Local Industrial Shocks and Endogenous Gender Norms

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Abstract

Does industrial development change gender norms? This is the first paper to explore the causal local effects of a continent-wide exogenous expansion of an industry on the formation of gender norms. The paper uses the recent rapid increase in industrial gold mining—plausibly exogenous to local characteristics—in Africa as a quasi-experiment. The identification strategy relies on temporal and spatial variation in a difference-in-difference analysis. Using a large sample of women living within 100 km of a gold mine, I show that the establishment of an industrial-scale mine bringing local economic growth changes gender norms: justification of domestic violence decreases by 19%, women have better access to healthcare are 31% more likely to work in the service sector. I exclude that the effects are driven by increased schooling attainment but women access more information through media. The findings are robust to different assumptions about trends, distance, and migration, and withstand a novel spatial randomization test. The results support the idea that entrenched norms regarding gender can change rapidly in the presence of economic development.

Keywords: Gender Norms, Local Industrial Development, Gold Mining, Africa

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1 Introduction

Gender norms are part of the local institutions that determine the success rate of development polices. This has motivated gender targeted development policies, such as cash transfer programs to mothers, microcredit to women, and vocational training programs for young girls. Traditional gender practices—such as bride price—can be leveraged to increase uptake of schooling for girls (Ashraf et al., 2015). Present-day gender norms and beliefs regarding women's role in society can be traced back to historic adoption of an agricultural innovation—the plough—which affected the gender division of labor (Alesina, Giuliano and Nunn, 2011).

Gender norms may, however, be endogenous to the processes of economic development, explaining why developed countries are more gender equal in the cross-section (Jayachandran, 2015; Doepke, Tertilt and Voena, 2012). Moreover, gender equality may reinforce economic development (Duflo, 2012), as it is "smart economics" (The World Bank, 2013). To disentangle the cause and effect of gender norms and economic development is hard, in part because of nebulous definitions of gender norms and gender relations that span both the ideological and material (Agarwal, 1997), and because they reinforce each other (Duflo, 2012).

In this paper, I ask if gender norms change with local economic development spurred by industrial investment. I use the expansion of an industry whose establishment decision is exogenous to the pre-existing local economy as a quasi-experiment. Importantly, the chosen industry—large-scale gold mining—is not dependent on women's labor supply. I analyze the effect of of large-scale gold mine openings on gender norms across 8 African countries. For the purpose of this paper, I define gender norms broadly to capture attitudes, constraints, and bargaining power. I confirm that gender norms change rapidly with local economic development.

The recent supercycle of commodity prices led to a rapid increase in large-scale gold mining in the African continent, providing a quasi-experimental setting to explore the effect of local industrialization on gender norms. A reason to focus on large-scale gold mining is in the sector's nature: it's establishment decisions do not depend on local population characteristics but on geological characteristics uncorrelated with the preexisting local economies (Gajigo et al., 2012). The necessary condition for mining is a mineral deposit—a random geological anomaly (Eggert, 2002). In addition, open pit gold mining—the dominant form of large-scale gold mining in the region—has a high capital to labor ratio meaning that it is less reliant on the local labor market, further

reducing the fear for selection effects. The last advantage of studying an extractive industry is that it is dominated by large multinational firms (Gajigo et al., 2012), whose operations are orthogonal to the pre-existing local, often rural and underdeveloped, economies in which they operate. Previous evidence from sub-Saharan Africa shows that large-scale mining investment induces structural shifts from agriculture to modern sectors for both men and women (Kotsadam and Tolonen, 2016).

The main empirical strategy is a difference-in-difference approach using the spatial and temporal variation—mine opening year and precise mine location—while controlling for initial level differences in development between the communities near the mines (within 15 km from the mine location) and the neighboring communities (15-100 km from the mine location). With country-year and district fixed effects, the analysis depends on the timing of mine opening being exogenous to local changes in gender norms. This assumption is later relaxed by including districts time trends, and by using the international gold price to predict mining intensity.

To measure the effect of large-scale gold mining on gender norms I use individual level data on more than 50,000 women aged 15-49 over the time period 1993 to 2012 surveyed in eight countries. The data include questions on justification of domestic violence, access to health care for self, and final say in household decisions. In addition, I explore effects on variables associated with female empowerment: occupation, earnings, marriage, schooling and fertility. The results reveal a stark change in local gender norms, and illustrate that pervasive norms regarding women's participation in society can change rapidly with local development.

With the local boom in gold mining, the acceptance rate of domestic violence decreases by almost 19%[1], from an average acceptance rate of 44%. Women have better self-stated access to healthcare, with a 23% decrease in self-stated barriers to access care, including getting the permission. The magnitudes of these effects are economically significant. Ceteris paribus, a large-scale mine leads to a decrease in justification of domestic violence comparable to 5.8 extra years of schooling. This is significant as the mean years of schooling in the sample is 2.95 years, and thus almost comparable to a doubling of schooling among women. The change in barriers to access healthcare for self, which includes getting the permission to seek healthcare, is equivalent to 8.7 years

[1]The questions are listed in the Appendix, Table B.16, The domestic violence attitude questions are of the type: "In your opinion, is a husband justified in hitting or beating his wife in the following situations: *example*", and for access to healthcare: "Many different factors can prevent women from getting medical advice or treatment for themselves. When you are sick and want to get medical advice or treatment, is each of the following a big problem or not? *example*"

of schooling. Further investigation of these results indicate that the largest changes in these attitudes are found among younger women. However, I rule out that the mine opening changed norms through increased education among younger women, although women marry men with more education.

Moreover, women's exposure to non-traditional norms may have changed through increased access to media. Women have better access to radios, and are significantly more likely to have listened to radio shows discussing family planning, or read about family planning in the newspaper. The findings relate to studies finding that media access, such as cable TV connection (Jensen and Oster, 2009), and soap operas (La Ferrara, Chong and Duryea, 2012) change fertility patterns and women's empowerment in India and Brazil, respectively.

Despite the sector's traditional association with male labor, women access new types of jobs in mining communities. Service and sales employment increases by 31% for women. The estimated intention-to-treat effect size on service sector employment—7 percentage points—is larger than benchmark findings in the experimental literature aiming to increase women's work participation (cf. Jensen, 2012). This indicates that the industry is effective in stimulating women's non-farm employment. I rule out that the jobs created in the service sector are limited to jobs in prostitution.

