female labor decreases (substitution effect). Nonetheless, if natural resource extraction is associated with local spillover effects and women work in the service sector, there will be increased demand for female labor and it is an empirical question whether the men's increased income saturates households' cash needs even for married women. Thus, even following the extreme case in Frederiksen (2007) whereby the household sector uses only female labor, it is still the case that female labor supply need not decrease as demand and supply of the non-traded good and of the household both increase.

There are, however, several reasons to expect the effects to differ depending on women's marital status, also in addition to pure income effects. Stigma attached to working women that are married is stronger than for unmarried women, and widows, since work may be signaling negligent behavior from the husband. A husband may be perceived as forcing his wife to engage in low skilled, manual work, i.e. 'a man's work' and he may thus experience a cost in terms of a shame burden. Once women are educated enough to have white-collar jobs this difference in supply disappears (Goldin 1995). We therefore expect the effects of mining to differ across women depending on marital status.

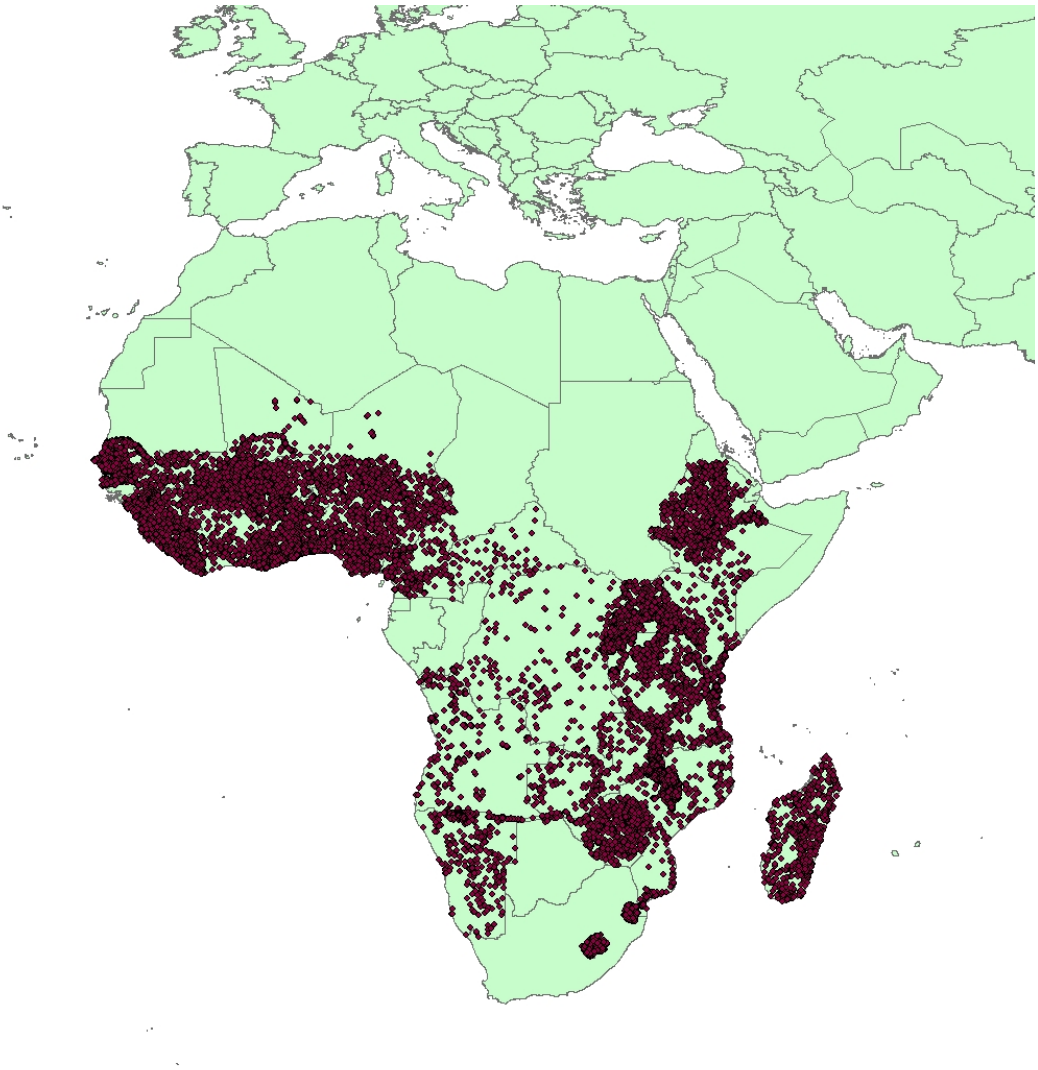
Hence, while Ross (2008) argues that the relocation goes from formal employment to household work or leisure it is a priori equally likely that it goes from household labor to other types of employment. In particular, the effect of mining on women's employment will depend on the multipliers, crowding out effects, and spillovers generated and the previous literature boils down into two testable competing hypotheses: mining causes women to shift from market work to household production or mining causes women to shift from household production (including backyard farming and subsistence farming) to market work. We further hypothesize that currently not married women will respond stronger to labor market opportunities, since there is less stigma attached to their labor force participation and they are less likely to benefit from increased household income stemming from male labor income. The following section will describe the data we use to test the hypotheses.

