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African Mining, Gender, and Local Employment

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Summary. — The discovery of natural resources across the African continent brings hope for millions of poor people, but there are long-standing fears that the resources will be a curse rather than a blessing. One of the most frequently claimed effects is that gender inequality in economic opportunities may increase with mining. This paper is the first multi-country quantitative analysis of the local employment impacts for men and women of large-scale mining in the African continent. Using exact mine locations, we merge survey data for 800,000 individuals with data on all mine openings and closings across the continent, which enables a highly localized analysis of spillover effects. We employ a geographic difference-in-difference estimation exploiting the spatial and temporal variation in mining. We show that industrial mine opening is a mixed blessing for women. It triggers a local structural shift, whereby women shift from agricultural self-employment (25% decrease) to the service sector (50% increase), and are 16% more likely to earn cash. However, overall female employment decreases by 8% as agriculture is a larger sector than services. Male partners shift to skilled manual labor, and some find jobs in the mining sector. The effects of mine openings diminish with distance and are close to zero at 50 km from a mine. Mine closure causes the service and skilled sectors to contract. The results are robust to a wide battery of robustness checks, such as using different measures of distance and excluding migrants from the sample. This paper shows that large-scale mining can stimulate nonagricultural sectors in Africa, although it creates local boom-bust economies with transient and gender-specific employment effects.
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Key words — natural resources, female employment, Africa

1. INTRODUCTION

Africa's opportunities are being transformed by new discoveries of natural resources and their rising prices (Collier, 2010), and the mining sector is the main recipient of foreign direct investment in Sub-Saharan Africa (World Bank, 2011). Whether the discovery of natural resources is a blessing or a curse to the economy and to a country's citizens is a contentious issue (see Frankel, 2010 or van der Ploeg, 2011 for overviews), and natural resource dependence is linked to various outcomes at the national level: institutions (e.g., Mehlum, Moene, & Torvik, 2006a, 2006b), corruption (e.g., Leite & Weidmann, 2002), civil war and conflict (e.g., Collier & Hoeffler, 2004; Collier & Hoeffler, 2005), rent appropriation by an elite (e.g., Auty, 2001, 2007), democracy (e.g., Barro, 2000; Jensen & Wantchekon, 2004), and female labor force participation (Ross, 2008, 2012).¹

While the country-level economic and political effects of extractive industries are well explored, the research on their local economic effects is nascent. The present paper adds to recent literature on local effects of natural resources (e.g., Allcott & Keniston, 2014; Aragón & Rud, 2013; Berman, Couttenier, Rohner, & Thoenig, 2014; Caselli & Michaels, 2013; Chuhan-Pole, Dabalén, Kotsadam, Sanoh, & Tolonen, 2015; Kotsadam, Olsen, Knutsen, & Wig, 2015; Michaels, 2011; Wilson, 2012), by investigating the effects of large-scale industrial mining on local labor markets.² We use the best available survey data for Africa, Demographic and Health Surveys (DHS). The main focus is on women's labor market opportunities, and we contrast our findings with the effects for men. Access to employment improves women's lives and is listed among the top five priorities for promoting gender equality in the 2012 World Development Report (World Bank, 2012).

It is theoretically ambiguous whether industrial mining increases or decreases female employment. The African Mining Vision, formulated by the member states of the African Union, together with the African Development Bank and

the United Nations, emphasizes that extractive industries may hurt women (UNECA, 2011). Similarly, Ross (2008, 2012) claims that exploitation of natural resources hurts women's employment via both demand and supply channels. In his model, female labor supply is reduced via a household income effect, spurred by higher male incomes and/or increased government transfers. The demand for female labor decreases as export-oriented and female-dominated manufacturing is crowded out by Dutch disease effects. He tests his theory using cross country regressions of female labor force participation on oil wealth and finds that oil rich countries have fewer women working, a finding he claims is also valid for mining. There is, however, little reason to expect these

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effects in Sub-Saharan Africa (SSA). First, the manufacturing sector in rural SSA is small (see Bigsten & Söderbom, 2006 or Isham, Woolcock, Pritchett, & Busby, 2005 for an overview).³ Second, if women have the opportunity to shift to the service sector, the demand for female labor need not decrease. Women are overrepresented in sales and services in SSA, but underrepresented in production and manufacturing, as shown by data from ILO's Key Indicators of the Labour Market database (ILO, 2011).

The effects of natural resource extraction on the local economy are often described in terms of linkages and multipliers (e.g., Aragón & Rud, 2013; Eggert, 2002). Local multipliers describe the effect of an employment increase in one sector on employment in other sectors. Moretti (2010) shows that an increase in the production of tradable goods leads to increased local demand for non-tradables as the number of workers and their salaries increase. However, the multipliers for tradables depend on local changes in labor costs, since tradable goods have prices set nationally or internationally (Moretti, 2010; Moretti & Thulin, 2013).