Contrary to the hypothesis that the male-dominated mining sector increases men's bargaining power within the household, I find no effects on decision-making power between spouses, nor changes in marriage formation, such as likelihood that the marriage is polygamous, age at marriage, or age gap between partners.

Selective migration of women with more gender equal norms cannot be ruled out, however, I confirm that women born in the communities are, alongside their migrant peers, less likely to justify domestic violence and more likely to work in the service sector. It is possible that inward migration of men and women with more pro-female norms increased local women's exposure to less traditional norms, resulting in norm shifts. Because the norms of migrant women and men cannot be observed prior to the migration decision, it is however not possible to test this hypothesis.

I explore heterogeneity depending on treatment intensity, such as the number of active mines, the international gold price, and household's distance from the mine. The effects are stronger the more active mines are close-by, the higher the gold price, but attenuate with distance from mine. The results are robust to different specifications, such as the inclusion of mine fixed effects, country-year fixed effects, district time

trends, and different levels for clustering. In addition, I design a spatial randomization placebo test where I randomize mine location 1500 times and re-estimate the treatment effects, to exclude the possibility that a mis-specification of the model is driving the results.

The findings relates to two strands of literature. First, it adds to the literature on economic development and gender norms. This literature has been focused on theoretical arguments on how female labor force participation can change gender norms (Basu, 2006; Hiller, 2014), and empirical studies using household data exploring the links between own earned income, intra-household bargaining power, and female empowerment (see for example Ashraf et al., 2010; Baird et al., 2011; Bandiera et al., 2014; Heath and Mobarak, 2015). The paper also adds to the recent literature understanding how access to media changes gender norms (Jensen and Oster, 2009; La Ferrara et al., 2012). I contribute to the literature by understanding the effect on a local aggregate economic shock, that change society as a whole, on gender norms and women's empowerment.

Moreover, I contribute to the growing literature on local effects of mineral economies (Aragon and Rud, 2013; Aragon and Rud, 2015; Asher and Novosad, 2014; Berman et al., 2014; Chuhan-Pole et al., 2015; Corno and de Walque, 2012; Fafchamps et al., 2015; Loayza et al., 2013; Kotsadam and Tolonen, 2016; von der Goltz and Barnwal, 2014; Wilson, 2012), summarized in the review paper by Cust and Poelhekke (2015). This is the first paper within this literature to explore the effects of mining economies on the formation of gender norms and female empowerment.

The rest of the paper proceeds as follows. I develop a conceptual framework and describe the context of mining in Section 2, the data in Section 3 and the empirical strategy in Section 4. In Section 5, I present the main results, robustness specifications and mechanisms. I conclude the paper in Section 6.

2 Conceptual framework

New discoveries of natural gas, oil, and minerals have led to booming foreign direct investment (FDI) in the African extractives sector, making it the largest sector in terms of FDI. The sector accounted for two-thirds of the increase in exports from Sub-Saharan Africa from 2003-2008 (Chuhan-Pole et al., 2013). Gold mining, in particular, has received a large share of the FDI due to growing demand from emerging markets.

This has led to a boom in gold extraction (see Figure 1). Africa accounts for 20% of the world production with the study countries of Ghana, Mali, and Tanzania among the major producers. However, there are at least 34 countries in Africa with significant gold deposits that do not yet have industrial-scale gold mining, but that are producing small quantities with traditional methods. The economic importance of the gold sector is thus predicted to grow over time (Gajigo et al., 2012), motivating a better understanding of the social implications of the sector.

Despite the rising importance of extractive industries in developing countries, we have limited understanding of the welfare effects at the sub-national level. Why natural resource endowments do not necessarily turn into high economic growth and prosperity is a much-studied conundrum (called "the natural resource curse"; see van der Ploeg (2011) for an overview). Recently, interest has focused on local effects of natural resource extraction (see Cust and Poelhekke (2015) for an overview), including local community development (Aragon and Rud, 2013; Aragon and Rud, 2015; Loayza et al., 2013; Kotsadam and Tolonen, 2016), and health effects (von der Goltz and Barnwal, 2014; Tolonen, 2016). Little emphasis within this literature, with the exception of Kotsadam and Tolonen (2016) and Wilson (2013), has been placed on the local welfare effects of extractive industries on women.

Women's labor market participation — The association between economic modernization and women's labor force participation is U-shaped (Goldin, 1995). In traditional agrarian societies, the female labor force participation is high but decreases with the growth of modern industrial sectors. The contraction of the female labor force continues until new sectors emerge where women can find productive and non-stigmatized employment (Goldin, 1995), such as within the service sector that has been an important engine of increasing women's work hours (Olivetti and Petrongolo, 2016). Hiller (2014) argue that gender inequality mimics the the U-shaped pattern of female labor force participation along the process of economic development.

Labor force participation and own income are considered the main vehicles for women's empowerment, as they increase age at marriage (Baird et al., 2011; Bandiera et al., 2014; Heath and Mobarak, 2015; Jensen, 2012), reduce fertility (Baird et al., 2011; Bandiera et al., 2014; Jensen, 2012), and change household bargaining power (Duflo 2003; Heath and Tan, 2015). Female labor force participation has also been considered a driving force behind changes in gender norms (Hiller, 2014; Fernandez et al., 2004; Fernandez, 2007; Fernandez and Fogli, 2009), including norms of education

(Jensen, 2012; Heath and Mobarak, 2015; Sviatschi, 2014). On the other hand, women-targeted development policies aiming to strengthen female entrepreneurship—such as microfinance—has surprisingly little effect on female empowerment (Banerjee et al., 2015; Tarozzi et al., 2015), although access to saving commitment technology increased female empowerment among women with initially low bargaining power (Ashraf et al., 2010).

Measures of gender norms and female empowerment — I define gender norms broadly, encompassing three questions measuring gender relations: justification of wife beating, constraints to seek health care for oneself, and final say in household decisions. The exact definition of gender norms is, however, disputed. The term gender relations capture power relations between men and women, both in the ideological and material realms (Agarwal, 1997). The literature on power relations between men and women is nebulous regarding the terminology: it refers to gender relations, gender asymmetries, gender roles, gender role attitudes, gender beliefs, gender differences, gender disparities, gender inequality, gender bargaining power, gender norms, gender identity norms, social norms and perceptions, as well as intra-household dynamics, intra-household bargaining power, household balance of power, female empowerment, and women's status (Agarwal, 1997; Albanesi and Olivetti, 2016; Alesina et al., 2011; Ashraf et al., 2010; Ashraf et al., 2014; Balk, 1997; Basu, 2006; Bertrand et al., 2015; Hiller, 2014; Farre and Vella, 2013; Komura, 2013), to name a few. Moreover, gender norms—such as those relating to fertility—have also been equalized with "culture" (Fernandez and Fogli, 2006), a concept notably hard to define (Fernandez and Fogli, 2009).