Data

Individual level data

We use microdata data from the Demographic and Health Surveys (DHS). DHS contain data on micro level, with both individual and household level observations. The DHS data provides relatively standardized surveys across years and countries, with Global Positioning System (GPS) coordinates at the cluster level. We use the women's questionnaire from 76 DHS surveys in Sub-Saharan Africa. In particular, we have data on 617 584 women, from 29 countries, living in 2181 survey clusters in 270 regions. The survey clusters are shown in Figure 1 below. As can be seen in the figure, the data covers large parts of Sub Saharan Africa and Table A1 in the appendix shows the distribution of the sample by country. Appendix Table A2 shows the distribution of the sample by years.

Figure 1: DHS clusters.



Definitions as well as summary statistics for our variables are shown in Table 1 below. The outcome variables of main interest are those related to employment. The surveys include a question of whether the respondent has been working or not during the last 12 months and we see that 64 % of the women are working. Women who are not working are engaged in household production, which may include backyard farming. As discussed above, we are interested in the sectoral composition effects of mining and DHS has questions about which sector the woman works in (services, sales, and agriculture). We also use a question on the type of earnings the woman receives and we create a variable for whether the type of earnings is cash. We see that the number of observations is lower for the cash earnings variable as it is not included in all surveys.

In particular, the question on cash earnings was not asked in Cote d'Ivoire, Central African Republic, Mozambique, Niger, or Togo.

Table 1. Descriptive statistics of main variables.

Variable	Definition	Mean	N
Dependent variables			
Working..	1 if respondent is currently working.	0.640	562786
in services	1 if respondent is working in the service sector.	0.033	542498
in sales	1 if respondent is working with sales.	0.172	542498
in agriculture	1 if respondent is working in agriculture.	0.323	546564
for cash	1 if respondent is working for cash payment.	0.462	258082
Mine variables			
kilometers	Distance to mine in kilometers.	226.51	617584
closest_mine0_25	Distance to mine < 25 kilometers.	0.063	617584
closest_mine 0_50	Distance to mine < 50 kilometers.	0.164	617584
closes_mine 0_75	Distance to mine < 75 kilometers.	0.258	617584
closest_mine 0_100	Distance to mine < 100 kilometers.	0.339	617584
active	The mine has nonzero production in the year of the survey.	0.376	503692
Control variables			
urban	1 if respondent is living in an urban area.	0.332	617584
age	Age in years.	28.269	617584
schoolyears	Years of education.	4.100	617009
christian	1 if respondent is Christian.	0.568	548032
muslim	1 if respondent is Muslim.	0.355	543225
non_mover	1 if respondent always has lived in the same place.	0.461	490476

Resource data

The DHS data clusters are connected to data on mineral resource extraction. This is made possible by using geocoded data from Raw materials group (RMG) which provides panel data with exact geographic coordinates for all sites, as well as historic information on production levels. In total, 839 industrial mines are included in our dataset and we have production levels for 1975 and then every year from 1989 to 2010. The geographic location of the mines can be seen in Figure 2 below.

Figure 2: RMG mines

The data on the mines are also presented in Table 1. The first distance measure is a continuous measure of distance in kilometers from the closest mine. We see that the average distance to the closest mine is about 227 kilometers in our sample. The next set of variables are indicator variables for whether the respondent lives within a certain distance to the closest mine and we see that 6.3 percent of the women in our sample live within an area of 25 kilometers from their closest mine and 34 percent of the women live within an area of 100 kilometers from their closest mine. In our regressions below we also include a number of control variables in addition to region and year fixed effects and these variables are described at the bottom of Table 1.

We have a large number of mines in our mining data. Not all of these will be the closest mine to any of the geographical clusters from the DHS data. Looking only at those mines that show up as the closest mine for at least one cluster (see appendix Table A3), 51 mines are active when the data starts in 1975, 111 mines open during the following 35 years and 91 mines close down during the same period. This means that we have substantial variation in the data.

Empirical strategy

While the early literature on the resource curse seemed to view the existence of natural resources, and even the degree of resource dependence, as random across countries recent contributions have tried to account for the fact that this is unlikely (Brunnschweiler and Bulte 2008a, 2008b, 2009; Bruckner and Ciccone 2010; De Luca et al. 2012). These authors therefore try to instrument for resource dependence and exploit resource abundance rather than dependence as the latter is related to the efficiency of other sectors of the economy. Nonetheless, it is still unlikely that cross country differences in resource abundance are exogenous to other factors which have been used as dependent variables, such as institutions, civil wars, and growth. Efficiency of the economy in general (Norman 2009) and the protection of property rights are likely to be of importance for the search and exploitation of resources. Wright and Czelusta (2003) argue that abundance of non-renewable resources is the result of technological progress and investments. Therefore, mineral abundance should not be viewed as an exogenous endowment and revenues from them are not windfall gains. National level strategies are employed and country specific knowledge is built up.