The strand of literature on linkages and multipliers argue for positive local employment effects. If the multipliers are small, we will find economically and statistically insignificant effects. Such findings would support the traditional view of mines as having few or no linkages to the local community. This "enclave" theory was first hypothesized by Hirschman (1958) and became a stylized fact in the second part of the last century (UNECA, 2011, see also Ferguson, 2005). There is limited empirical evidence for this theory. Numerous case studies on artisanal and small-scale mining show that mining enables livelihood diversification (e.g., Fessehaie & Morris, 2013; Hirons, 2014; Hilson & Garforth, 2013; Okoh & Hilson, 2011; Spiegel, 2012). However, small-scale and large-scale mining differ in many respects: One important aspect is the labor to capital ratio, assumed high in small-scale mining and low in large-scale mining. Quantitative case studies of the large-scale sector find mixed results. The coal mining boom of the 70s in the US resulted in modest local employment spillovers but increasing wage rates (Black, McKinnish, & Sanders, 2005), and contemporary oil and gas booms in the US have increased district employment levels (Allcott & Keniston, 2014). A study of local welfare effects around the world's second largest gold mine in Peru found support for the enclave hypothesis in absence of policies for local procurement of goods (Aragón & Rud, 2013).

If the multiplier effects are stronger, we expect an increase in male and female labor force participation with female employment concentrated in services and sales and male employment concentrated in manual labor, reflecting the gender segregation in the Sub-Sahara African labor markets. Qualitative studies have found that women dominate the provision of goods and services around small-scale mines in Africa (Hinton, 2006; ILO, 1999), while they are not much engaged in the mining sector directly.⁴ Spillover effects on the tradable sector are less likely to substantially affect the demand for female labor because women are not strongly represented in the tradable sector, including manufacturing and construction.

The effect on labor supply in agriculture is *a priori* ambiguous. A mine expansion can change local agriculture through a variety of channels: competition over land use, expropriation and changes in land prices (UNECA, 2011), pollution (Aragón & Rud, 2015), intra-household reallocation of labor including substitution effects, and demand changes for agricultural goods. The literature on small-scale mining often finds a shift from agriculture to mining (e.g., Lu & Lora-Wainwright, 2014), although some leave agriculture without finding new

livelihood opportunities (Bebbington, Bebbington, Bury, Lingan, Muñoz, & Scurrah, 2008). Furthermore, the shift may not be sustainable in the long run as mines have limited life-spans (Cartier & Bürge, 2011; Jaskoski, 2014; Maconachie & Binns, 2007). We contribute by analyzing if these patterns hold for large-scale mining and through a gender lens. Moreover, we contribute by quantitatively assessing the long-run sustainability of the large-scale mining sector by separately analyzing mine closures. A limitation of the study is that it cannot compare the employment effects of small-scale versus the large-scale mining sector. Such a comparative analysis could inform national and international strategic policies on the total mineral sector. However, the study is policy relevant as it is, to our knowledge, the first quantitative assessment of the African large-scale mining sector's ability to generate local employment.

A novelty of the present paper is that it connects production data on 874 industrial mines starting in 1975 to DHS household survey data for women aged 15–49. The unique combination of datasets with more than 500,000 sampled women and almost 300,000 partners in 29 countries enables us to investigate local spillover effects on employment by a difference-in-difference method. By exploiting the spatial and temporal variation in the data, we compare people living close to a mine with those living further away, and individuals living close to a producing mine with those who live in the vicinity of a mine that is yet to open. We include sub-national region fixed effects and thereby control for time-invariant differences between countries and sub-national regions, such as time-stable mining strategies, institutions, trade patterns, openness, sectoral composition, level of economic development and gender norms. In addition, by including regional-specific time trends we make the identification strategy less reliant on assumption of similar trends across areas.

We show that industrial mine openings constitute a mixed blessing for women. They trigger a local structural shift, whereby women shift from agricultural work to the service sector, or out of the labor force. More women leave self-employment in agriculture (seven percentage points, or 25% decline) than enter into services (two percentage points, or 50% increase), but the service sector jobs are less seasonal and cash earnings opportunities increase with 7.4 percentage points (16%). A back-of-the-envelope calculation estimates that more than 90,000 women get service sector jobs as a result of industrial mining in their communities, and more than 280,000 women leave the labor force. Male partners shift to skilled manual labor, and some find jobs within mining. The effects of mine openings wear off with distance and are close to zero at 50 km from a mine. Mine closing causes the expanded sectors to contract. The results are robust to a wide battery of robustness checks, such as using different measures of distance and excluding migrants from the sample.

There are large and persistent differences in value added per worker in agriculture and non-agricultural sectors in developing countries (Gollin, Jedwab, & Vollrath, 2014). The difference indicates misallocation of workers, with too many workers in low yielding agriculture. In this paper, we show that mining has the power to locally stimulate non-agricultural sectors and provide cash earning opportunities. However, more people leave agriculture than access jobs in the growing sectors, and the jobs in the growing sectors are seemingly temporary. The findings indicate that large-scale mining is creating local boom-bust economies in Africa, with transient and gender-specific employment effects.

In the next section we present the data. In Section 3, we lay out the empirical strategy. In Section 4, we present the

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