Gender norms are socially constructed, but we have limited understanding of how they form, are maintained, and under what conditions they change (Agarwal, 1997). Basu (1996) argues that while there is an extensive literature on how balance of power within the household affects household behavior, the literature has largely ignored how household behavior may affect household balance of power allowing for a time lag. That is, how gender norms are endogenous to household economic behavior.

Changes in gender norms, can for the purpose of this study, be understood as an expansion in a woman's choice set. While I focus on what I call gender norms, some of the outcome variables are also reflective of female empowerment. There are two main limitations of this study. First, I cannot determine causality between the different measures of gender relations. That is, I will not be able to say if increases in labor force participation changes justification of wife beating, or if changes in attitudes

toward wife beating change female labor force participation. Rather, I estimate the causal and composite effect of local economic development on gender norms, and I will show results on additional indicators for female empowerment. Second, the individuals in the sample are limited to women. This distinguishes the study from studies on female empowerment, focusing on changes in treated women's behavior (see e.g. Ashraf et al., 2010; Bandiera et al., 2015; Banerjee et al., 2015). The results from the analysis will not be able to confirm if gender norms held by men cause, or are caused by, changes in gender norms held by women.[2]

Violence against women — Labor market participation and own-earned income can provide protection against sexual and physical violence (Aizer, 2010), although it is dependent on the geocultural context (Devries et al., 2013), and a woman's initial bargaining power. Women with initially low bargaining power—measured by lack of property rights (Panda and Agarwal, 2005), educational gap (Heath, 2014; Hidrobo and Fernald, 2013), or age gap between spouses (Heath, 2014)—are at higher risks of suffering domestic violence with increased own income.

In contrast to this literature, this study focuses on mostly on justification of wife beating. The data on justification of wife beating has previously been used by Jayachandran (2016) in a global context[3]. She finds a negative correlation between justification of wife beating and GDP per capita. Justification of domestic violence is, however, distinct from experiences of violence. There are a few advantages of focusing on attitudes rather than experiences. First, focusing on attitudes toward the acceptability of violence may reduce the risk of underreporting (especially in a context with very high acceptance rate of violence). However, DHS employs a strict protocol when collecting the data and ensures that enumerators are trained for the purpose. Second, within this study, focusing on attitudes is preferred as the attitudes module is more often collected by DHS than the module on experiences of violence. A disadvantage of focusing on attitudes is that the link between justification of violence and experience of violence is not clear. Nonetheless, self-perceived rights and perceptions of bodily integrity are, themselves, important outcomes[4].

[2]Similar questions have been included in DHS men surveys but are excluded because of limited sample sizes.

[3]Limited by the countries that the DHS surveys, which is mostly low income and middle income countries.

[4]For example, aspirations have been shown to play a key role in development outcomes. Child sponsorship interventions, focused on raising disadvantaged children's self-esteem and self-confidence, result in higher schooling attainments and benefiting children are more likely to work as adults (Wydick

African mining and women's empowerment — The African Mining Vision, funded by the UN and the African Union, hypothesizes that large scale mining decreases women's bargaining power by increasing the gender wage gap (African Union, 2009). At the national level, Dutch disease effects induced by natural resource exports may reduce the demand women's labor market participation, by increasing their reservation wage and reducing the wage rate (Ross, 2008). This occurs as welfare transfers to their household increase, through higher male wages, and by decreasing the demand for female labor by crowding out female-dominated sectors such as manufacturing. The pattern was confirmed using cross-country regressions (Ross, 2008). On the other hand, at a local level, Kotsadam and Tolonen (2016) show that the onset of large-scale mining made women shift from subsistence farming to the service sector, or out of the labor force. In the context of copper mining in Zambia, contrary to hypotheses of decreasing bargaining power, income-earning opportunities created by the mining boom led to a reduction in sexual risk-taking behavior among young women (Wilson, 2012). Although large-scale mining has been shown to create new non-farm income earning opportunities for women—income is important for women's intra-household bargaining power (Duflo, 2003)—in sub-Saharan Africa, the wage gap between men and women may still increase if the increase in returns to male labor exceeds that of women. An expansion in industrial mining is therefore not guaranteed to increase women's bargaining power. It remains an empirical question if large-scale mining industries increase or decrease women's intra-household bargaining power.

Whether there is a link between natural resource extraction and violence is a contentious issue discussed in the "natural resource curse" literature. The focus is generally placed on the extractive industries' role in financing wars, or on their potential economic gains motivating onset of conflict and war (in the cross-section, see Collier and Hoeffler, 2005, and sub-nationally (Berman et al., 2014 and Maystadt et al., 2013). Aragon and Rud (2013) find that one large mine in Peru had a moderate positive effect on local crime rates. The present paper moves beyond the inter-state, intra-state, and local effects of extractive industries on social conflict. I consider attitudes to violence at the lowest level of social organization: the household. Within anthropological research, it has been noted that girls migrating to artisanal mining communities in Burkina Faso seeking economic opportunities risk encountering sexual harassment and being subjected to violence (Werthmann, 2009). In addition, southern African mining

et al. 2013).

communities are associated with strong "masculinity" norms (Campbell, 2007), which could lead to increasing acceptance of violence against women. However, if large-scale gold mining creates economic opportunities for women, this can decrease the acceptance rate and prevalence of violence against women.

3 Data

The paper uses the best available pan-African data source with information on labor market outcomes, empowerment, fertility, and child health: the Demographic and Health Surveys (DHS)[5]. DHS has the additional advantage of having GPS coordinates for the surveyed individuals' villages and urban neighborhoods. I will call these locations DHS clusters. The geographic identifiers allow us to match the village or neighborhood in which the mother or the child was surveyed to the gold mines. The large-scale gold mining data comes from Raw Minerals Group[6] and contains all large-scale gold mines across the African continent, with GPS coordinates for each mine center-point and historic production volumes from 1975 to 2013. The companies have different reporting standards which leads to measurement error in the production volumes. For this reason, my preferred strategy is an indicator variable for mine activity status rather than using the reported production volumes.