The specifications we apply have several advantages due to the local level of the measures and due to the temporal dimension of the data. By controlling for regional fixed effects we control for time invariant regional mining strategies, institutions, trade patterns, openness, sectoral composition and level of economic development. Therefore we argue that the presence of mineral resources is more likely exogenous to employment outcomes at the fine geographical level. Exploiting within-country variation lead to more robust causal claims according to recent studies on the effects of natural resources (e.g. Angrist and Kugler 2008; Buhaug and Rod 2006;

De Luca et al. 2012; Dube and Vargas 2008 on conflicts, Corno and de Walque 2012 on HIV in Lesotho, Swaziland and South Africa, Aragón and Rud 2012 on the local economy in Peru, and Cust 2012 on the local economy in Indonesia). Nonetheless, and as mentioned above, the exact location of a mine within a country or region may still be influenced by factors other than abundance of resources. In particular, the literature review suggests it should depend on three other factors (Krugman 1991 and Isard 1998); (i) access to and relative price of inputs, (ii) transportation costs, and lastly (iii) agglomeration costs.

If selection into being a mining area, even within a country or region, is based on factors other than mineral endowments that are stable over time we can exploit the temporal variation in the data to control for such factors. In particular, by comparing areas that start mining to areas that have not yet started or never start mining, before and after some areas start mining we essentially control for stable differences across areas. The identifying assumption in such a difference in differences approach is crucially that absent the opening of a mine in the affected regions, the trends in the regions would have been the same. Even though the levels of e.g. employment are allowed to differ across areas, as this is controlled for, we will investigate whether this is the case as it provides useful insights into the discussion of entrepreneurial selection and mining allocation in particular.

Hence, we also compare areas that do not yet have existing mines when data was collected to those that have active mines at the time of data collection. That is, we estimate a regression of the form:

$$(1)\quad Y_{irvjt} = \alpha_r + g_t + \delta_{rt} + \beta_1 \cdot Closest\_mine0\_50_j + \beta_2 \cdot active_j + \beta_3 \cdot Closestactive_j + \lambda X_i + \varepsilon_{icvt}$$

Where the outcome of an individual i in region r, cluster v, closest to mine j and for year t is regressed on region and year fixed effects, region specific linear time trends, a dummy for whether the respondent lives within 50 kilometers from a mine (we do present results using other distances as well and using several distance dummies in the same regression), a dummy for whether the mine is active at the time of the survey, an interaction term between active mines and living close to a mine, and a vector of individual level control variables. All standard errors are clustered at the DHS cluster level. The coefficient of main interest is β_3 capturing the differential effect of living close to an active mine. This coefficient gives the difference from other people living close to mine that has not yet been discovered or activated. Interestingly, the coefficient β_1 will tell us the difference between living close to a mine that has yet to become active and living further away and as such it is a good measure of the time invariant selection effect into being a mining area. We also apply other specifications with other distance dummies as well as continuous measures of distance to this difference in difference setup.

Robustness check with migration

Migration and population changes are likely to occur as a response to the presence of industrial mining. Natural resource exports have been shown empirically to be linked to urbanization, by the creation of consumption cities (cocoa booms in Ghana and Ivory Coast, Jedwab, 2012), mining cities (Lange (2006) in Tanzania), driving urban-rural migration (artisanal and small scale mining in Sub-Saharan Africa, Hilson 2009) as well as work-migration (Corno and de Walque, 2012). This may be problematic in our setting as the sample of women interviewed after a mine has been discovered may have moved there precisely for work and hence we capture different sets of people in our treatment and control groups. While the effects of mining on migration and employment migration are interesting and important, they are not central in a discussion of local spillover effects. Hence we need to show that our results are not merely driven by other types of people having e.g. a stronger preference for working in the service sector coming to the area. The DHS data allows us to exclude all women who say that they have not lived in the same place for their entire life and we show that the results are robust to such an exclusion.

Testing the differential effects marital status

We have argued that whether women benefit from jobs created in a mineral extraction boom is an empirical question. Their response will furthermore depend on an income effect (making her household richer) and a substitution effect if wages change. We interact the mining variables with marital status (having a partner, being divorced or separated, being a widow, or being single and never married) to further investigate if there are heterogeneous effects and we expect to see more pronounced effects for widows, those never married, and those being divorced or separated. The results obtained cannot be solely interpreted as stemming from income effects, there may be other factors at play such as norms regarding married women or self-selection into marriage, but nonetheless it is an interesting heterogeneity to consider.

Results

Following the empirical strategy outlined above we first present the results from the baseline difference in differences specification. In essence, this strategy controls for selection by comparing areas with active mining to areas that have not yet started or that have stopped mining. The coefficient of main interest in Table 2 is the one for closetsactive050, which is an interaction term between being an active mine and being within an area of 50 kilometers. This coefficient shows the effect of getting an active mine in the area rather than just being a mining area. We see that this interaction term is positive and statistically significant for working and working in services. With respect to selection it is also interesting to interpret the coefficient for closest_mine0_50 which shows the correlation between being a mining area and our outcomes *before the mines have any production*. As these coefficients are generally statistically significant they suggest that selection into being a mining area is an issue, even within regions. Note that our empirical strategy allows for differences in pre-existing levels and the results definitely cast some doubt on the arguments made in some of the previous literature that going down to the local level deals successfully with selection.

These results are robust to a wide array of robustness checks presented in the Appendix. Table B1 show that the results are robust to using a cutoff value of 25 kilometers instead of 50 kilometers and that the results wear off for a distance of 75 and 100 kilometers. Table B2 shows the results when using several indicator variables at the same time and it is clear that most of the effect is closest to the mine as expected. Table B3 shows that the results are robust to restricting the control group to be within 100 kilometers from their closest mine and Table B4 shows the corresponding results when we include a continuous measure of distance instead of an indicator variable. These results similarly show that living further away from a mine is correlated with a reduced probability of working in the service sector and also a reduced probability of earning cash income for these people as compared to those who experience a mine opening nearby.