Combining the two data sources using the geographic information, I construct different measures of proximity to large-scale gold mining operations. The final data set contains all DHS survey rounds that have geographic data for countries in which there is at least one large-scale gold mine that was active at least one year during the study time period. This leaves us with a repeated cross-sectional data set with four survey rounds for Burkina Faso, Ghana, Guinea, Mali, and Tanzania, and three survey rounds for Cote d'Ivoire, Ethiopia, and Senegal[7]. The survey years span 1993 to 2012. Table B.12 in the Appendix shows the sample size divided by country and survey year.

Some countries have artisanal and small-scale gold mining. Such mines are not included in this study for two reasons. First, due to the informal, and sometimes illegal, nature of the artisanal and small-scale gold mining sector, there is little accurate

[5]The Demographic and Health Surveys collects data on health and fertility in developing countries and is funded by USAID. More information can be found at www.dhsprogram.com.

[6]More information about IntierraRMG can be found at http://www.intierrarmg.com/Homepage.aspx. The data is licensed and obtained by subscription.

[7]The complete data set includes all DHS surveys that were available for download in December 2013.

data on production volumes and location of such operations. Second, the artisanal and small-scale gold mining sector is significantly different from the large-scale gold mining sector. While the latter is dominated by capital intensive operations headed by multinational firms, the former is mostly domestic, labor intensive and uses simple technology. The assumption that the establishment of a new gold mine to be orthogonal to the local labor market is, therefore, much less credible for the artisanal and small-scale mining sector. For the same reason, the results from this study can therefore not be expected to hold also for artisanal and small-scale gold mining operations.

Figure 2 shows the geographic location of the large-scale gold mines used in the analysis. The gold mines show a pattern of geographic clustering, such as around the Ashanti gold belt in Ghana and the Lake Victoria greenstone belt in Tanzania. The right panel in Figure 2 zooms in on Tanzania, highlighting the mine location (the yellow circles) relative to the DHS clusters (blue dots), i.e. villages and neighborhoods where the women were sampled. The large green circles have a radius of 100 km, which is the sample limitation that I use in the analysis, and the small dark green circles are the treatment areas.

Descriptive statistics are presented in Table 1. The first column describes the whole sample. Women are on average 28.7 years old, and 27% live in urban areas. More than 40% of women have never moved and were born in the cluster where they were surveyed, and most women work in agriculture (44%). The occupational outcome variables are binary outcome variables, taking a value of 1 if the woman works in the sector. The variable captures self-stated main occupation. I focus on the largest employment groups: agriculture and service and sales, as well as not working.

Mean values for the main outcome variables justification of domestic violence, barrier to healthcare access, and final say in household decisions are presented in Table 1. The variables are index variables and represent the mean of a set of questions. The domestic violence attitude questions are of the type: "In your opinion, is a husband justified in hitting or beating his wife in the following situations: *example*", and for access to healthcare: "Many different factors can prevent women from getting medical advice or treatment for themselves. When you are sick and want to get medical advice or treatment, is each of the following a big problem or not? *example*", and for final say in household decisions: Who usually decides *example*: you, your husband, or jointly? The original questions are presented in the Appendix Table B.1. The answers to the original questions are coded as dummy variables that take a value of one if the woman

agrees with the statement, and zero otherwise. For the third question, I assign a value of 1 if the woman takes the decision alone or jointly with her partner.

The summary statistics show that women justify domestic violence in 40.4% of the cases. In particular, they agree with a statement that a husband has the right to hit his wife if she burns the food (23%), refuses sex (37%), argues with him (45%), neglects the children (48%), or goes out without his permission (47%) (see Table B.1).

Women have low access to healthcare for themselves, with an average of 39.3% of permission from a household member, distance to clinic or money are obstacles to access healthcare for self when needed. Money is the most common limitation, with 60% of women stating it as a problem. Getting the permission to seek healthcare is a problem for 17% of the women in the sample (Table B.1).

Women have alone or jointly with their partner final say in 31.8% of household decisions (Table 1), with more than 50% claim to have the final say in food decisions, but only 17% have a say in how to spend the husband's income, and nearly 30% say they have decision-making power regarding healthcare and large purchases. The sample sizes are smaller for daily purchases and husbands wage (Table B.1), than the other questions. In the main analysis, I will create the index out of the three most commonly asked questions (healthcare, large purchases and family visits). However, results are presented in the appendix on all the original questions.

4 Empirical Strategy

With multiple survey rounds and historic records of openings of gold mines across Sub-Saharan Africa, the identification strategy relies on a difference-in-difference framework using several treatment definitions based on proximity to a mine. The true counterfactual in the baseline is "no mine", and I try several methods to identify the relevant comparison group by varying the definition of the control group.

The strategy of the paper follows from an approach used by Kotsadam and Tolonen (2016) to measure local employment effects from industrial mining across a continent. More generally, the strategy links to the subfield of economic geography concerned with exploring local industrialization effects, e.g. local multipliers (Moretti, 2010), agglomeration economies and total factor productivity (Greenstone et al., 2010), and toxic industries, housing prices, and infant mortality (Currie et al., 2012). The paper follows the strategy by Currie et al. (2012) who examine U.S. plants that produce toxic

waste. Due to the risk of measurement error in reported quantities of toxic waste, the authors' preferred strategy is plant opening and closing year. For similar reasons, I rely on the opening of mines rather than annually reported production volumes because of data limitation and data quality.

Mining is primarily determined by the availability of a mineral deposit. Despite true deposits being random, it is not possible to argue that known deposits are truly exogenous measures. Long exploration processes precede discovery and production. The level of exploration undertaken in an area is determined by (1) institutions, (2) royalties and tax-rules, (3) accessibility (Eggert, 2002), and (4) expected profitability. The first two determinants are likely to only vary within-country or across sub-national regions (such as districts). The latter two may, however, vary within sub-national regions, because important determinants such as road network or railway infrastructure will vary within a district. Mineral deposits have been used in the natural resource literature (see, e.g. Allcott and Keniston, 2014) as an exogenous measure of mining activities. However, a deposit measure is time-invariant, so by definition it only allows for a difference-in-means estimation. I define a variable, *mine*, that captures the time-invariant geographic location of a gold deposit. These are limited to sites with a gold deposit that features in the IntierraRMG database. To ensure comparability of the sites that are chosen, no gold deposit sites without known potential for industrial production, or that had not been in production by December 2012 are included in the data. A limitation of the data is that the discovery years are not known, and that we do not know what sites could have industrial production moving forward from the last data point in 2012. The majority of the mines in the data will have ever had production by the end of 2012. The main treatment effect is the interaction between the time-invariant gold deposit variable (*mine*) and a time-varying indicator variable for industrial production status (*industrial*):