Table 2. Effects of getting an active mine within 50 kilometers. All regressions include region and year f.e's and linear regional time trends.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
closest_mine0_50	0.019***	-0.007***	-0.003	0.029***	-0.027***
	(0.007)	(0.002)	(0.006)	(0.009)	(0.009)
active	-0.018**	-0.002	-0.001	-0.030***	0.045***
	(0.007)	(0.002)	(0.006)	(0.009)	(0.011)
closestactive050	0.027**	0.015***	-0.012	0.019	0.003
	(0.011)	(0.004)	(0.009)	(0.014)	(0.017)
urban	-0.060***	0.031***	0.123***	-0.266***	0.262***
	(0.004)	(0.001)	(0.003)	(0.004)	(0.006)
age	0.012***	0.000***	0.004***	0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	0.001***	-0.005***	-0.019***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
christian	-0.017***	0.011***	0.036***	-0.078***	0.044***
	(0.004)	(0.002)	(0.003)	(0.005)	(0.006)
muslim	-0.064***	0.004***	0.092***	-0.158***	0.087***
	(0.005)	(0.001)	(0.005)	(0.007)	(0.009)
Constant	0.202***	-0.021***	-0.086***	0.867***	0.135
	(0.062)	(0.002)	(0.021)	(0.006)	(0.201)
Observations	406,002	393,134	393,134	393,154	191,619
R-squared	0.197	0.084	0.151	0.370	0.337

Robust standard errors clustered at DHS cluster level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The identification used in the present paper successfully controls for selection effects that are stable across areas over time. It does not, however, control for time variant heterogeneity and simultaneous changes in the population of mining and non-mining areas. In particular, migration is likely to be affected by mining and there is evidence in the literature of mining cities (Lange (2006), urban-rural migration (Hilson 2009) as well as work-migration (Corno and de Walque, 2012). This raises the important question of whether we are just picking up another type of women (e.g. women who are more inclined to work outside the home). In the worst case scenario, we would only pick up women who have migrated into the area precisely because they want to earn cash incomes and these women would have been different irrespective of the mines. Fortunately, the DHS data allows us to conduct a stringent test of this hypothesis by excluding all women who have ever lived anywhere else than the area in which they are interviewed. As seen in Table 3 below, the results are robust to such a restriction even if the sample size is sharply reduced.

Table 3. Effects of getting an active mine within 50 kilometers for a sub-sample of women who have never moved.All regressions include region and year f.e's and linear regional time trends.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Working	Service	Sales	agriculture	Cash
closest_mine0_50	0.021**	-0.003	0.001	0.025**	-0.015
	(0.010)	(0.003)	(0.008)	(0.013)	(0.013)
active	-0.006	-0.001	0.009	-0.037***	0.042***
	(0.011)	(0.002)	(0.007)	(0.012)	(0.016)
closestactive050	0.033**	0.018***	-0.003	0.009	-0.004
	(0.015)	(0.005)	(0.013)	(0.020)	(0.022)
urban	-0.055***	0.033***	0.115***	-0.246***	0.264***
	(0.005)	(0.002)	(0.005)	(0.006)	(0.009)
age	0.011***	0.001***	0.003***	0.005***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.010***	0.002***	-0.004***	-0.020***	0.017***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
christian	-0.027***	0.013***	0.033***	-0.081***	0.044***
	(0.005)	(0.002)	(0.004)	(0.007)	(0.008)
muslim	-0.083***	0.010***	0.089***	-0.178***	0.103***
	(0.007)	(0.002)	(0.006)	(0.009)	(0.011)
Constant	0.165**	-0.035***	0.020	0.263***	0.533***
	(0.075)	(0.004)	(0.060)	(0.076)	(0.065)
Observations	164,458	159,985	159,985	159,993	77,267
R-squared	0.215	0.098	0.154	0.356	0.315

Robust standard errors clustered at DHS cluster level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Interactions with marital status. All regressions include region and year f.e's and linear regional time trends. Control variables are suppressed for space reasons.

Panel A: Interactions with being divorced or separated.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
closest_mine0_50	0.022***	-0.005***	-0.005	0.031***	-0.029***
	(0.008)	(0.002)	(0.007)	(0.011)	(0.010)
active	-0.023***	-0.000	-0.001	-0.036***	0.048***
	(0.008)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive050	0.029**	0.014***	-0.012	0.026	0.010
	(0.012)	(0.004)	(0.011)	(0.017)	(0.018)
divsep	0.064***	0.023***	0.053***	-0.049***	0.070***
	(0.005)	(0.002)	(0.004)	(0.004)	(0.006)
divsep_closest	-0.018*	-0.007	-0.044***	0.030***	-0.014
	(0.010)	(0.005)	(0.010)	(0.010)	(0.013)
divsep_active	-0.011	-0.007*	-0.032***	0.017**	0.003
	(0.007)	(0.004)	(0.006)	(0.007)	(0.010)
divsep_closestactive	0.059***	0.048***	0.074***	-0.055***	-0.003
	(0.018)	(0.012)	(0.017)	(0.016)	(0.022)

Panel B: Interactions with being widow.

	(1)	(2)	(3)	(4)	(5)
closest_mine0_50	0.020***	-0.007***	-0.003	0.028***	-0.026***
	(0.007)	(0.002)	(0.006)	(0.009)	(0.009)
active	-0.018**	-0.002	-0.000	-0.030***	0.045***
	(0.007)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive050	0.026**	0.015***	-0.013	0.021	0.003
	(0.011)	(0.004)	(0.009)	(0.015)	(0.017)
widow	0.011**	-0.001	0.005	-0.018***	0.044***
	(0.005)	(0.002)	(0.005)	(0.005)	(0.007)
widow_closest	-0.019	0.012**	-0.015	0.010	-0.034**
	(0.012)	(0.005)	(0.011)	(0.012)	(0.014)
widow_active	0.003	0.004	0.014	0.006	0.006
	(0.010)	(0.004)	(0.009)	(0.010)	(0.013)
widow_closestactive	0.038*	-0.003	0.015	-0.051***	-0.012
	(0.022)	(0.012)	(0.020)	(0.019)	(0.027)

Panel C: Interactions with being single.

	(1)	(2)	(3)	(4)	(5)
closest_mine0_50	0.020***	-0.007***	-0.003	0.030***	-0.028***
	(0.007)	(0.002)	(0.006)	(0.009)	(0.009)
active	-0.019**	-0.001	0.006	-0.036***	0.054***
	(0.008)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive050	0.026**	0.015***	-0.015	0.016	0.000
	(0.011)	(0.004)	(0.010)	(0.015)	(0.017)
single	-0.136***	-0.003***	-0.034***	-0.092***	0.003
	(0.003)	(0.001)	(0.003)	(0.003)	(0.004)
single_closest	-0.004	0.010**	-0.002	-0.028***	0.007
	(0.009)	(0.005)	(0.008)	(0.008)	(0.010)
single_active	0.002	-0.004**	-0.034***	0.030***	-0.067***
	(0.006)	(0.002)	(0.004)	(0.005)	(0.008)
single_closestactive	-0.003	-0.001	0.014*	0.002	0.020
	(0.010)	(0.006)	(0.008)	(0.009)	(0.014)

Panel D: Interactions with having a partner.

	(1)	(2)	(3)	(4)	(5)
closest_mine0_50	0.027***	-0.007***	-0.003	0.016*	-0.016
	(0.008)	(0.002)	(0.006)	(0.009)	(0.010)
active	-0.010	-0.004*	-0.020***	-0.012	0.021*
	(0.008)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive050	0.018	0.021***	-0.000	0.020	-0.014
	(0.013)	(0.006)	(0.009)	(0.014)	(0.018)
partner	0.072***	-0.005***	0.008***	0.072***	-0.031***
	(0.003)	(0.001)	(0.002)	(0.003)	(0.004)
partner_closest	-0.011	0.000	-0.001	0.021***	-0.016**
	(0.007)	(0.002)	(0.005)	(0.007)	(0.008)
partner_active	-0.011**	0.003*	0.027***	-0.024***	0.030***
	(0.005)	(0.002)	(0.004)	(0.004)	(0.007)
partner_closestactive	0.011	-0.009*	-0.016*	-0.006	0.026*
	(0.011)	(0.005)	(0.009)	(0.011)	(0.015)

Heterogeneous impacts

In table 4 above we investigate the possible heterogeneity by marital status. Focusing at the interaction term between the marital status and the closestactive coefficient at the last row of every panel the results show heterogeneity across marital status. The divorced or separated individuals get much more pronounced effects of mine openings and there is a clear shift from agriculture to the other sectors for this group (Panel A). Similarly, the widows are less likely to work in agriculture once a mine opens and perhaps even more likely to work in general, although only statistically significant at the 10 percent level (Panel B). For singles that have never been married and for those living with a partner there is not much of a difference from the main effects.

Conclusion

The discovery of natural resources across the African continent brings hope for millions of poor people but at the same time there is a fear that the resources will be a curse rather than a blessing (e.g. Collier 2010; Frankel 2010; van der Ploeg 2011). There is an extensive literature on the curse of natural resources linked to various outcomes such as institutions (e.g. Mehlum et al. 2006), corruption (e.g. Leite and Weidmann 1999), civil war and conflict (e.g. Collier and Hoeffler 2005), rent appropriation by an elite (e.g. Auty 2009), and democracy (e.g. Ross 2006). There is an argument that resource wealth crowds out industry and employment in other sectors and the negative effects on female employment, it is argued, are particularly strong as women do not work in the resource sector directly and since they are assumed to work in the crowded out sectors (Ross 2008; 2012). On the other hand, there may be positive spillover effects on other sectors due to increased employment and wages in the resource sector. In particular, such spillover effects are most likely strongest in the local nontradable sector as argued by Moretti (2010) and if women work predominantly in services or sales their employment may rise accordingly. Exploiting detailed data on industrial mining in sub Saharan Africa we therefore ask whether mining generates employment for women by inducing a shift from household to market production or whether the reverse is true.

Using GPS coordinates we merge individual level data with mining data, which enables us to conduct a highly localized analysis of spillover and crowding out effects. Moving down to the local level has several advantages as compared to cross national analyses as argued by e.g.