$$Y_{icdt} = \beta_0 + \beta_1 mine_c + \beta_2 industrial_{ct} \cdot mine_c + \alpha_d + \delta_{kt} + X_i + \varepsilon_{icdt} \qquad (1)$$

where i indicates an individual observation, c DHS cluster, d district (sub-national administrative level 2), k country, and t year. The variables of interest are *mine*, an indicator variable that takes a value of one if there is a mineral deposit within a baseline distance from the community, usually 15 km, and the treatment variable indicating the presence of an active industrial scale mine (*industrial*mine*) in the

given year. Importantly, the specification includes year fixed effects γ_t, which allows for the difference-in-difference interpretation. Moreover, the specification includes district fixed effects, α_d, country-year fixed effects, δ_{kt}, and a vector of individual level controls, X_i. In all regressions, I have limited the sample to within 100 km from a deposit and I cluster the standard errors at the DHS cluster level (unless otherwise stated).

The choice of distance is crucial for correctly estimating the treatment effects. To be transparent about the choices made regarding distance, I will show the effects from different distance cut-offs as well as a spatial lag model. To capture the communities affected by the mining operations we need to consider an area that is larger than the mine itself. Treatment distance needs to also reflect commuting behavior and market integration. In the late 1980s, the median worker in rural Tanzania and Ghana traveled roughly 5 km to work (Shafer, 2000). More recent studies from Cote d'Ivoire and Ghana find that travel distances are commonly between 5 km and 15 km (Kung et al., 2013; Amoh-Gymiah and Aidoo, 2013). This suggests that a 15 km zone around the mine can be considered an integrated economic area — 15 km will be the baseline treatment distance in this paper.[8] One contribution of the present paper is its empirical approach to estimating distance effects in spatial analyses where a radius of influence is not known *a priori,* by carefully mapping the spatial decay function with a spatial autoregressive model.

The baseline distance, together with a spatial lag model, is comparable to those used in previous studies on mining in sub-Saharan Africa, such as 20 km in a study on agricultural productivity in Ghana close to gold mines (Aragon and Rud, 2015), 20 km in a study on labor market effects across Africa (Kotsadam and Tolonen, 2016), and 5 km in a study on environmental pollution and health (von der Goltz and Barnwal, 2014). Beyond the local analyses, there are papers exploring district level effects and shedding light on the fiscal channels (Loayza et al., 2013; Allcott and Keniston, 2014).

4.1 Threats to Identification

The estimation strategy relies on the assumption that the timing and the placement of the mines are not driven by local changes, such as trends in labor market participation, women's empowerment, or population characteristics. The mining industry may to a

[8] A reason to not consider shorter distances than 5 km bins is that the geocoordinates in the DHS data are displaced by 1-5 km, and up to 10 km in 1% of the cases, to ensure that individuals cannot be identified.

lesser extent than other industries depend on local characteristics. Mine locations are first and foremost determined by mineral deposits, considered geological anomalies, and not by the availability of human capital and labor. Throughout the earth's crust there are pockets of mineral deposits, often clustered within a region (Eggert, 2002). The necessary condition determining an investment decision is the existence of a deposit; deposits are not mobile, whereas production technology and labor inputs are.

Nevertheless, we can think of various factors that could influence mine location or mine opening year. Access to, and costs of, inputs, agglomeration economies and historic legacy are considered important (Eggert, 2002). Another important factor is institutions, such as mineral property rights, openness to foreign direct investment, rules for revenue sharing of tax and royalties, and environmental regulation. Analysis of gold mining investment behavior shows that multinational gold mining firms are attracted to regions with low corruption, close to head offices, and with low-risk, stable, and transparent business environments (Tole and Koop, 2011). This is not an issue for identification, as regulatory frameworks for businesses are predominantly national or regional. Assuming that institutions are homogeneous at this sub-national level—sub-national districts—differences in institutions will not drive the investment decisions.

The difference-in-difference identification strategy with district fixed effects and country-year fixed effects reduces the concern that institutions drive the mine opening and location. Effects are identified within sub-national areas assumed to have homogeneous political and legal institutions. In addition, the country-year fixed effects account for national changes in policies and institutions. Results using district specific time trends are presented in the robustness section.

Of more concern are variations in infrastructure for water, electricity, and transportation, which may vary within-district. Transportation infrastructure and accessibility are argued to be important in both the exploration phase and the production phase (Eggert, 2002). Large-scale mining can bring better access to infrastructure. If so, the economic effects of the large scale mining includes this intermediate effect. A threat to the identification strategy is only if changes in infrastructure causes the mining operations, not if mining causes infrastructure investment. It is less likely that infrastructure investment causes investment in industrial gold mining compared with other types of minerals. Gold is a high-value commodity and private airstrip access is more important for transportation than railway or road network connectivity. In contrast, the extraction of high-volume resources such as coal and iron ore is heavily

reliant on good infrastructure, including railways, road network, and ports (Weng et al., 2013).

A final concern is artisanal and small-scale mining (abbreviated ASM), which is a large sector in terms of employment but small in terms of total production compared with the large-scale gold mining industry. No detailed, time-varying records of legal and illegal ASM activities exist (to my knowledge), and thus I cannot control for the location of such activities. In some countries and districts, ASM will be part of the land use prior to the establishment of a large-scale gold mine. If so, we will be estimating the general equilibrium effect of the partial replacement of one production method with another. It is unlikely that legal ASM activities will increase with the large-scale gold mining activity since the large-scale mining firm typically have the mineral rights to all findings within a larger concession area. Moreover, it is hard to make any conjectures regarding the response of the illegal mining sector, although a decrease in illegal activities is likely if property rights of the minerals are better enforced with the arrival of the large mining company.

To further convince the reader that the model is not mis-specified and the results spurious due to cross-sectional correlations, I conduct a spatial randomization placebo test.

4.2 Parallel Trends

Difference-in-difference analysis hinges on the assumption of parallel trends. In this context, that would be that the trends in the treatment (mining) communities and the control communities (further away from a mine) would be on the same trajectory, in absence of the mine opening. This section will analyze a balancing table for the treatment and control groups, and parallel trends.