Angrist and Kugler (2008) and Aragón and Rud (2012). In particular, it is unlikely that cross country differences in resource abundance are exogenous to factors such as institutions, civil wars, and growth (Brunnschweiler and Bulte 2008a, 2008b, 2009; Bruckner and Ciccone 2010; De Luca et al. 2012; Norman 2009). Using geocoded data from the Demographic and Health Surveys from 1986 to 2011 for more than 600 thousand women in sub-Saharan Africa we are able to control for region and year fixed effects. The data is well suited for our analysis as it allows us to investigate female employment in general as well as the sectoral composition of this employment and the type of earnings received. Despite the advantages of using highly localized data it also introduces concerns that there is selection into mining based on factors unrelated to mineral abundance such as access to inputs, transportation or agglomeration costs (Krugman 1991; Isard 1998). Since our geocoded data on minerals from the Raw Minerals Group covers 839 industrial mines across Africa with panel data on production levels from 1975 we are able to control for and investigate the selection issue by means of a difference in differences estimation strategy.

We show that the opening of industrial mines increases female employment, in particular in the service sector. The results are robust to a wide array of robustness tests such as using regional or country fixed effects, continuous variables or indicator variables for distance to mines, different sets of indicator variables for distance introduced separately or at the same time, and excluding individuals that may have self selected into the mineral intensive areas by migration. The results also point to an important selection into becoming a mining area and thereby show the importance of using the difference in differences method also at the local level. We further test for heterogeneity in the effects by marital status and find clear indications of a heterogeneity whereby divorced women and widows experience a more pronounced effect of mining activity on their employment.

More natural resources are discovered across the world, and the high prices of these resources induce exploring activities in previously unexplored areas (Collier 2010). As Africa is thought to have very large sub-soil assets (Collier and Venables 2008) the results from the present paper are most likely relevant for decades to come. Female employment is likely to foster female agency and is also argued to be important for child health, schooling, and survival (e.g. Duflo 2000; Hoddinott and Haddad 1995; Thomas 1990; Qian 2008). Future studies should investigate the impacts of mining on these aspects as well. Our results of mining leading to more employment is in sharp contrast to the bleak picture painted by previous literature that female employment is harmed by the existence of natural resources (Ross 2008; 2012). These different results may depend on the geographical area, the resources under study, the level of analysis or the methods used and we urge future studies to conduct similar analyses in other contexts.

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Appendix

This appendix presents results that are not central to the understanding of the paper but that can be used for extra information and it also shows a wide battery of robustness checks. The appendix starts with presenting extra summary statistics in section A. Alternative specifications of the main regression results are then presented in section B.

Section A: Descriptive statistics.

Appendix Table A1. Distribution of the sample by country.

Country	Number of observations.
Angola	11 292
Benin	11 710
Burkina Faso	25 239
Cameroon	14 527
Central African Republic	5 884
Congo DR	9 773
Cote d'Ivoire	11 139
Ethiopia	45 088
Ghana	19 918
Guinea	14 592
Kenya	16 594
Lesotho	14 263
Liberia	16 587
Madagascar	24 143
Malawi	47 398
Mali	37 059
Mozambique	6 413
Namibia	16 391
Niger	14 080
Nigeria	56 092
Rwanda	32 244
Senegal	64 042
Sierra Leone	7 320
Swaziland	4 908
Tanzania	29 775
Togo	11 929
Uganda	18 365
Zambia	7 146
Zimbabwe	23 673
Total	617 584

Appendix Table A2 Distribution of the sample by year.

Year	Number of observations.
1986	5 239
1988	3 360
1990	8 781
1991	3 871
1992	12 813
1993	10 916
1994	13 983
1995	9 704
1996	5 491
1997	15 653
1998	30 474
1999	16 613
2000	41 830
2001	19 068
2003	40 749
2004	29 075
2005	56 254
2006	39 765
2007	40 356
2008	90 418
2009	22 486
2010	76 576
2011	24 109
Total	617 584

Appendix Table A3 Mines opening and closing between 1975 and 2010 .
Opening mines

First year	Freq.	Percent	Cum.
1975	51	31.48	31.48
1984	9	5.56	37.04
1985	1	0.62	37.65
1986	1	0.62	38.27
1988	7	4.32	42.59
1989	1	0.62	43.21
1990	5	3.09	46.30
1991	3	1.85	48.15
1992	4	2.47	50.62
1993	3	1.85	52.47
1994	2	1.23	53.70
1995	3	1.85	55.56
1996	3	1.85	57.41
1997	10	6.17	63.58
1998	7	4.32	67.90
1999	4	2.47	70.37
2000	4	2.47	72.84
2001	5	3.09	75.93
2002	6	3.70	79.63
2003	4	2.47	82.10
2004	2	1.23	83.33
2005	6	3.70	87.04
2006	7	4.32	91.36
2007	4	2.47	93.83
2008	4	2.47	96.30
2009	3	1.85	98.15
2010	3	1.85	100.00
Total	162	100.00	

Closing mines

lastyear	Freq.	Percent	Cum.
1975	6	3.70	3.70
1984	1	0.62	4.32
1985	2	1.23	5.56
1988	1	0.62	6.17
1989	3	1.85	8.02
1991	2	1.23	9.26
1992	2	1.23	10.49
1993	1	0.62	11.11
1994	1	0.62	11.73
1995	1	0.62	12.35
1996	2	1.23	13.58
1997	4	2.47	16.05
1998	5	3.09	19.14
1999	8	4.94	24.07
2000	5	3.09	27.16
2001	7	4.32	31.48
2002	2	1.23	32.72
2003	4	2.47	35.19
2004	7	4.32	39.51
2005	2	1.23	40.74
2006	2	1.23	41.98
2007	9	5.56	47.53
2008	9	5.56	53.09
2009	5	3.09	56.17
Never	71	43.83	100.00
Total	162	100.00	

Section B: Alternative specifications.

Table B1. Alternative indicator variables for distances in the nd difference in differences regressions.

Panel A. Effects of getting an active mine within 25 kilometers. All regressions include region and year f.e's and linear regional time trends.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
closest_mine0_25	0.011	-0.002	-0.005	0.020*	-0.016
	(0.009)	(0.002)	(0.007)	(0.012)	(0.012)
active	-0.016**	-0.001	-0.004	-0.024***	0.044***
	(0.007)	(0.002)	(0.005)	(0.009)	(0.011)
closestactive025	0.033**	0.022***	0.016	-0.019	0.018
	(0.013)	(0.005)	(0.011)	(0.017)	(0.020)
urban	-0.060***	0.031***	0.123***	-0.266***	0.261***
	(0.004)	(0.001)	(0.003)	(0.004)	(0.006)
age	0.012***	0.000***	0.004***	0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	0.001***	-0.005***	-0.019***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
christian	-0.017***	0.011***	0.036***	-0.078***	0.044***
	(0.004)	(0.002)	(0.003)	(0.005)	(0.006)
muslim	-0.064***	0.005***	0.092***	-0.158***	0.087***
	(0.005)	(0.001)	(0.005)	(0.007)	(0.009)
Constant	0.365***	-0.025***	0.067	0.313***	0.136
	(0.058)	(0.003)	(0.052)	(0.090)	(0.200)
Observations	406,002	393,134	393,134	393,154	191,619
R-squared	0.196	0.085	0.151	0.370	0.337

Robust standard errors clustered at DHS cluster level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel B. Effects of getting an active mine within 75 kilometers. All regressions include region and year f.e's and linear regional time trends.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
closest_mine0_75	0.046***	0.003**	-0.015***	0.061***	-0.038***
	(0.007)	(0.001)	(0.006)	(0.010)	(0.010)
active	-0.014*	-0.000	-0.003	-0.025***	0.042***
	(0.008)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive075	0.005	0.004	0.003	-0.004	0.005
	(0.010)	(0.003)	(0.008)	(0.014)	(0.016)
urban	-0.060***	0.031***	0.123***	-0.266***	0.261***
	(0.004)	(0.001)	(0.003)	(0.004)	(0.006)
age	0.012***	0.000***	0.004***	0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	0.001***	-0.005***	-0.019***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
christian	-0.016***	0.011***	0.036***	-0.077***	0.044***
	(0.004)	(0.002)	(0.003)	(0.005)	(0.006)
muslim	-0.062***	0.005***	0.092***	-0.156***	0.086***
	(0.005)	(0.001)	(0.005)	(0.007)	(0.009)
Constant	0.198***	-0.021***	-0.085***	0.866***	0.127
	(0.062)	(0.002)	(0.021)	(0.006)	(0.200)
Observations	406,002	393,134	393,134	393,154	191,619
R-squared	0.197	0.084	0.151	0.371	0.337

Robust standard errors clustered at DHS cluster level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Panel C. Effects of getting an active mine within 100 kilometers. All regressions include region and year f.e's and linear regional time trends.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
closest_mine0_100	0.045***	0.004**	-0.020***	0.068***	-0.040***
	(0.007)	(0.002)	(0.006)	(0.010)	(0.011)
active	-0.013	0.001	-0.005	-0.023**	0.042***
	(0.008)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive0100	0.001	0.001	0.006	-0.007	0.003
	(0.010)	(0.003)	(0.008)	(0.013)	(0.016)
urban	-0.059***	0.031***	0.123***	-0.266***	0.261***
	(0.004)	(0.001)	(0.003)	(0.004)	(0.006)
age	0.012***	0.000***	0.004***	0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	0.001***	-0.005***	-0.019***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
christian	-0.017***	0.011***	0.036***	-0.077***	0.044***
	(0.004)	(0.002)	(0.003)	(0.005)	(0.006)
muslim	-0.063***	0.005***	0.092***	-0.157***	0.087***
	(0.005)	(0.001)	(0.005)	(0.007)	(0.009)
Constant	0.196***	-0.021***	-0.086***	0.866***	0.145
	(0.062)	(0.002)	(0.021)	(0.006)	(0.198)
Observations	406,002	393,134	393,134	393,154	191,619
R-squared	0.197	0.084	0.151	0.371	0.337