The balancing Table 1 shows differences in levels pre-treatment across the treatment (column 3) and control group (column 2). Women in the treatment group are of similar age to women in the control group but have slightly more education and more children. The treatment areas are less urban with a higher share of women working in agriculture and a smaller share in services. There are several significant differences between the control and treatment group, pre-treatment[9]. The difference-in-difference framework

[9]Note that there is variation in the mean sample year. The sample is unbalanced and different individuals will be affected by different mines. This sample year variation may explain some of the differences noted here.

allows for different levels as long as the two groups are on similar pre-treatment trends. To investigate whether this assumption is plausible, I look at the trends in observable characteristics and outcome variables for women within 15 km from a mine, ten years before to ten years after the mine opening, and compare them with the corresponding trends for women who live 30-50 km away from mines. I use two strategies: a non-parametric estimation (local polynomial smooth) and linear trends allowing for trend breaks at the mine opening.

The decision to compare with women 30-50 km away rather than up to 100 km was made for two reasons: (1) the specification considers the first opening year of the closest mine only. Limiting the geographic area limits the risk that an individual is treated by an additional mine. (2) It allows for comparison across more similar people. In the regression specification, district fixed effects will partly ensure this.

The non-parametric results (Figure 3) show no pre-mine differences in trends in age and education, yet women in mining communities may be slightly younger and more educated after the mine opening. Service and sales employment is lower in the mining communities before the mine (Figure 3c) but follows a similar trend as the treatment group. However, we notice an increase in service and sales employment roughly 1 to 2 years before the mine opens, which is in line with an investment story: mines are capital intensive, and employment generation can be substantial during the investment phase (we will drop these two years in the linear trend break strategy).[10] The trends in agriculture are less clear, but it seems like agricultural employment dips around mine opening in mining communities and then reverts back to pre-mine level in the long run.

The results supported by non-parametric analysis of night lights (Figure 4). Night lights have previously been used as a proxy for local economic development, also in analysis focusing on Africa, see Michalopoulos and Papaioannou (2013). We observe parallel trends prior to the investment phase, highlighted in grey, in areas near large gold mines (within 10km) and areas further away (30-50km away). The trends in the two areas diverge from the investment phase, and the local mining areas see rapid increase in local economic development.

Overall, the figures of the evolution of observable characteristics, outcomes, and potential confounding factors show similar pre-mine trends, supporting the use of a difference-in-difference method.[11] Additionally, the figures indicate that mining com-

[10] This indicates that we may consider the investment phase as part of the treatment years, although in the main analysis I assume first year of production, i.e., year 0, as the start of the treatment period.

[11] The differences in levels and the observed trends in the data indicate that a difference-in-difference

munities change their development trajectory around the time of the mine opening.

5 Results

5.1 Main Results

Determining Treatment Distance

To allow for non-linear effects with distance and better understand the geographic distribution of effects, I implement a spatial lag model. By including a lag structure for distance to a mining site as well as one for distance to an industrial scale producing mine, we allow for two sets of non-linear spatial structures:

$$\begin{aligned} Y_{icdt} \quad = \quad & \beta_0 \\ & + \sum_d \beta_d \, mine_c \\ & + \sum_d \beta_d \, industrial_{ct} \cdot mine_c \\ & + \alpha_d + \delta_{kt} + \varepsilon_{icdt} \end{aligned} \tag{2}$$

for $d \in \{0-10,\ 10-20, \ldots, 80-90\}$

Figures 5b and 5c confirm that the effects on services and agriculture are found close to mines and sharply decrease at 10-20 km. Beyond 20-30 km, we see few effects on service and sales employment and the estimates are approaching zero. For agriculture, there is more variation in the estimates, but there is a tendency for a lower participation rate in agriculture close to active mines.

Figures 5d, 5e, and 5f show the results for the three main variables for empowerment: justification of domestic violence, barriers to healthcare access, and final say in household decisions. Figure 5e for "Barriers to healthcare access" shows that up to 20 km from a mine, women state fewer barriers to healthcare access, especially compared with women at the same distance from a non-active mine (dotted line), for whom access is more restricted than for peers further away. For attitudes to domestic violence,

estimation strategy is preferred over a simple difference strategy.

there is a clear shift from higher levels of acceptance (dotted line) to lower levels of acceptance (solid line) close to mines that become active. There is no clear pattern detectable for final say in household decisions, neither close to mines nor further away. For occupational outcome, especially services, the mine impact is found within 20 km, but for domestic violence it is found within 10 km. As a baseline measure I will continue using 15 km, since this gives a bigger sample size and more precisely estimated effects.

Gender norms and Female Empowerment

The first three columns in Table 2 show the results for three index variables measuring gender norms: justification of domestic violence, barriers to healthcare access, and final say in household decisions. The outcome variables are indexes that takes a value from zero to 1. If she answers yes to all statements, the index will take a value of 1. The full list of questions is presented in the Appendix, Table B.1 and with the questions from the questionnaire in Appendix Table B.16. Using an index is a preferred strategy since it effectively limits the number of hypotheses tested and hence removes some of the concerns regarding multiple hypothesis testing. For transparency, the results for all individual outcomes are presented in Appendix Table B.9, and a discussion regarding multiple inference is found in Section 5.3.

The first column of Table 2 shows that women near active mines are less likely to justify violence: the estimated effect is a 19 percent decrease in the acceptance rate, from a mean value of 40.4%. Column 2 "barriers to access healthcare," measures whether a woman thinks that money, distance, or permission is hindering her from seeking healthcare for herself. Women close to active mines are significantly less hindered in this respect, with a drop of 23.3%. Barriers to healthcare access is a complex measure, as it includes different constraints, such as monetary, geographical but also social constraints, such as getting the permission. Exploring the constraints individually (Appendix Table B.9) shows that women in mining communities are insignificantly more likely to state they have permission to seek healthcare. However, women in mining communities do not have significantly different final say in household decisions such as large purchases or family visits (column 3)[12]. Overall, this points to that gender norms respond to changes in the local economy.

[12]There are additional outcomes that are not included in the index, since they are only collected for a smaller sample.

Moreover, women in active mining communities are 7.2 percentage points more likely to work in services and sales (column 4), but there is no significant increase in the likelihood of earning cash for work (column 5). Service and sales employment is chosen as a main occupational outcome variable. However, a more detailed discussion regarding the occupational outcomes can be found in in Section 7)[13]. Women's shift from agriculture to service sector employment (see Table B.8, columns 2 and 3), confirm that the expansion in mining causes a local structural shift. The findings are in line with evidence on large-scale African mines and structural shifts (Kotsadam and Tolonen, 2016), and evidence of reductions in infant mortality—a proxy for economic development—and night lights found in large-scale gold mining areas in Africa (Tolonen, 2016).