Robust standard errors clustered at DHS cluster level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B2. Effects of getting an active mine within various distances. All regressions include region and year f.e's and linear regional time trends.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Working	Service	Sales	agriculture	Cash
closest_mine0_25	0.056***	0.000	-0.022**	0.084***	-0.057***
	(0.012)	(0.003)	(0.009)	(0.015)	(0.015)
closest_mine25_50	0.057***	-0.002	-0.017**	0.080***	-0.055***
	(0.010)	(0.002)	(0.008)	(0.013)	(0.013)
closest_mine50_75	0.063***	0.011***	-0.026***	0.086***	-0.045***
	(0.009)	(0.002)	(0.007)	(0.013)	(0.013)
closest_mine75_100	0.030***	0.004**	-0.017**	0.051***	-0.026*
	(0.009)	(0.002)	(0.007)	(0.012)	(0.014)
active	-0.013	-0.000	-0.005	-0.023**	0.041***
	(0.008)	(0.002)	(0.006)	(0.009)	(0.012)
closestactive025	0.028*	0.021***	0.015	-0.023	0.024
	(0.015)	(0.006)	(0.012)	(0.019)	(0.022)
closestactive2550	0.005	0.003	-0.017	0.019	-0.000
	(0.014)	(0.004)	(0.011)	(0.018)	(0.021)
closestactive5075	-0.018	-0.008**	0.018	-0.027	0.005
	(0.014)	(0.004)	(0.012)	(0.020)	(0.023)
closestactive75100	-0.005	-0.004	0.007	-0.007	-0.005
	(0.013)	(0.004)	(0.012)	(0.017)	(0.022)
urban	-0.060***	0.031***	0.123***	-0.266***	0.261***
	(0.004)	(0.001)	(0.003)	(0.004)	(0.006)
age	0.012***	0.000***	0.004***	0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	0.001***	-0.005***	-0.019***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
christian	-0.016***	0.011***	0.036***	-0.077***	0.044***
	(0.004)	(0.002)	(0.003)	(0.005)	(0.006)
muslim	-0.062***	0.005***	0.092***	-0.157***	0.086***
	(0.005)	(0.001)	(0.005)	(0.007)	(0.009)
Constant	0.197***	-0.021***	-0.086***	0.866***	0.140
	(0.062)	(0.002)	(0.021)	(0.006)	(0.199)
Observations	406,002	393,134	393,134	393,154	191,619
R-squared	0.197	0.085	0.151	0.371	0.337

Robust standard errors clustered at DHS cluster level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B3. Effects of getting an active mine within 50 kilometers with a control group restricted to be within 100 kilometers from a mine. All regressions include region and year f.e's and linear regional time trends.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
closest_mine0_50	0.004	-0.011***	0.002	0.012	-0.016*
	(0.007)	(0.002)	(0.006)	(0.010)	(0.010)
active	-0.042***	-0.007*	0.017	-0.044**	0.039*
	(0.013)	(0.004)	(0.011)	(0.018)	(0.021)
closestactive050	0.026**	0.012***	-0.016	0.013	0.018
	(0.012)	(0.004)	(0.012)	(0.017)	(0.020)
urban	-0.040***	0.027***	0.148***	-0.280***	0.230***
	(0.006)	(0.002)	(0.006)	(0.008)	(0.011)
age	0.012***	0.000	0.003***	0.005***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	-0.001***	-0.006***	-0.017***	0.015***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
christian	-0.008	0.005*	0.033***	-0.060***	0.013
	(0.005)	(0.002)	(0.005)	(0.007)	(0.009)
muslim	-0.009	-0.005**	0.123***	-0.102***	0.043***
	(0.007)	(0.003)	(0.008)	(0.010)	(0.013)
Constant	0.729***	-0.023***	-0.195***	1.149***	0.481***
	(0.015)	(0.005)	(0.014)	(0.021)	(0.078)
Observations	131,976	122,868	122,868	122,868	63,502
R-squared	0.214	0.093	0.168	0.428	0.381

Robust standard errors clustered at DHS cluster level in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B4. Effects of distance in kilometers (scaled by 100 for presentational purposes) to an active mine.. All regressions include region and year f.e's and linear regional time trends.

VARIABLES	(1) Working	(2) Service	(3) Sales	(4) agriculture	(5) Cash
kilometers	-0.022***	-0.002**	-0.000	-0.022***	0.014***
	(0.004)	(0.001)	(0.002)	(0.004)	(0.005)
active	-0.023***	0.006**	-0.002	-0.040***	0.072***
	(0.009)	(0.003)	(0.007)	(0.012)	(0.014)
distance_active	0.005	-0.002***	-0.000	0.006*	-0.013***
	(0.003)	(0.001)	(0.002)	(0.004)	(0.005)
urban	-0.060***	0.031***	0.123***	-0.266***	0.261***
	(0.004)	(0.001)	(0.003)	(0.004)	(0.006)
age	0.012***	0.000***	0.004***	0.004***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
schoolyears	-0.006***	0.001***	-0.005***	-0.019***	0.017***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
christian	-0.018***	0.011***	0.036***	-0.079***	0.045***
	(0.004)	(0.002)	(0.003)	(0.005)	(0.006)
muslim	-0.063***	0.005***	0.092***	-0.157***	0.086***
	(0.005)	(0.001)	(0.005)	(0.007)	(0.009)
Constant	0.299***	-0.008	0.069	0.415***	0.135
	(0.067)	(0.006)	(0.053)	(0.095)	(0.200)
Observations	406,002	393,134	393,134	393,154	191,619
R-squared	0.197	0.084	0.151	0.370	0.337

Robust standard errors clustered at DHS cluster level in parentheses
*** p<0.01, ** p<0.05, * p<0.1