Table 3 shows the main effects run on two samples: women under the age of 30 (Panel A) at the time of the interview, and women above the age of 30 (Panel B). The treatment effects on women who are below 30 years are larger and more significant. Older women are, however, more likely to work in the service sector. Additional results in Table 4 illustrate that women listen more to family planning shows on the radio, or read in the newspaper. Older women in active mining communities are 14.7 percentage points (30%) more likely to have listened to a family planning show on the radio in the last months, compared with women in the same age who live further away from a mine. Young women, on the other hand, are 5 percentage points (63%) more likely to have read about family planning in the newspaper in the last months, compared with peers further away.

Ceteris paribus, exposure to a large-scale gold mine leads to a decrease in a woman's justification of domestic violence as an increase of 5.8 years of schooling indicated by the coefficients in Table 2. This is significant, as the mean value of years of education in the whole sample is 2.95 years. The drop in justification rate of domestic violence is thus comparable to the estimated effect of doubling schooling among women. Similarly, the magnitude of the treatment effect for barriers to access healthcare for oneself is equivalent to 8.7 years of schooling, ceteris paribus. I explore if education is an endogenous variable in Table 13 for women who were young at the time of mine opening. I find no significant changes in education among this subpopulation. Including a variable capturing a quadratic relationship between school years and gender norms does not change the estimate by much (see Table B.6), neither is the effect on schooling on

[13]These results are also confirmed by the Ghana Standard Living Measurement Surveys (GLSS) using the same strategy. Results are available on request.

gender norms heterogeneous by the age of the woman (see Table B.7).

5.2 Robustness

In this section I show the results from sensitivity analysis for alternative specifications such as control variables, fixed effects, time trends, and clustering. Using a spatial randomization placebo test, I test whether the results are spurious due to misspecification of the model. Tables 5, 6, and 7 show robustness analysis for the main three results —justifies domestic violence, barriers to health care access and service sector employment— across parsimonious specifications, fixed effects, district fixed effects, trends, mine fixed effect and different clustering of the standard errors. Tables 8, 9, and 10 show further sensitivity results, for migration, spillovers, intensity of mining and including extra control values.

Controls, Fixed Effects, Time Trend, and Clustering

I perform several additional robustness checks to ensure that the results are robust and not sensitive to the model specification. Tables 5, 6, and 7 show the results for the main three results —justifies domestic violence, barriers to health care access and service sector employment— across different specifications. First column is a parsimonious specification, column (2) is the baseline but without an urban dummy, column (2) is without district fixed effects, that are added in column (4), and specification five is the baseline specification with district fixed effects and country-year fixed effects. Columns (6), (7), and (8) show if the results are robust to the inclusion of district linear time trends, mine fixed effect, clustering at the district level but not clustering at the mine level.

Justification of domestic violence, in Table 5, is robust to all the different specifications, and the coefficients and significance levels remain stable across. However, the coefficients for barriers to access health care vary, and are not robust to exclusion of control variables and district fixed effects (Table 6, column 1, 2, or 3), or clustering of the standard errors at the mine level (Table 6, column 9) but the results are stable to district linear time trends (column 6) and mine fixed effects (column 7). The service sector employment result is stable across specifications (Table 7).[14]

[14]To explore if the effects are driven by certain countries, Table B.15 shows the main analysis run on a country-specific sample. Where the full model has not been possible to estimate, the space is left blank. This may be because some questions are not collected in all countries, or because the

Spatial Randomization Placebo Test

A randomization inference test can convince us that the main results are not spurious because of a mis-specified model. To ensure that the interpretation of the results is causal, I demonstrate using a spatial randomization placebo test that the exact location of the mine is needed to obtain the results. If the mine location is offset between 0 and 50 km in any direction while the mine keeps its *de facto* opening year, the results attenuate toward zero. Figure 6 shows the distribution of treatment effects (active*deposit) when the mine location was randomized 1,500 times, and the red lines show the initial treatment effects for the main outcome variables. The false data generated had the mine location offset by up to 50 km, implying that it will overlap in some cases with the true treatment area (set to 15 km). Thus it is not expected that the distribution of point-estimates to be centered right at zero for those outcomes where we had a significant treatment effect. The exact p-values are presented in the figure and show that it is unlikely that the model specified in Equation 1 is driving the results for service sector employment ($p = 0.019$) and acceptance of domestic violence ($p = 0.079$).

Migration

The second columns in Tables 8, 9, and 10, exclude all women who have ever migrated from the results, and columns (3) instead shows results on a sample of women who have ever migrated in their life. Migration is interesting for two reasons: (1) it affects the interpretation of the main results and (2) it may be a mechanism through which the effects of the mine opening are reinforced. The main analysis covered the entire local population, enabling us to understand how labor markets, and empowerment have changed within these communities. However, in the presence of selective migration to these communities, we cannot interpret the effects as treatment effect on the treated since the population composition has changed. Nevertheless, migration can be a mechanism: if mining communities grow because of inward migration it can create indirect job opportunities. That said, as mining-induced migration flows can also increase the competition over jobs, resources, and services (such as healthcare), the welfare impacts

sample size for a given question is too small to estimate the full model. The effects on service sector employment (Column 3) is positive in all countries except Senegal where it is negative and significant, and Tanzania where the effect is close to zero. All coefficients on accepts domestic violence are negative, but we lose power with the sample split.

of migration are *a priori* ambiguous.

Women born in mining communities take advantage of new service and sales jobs created by the sector (Table 10, column 2). The likelihood that a woman works in services and sales is 7.4 percentage points higher than elsewhere (comparing with women who never migrated), which corresponds to the baseline result presented in Table 2 column 3. Other observed changes for these women are in line with the main results: they are less likely to be hindered from seeking healthcare (column 4, insignificant), and are less likely to accept domestic violence (column 5, marginally significant).

Women who have migrated to their current localities benefit more from the opportunities created; service and sales employment increases by 13.1 percentage points (Table 10 column 3). These women are also less likely to justify domestic violence (Table 8 column 2) - acceptance rate of domestic violence decreases with 8.08 percentage points (insignificant), but are 13.3 percentage points less likely to state a barrier to access to health care. Women moving to mining communities take advantage of economic opportunities generated by mines, but that women born in these communities respond in similar ways. The results indicate that the main results are probably not driven solely by selective inward migration of individuals interested in taking advantage of new opportunities and bringing different norms, but that these individuals add to the local economy and reinforce changes that are already underway.

Spillovers

If the mine opening affects the control group, we will underestimate the treatment effects[15]. This could happen if the mine affects labor markets beyond 15 km. In Table 8, 9 and 10 columns (4), the results are re-estimated with the control group limited to individuals living more than 30 km from the mine. The estimated effects are generally slightly stronger, as expected. This specification could be part of the baseline specification, but since it increases researcher degrees of freedom, it is kept as a robustness strategy. Additionally, in Table 8, 9 and 10 columns (5), I have dropped individuals surveyed or born two years before a mine opening. I did this in order not to contaminate the control group with individuals affected by the mine investment phase, which is on average 1-2 years long. If we exclude such individuals, the effects remain similar to baseline, although sometimes a little stronger. Moreover, I ran the regressions including individuals sampled two years before captured by a dummy. The

[15]The SUTVA, stable unit treatment value assumption, would be violated.

directionality of the dummy was the same as the main treatment effects in all cases (and opposite the effects of deposit) (results available on request). This indicates that the mine had effects on the local economy two years prior to mine opening, and that if we are interested in the total mine effect we should include these years in the main estimated effects. Nevertheless, if we are interested in the production phase of the mine, the specification should be as the baseline specification.

Intensity of mining

The baseline results allow us to understand the effects of at least one mine opening. We are interested in knowing how the effects differ with the number of mines, which I will refer to as the "intensity" of mining. To measure intensity, I calculate the number of mines that are close to the community:

$$Y_{icdt} = \beta_0 + \beta_1 mine_c + \beta_2 industrial \cdot mine_{ct} + \beta_3 intensity_{ct} + \gamma_t + \alpha_d + \delta_{kt} + \varepsilon_{icdt} \quad (3)$$

Tables 8, 9 and 10 columns (6) show the results from a regression where we add a variable for the number of active mines within 15km. The main indicator (industrial*mine) is no longer significant for either three variables, but being close to more active industrial mines reduces the acceptance rate of domestic violence by 13.8 percentage points for each additional mine, and barriers to access health care decreases by 7.5 percentage points for each additional mine.

The World Price of Gold

This paper explores how industrial scale gold mining affects gender norms. Industrial scale gold mining is affected by the international gold price. The international gold price can affect local gold producing communities through different mechanisms. First, total production may increase with price increases, resulting in more job creation. Second, profitability of current production increases with the international gold price assuming that the cost structure does not change. The gold price is unlikely affected by the local gold production. In contrast to other minerals and metals, its role on the commodity price markets is mainly as a financial asset. The supply of gold is ever increasing, and the stock of newly extracted gold is small compared to the total inventory of gold. The supply behavior of an individual mine, a mining country or even

a mining company may therefore have limited effect on international price of gold, and therefore exogenous to the local labor markets where the extraction happens. Figure 1 illustrates that the world price of gold increased rapidly during the time period. I use this change in gold price to overcome concerns that the production decisions of a mine are determined by local changes. I interact the international price of gold with the main treatment variables. If a high gold price results in higher production volumes or higher wages, we can now capture such intensive margin effects of the gold extraction. The specification is as follows:

$$\begin{aligned} Y_{icdt} &= \beta_0 \\ &\quad + \beta_2 mine \cdot goldprice_{ct} \\ &\quad + \beta_3 mine \cdot industrial \cdot goldprice_{ct} \\ &\quad + \alpha_d + \delta_t + \varepsilon_{icdt} \end{aligned} \tag{4}$$

The specification controls for district fixed effects and a linear time trend. Year fixed effects are not possible to include in this specification as the gold price varies annually.

The results are in Table 11. Higher international gold price leads to less justification of domestic violence and more service sector employment. The results are in line with the baseline results, which increases the confidence in the main strategy.

5.3 Mechanism

Service Sector Jobs, Wealth, and Wages

A large-scale mining boom affects many parts of local societies, as confirmed by the previous analysis. Because we are analyzing a local economic growth process, it is hard to disentangle the causes and effects of the variables that vary jointly with the mining. However, in this section, I will attempt to see if service sector employment, cash earnings or household wealth are important mediating channels for the estimated main effects. I test these hypotheses in Tables 8, 9 and 10 columns 7-9. A caveat for this analysis is that these are potential endogenous controls.

In the cross-section, wealth correlates with less acceptance of domestic violence,

better access to health care, and more service sector employment. Adding wealth control reduces the coefficient size for industrial*mine for all three outcomes indicating that wealth effects might a mediating channel. In contrast to this, we cannot confirm that wealth is affected by the large-scale mining, as it has no significant effect on the wealth index, or the likelihood that a household is rich or poor (Table 12). Overall, we see few changes in household indicators, such as gender of the household head, if the marriage is polygamous, or if the dwelling has electricity. However, women in active mining communities are 5.65 percentage points more likely to have a radio (column 7), inline with the results that women are more likely to have listened to family planning shows in the lat months (see Table 4).

Service sector employment is endogenous to the large-scale mining operations, confirmed in Table 2. Service sector employment is negatively correlated with justification of domestic violence. Including this endogenous control does, however, not reduce magnitude of the coefficient for justification of domestic violence. This indicates that service sector job is not the main mechanism behind the change in norms. The similarly endogenous cash earnings indicator, however, reduces the magnitude of the coefficient for justification of domestic violence (Table 8, column 8).

Education, Age at First Marriage, Prostitution and Fertility

In this section I further analyze variables that may be important additional indicators for gender norms and female empowerment. These variables may also be mediating mechanisms to the main treatment effects estimated. I explore if the opening of a large-scale gold mine changed schooling outcomes, marriage patterns, engagement in sexual services, and fertility. I will explore if there are heterogeneous effects by age at mine opening. A limitation of this analysis is that these variables may be endogenous to the mining boom, and if they vary in parallel with the main outcome variables, we have little chance of determining causality among them. Should we find no changes in the variables, we will however be able to exclude them from potential mechanisms.

There are several reason why a boom in large-scale mining can change schooling outcomes. A demand effect on schooling could stem from a change in the returns to schooling as local labor markets change. A supply effect on schooling could come from an increase in local public funds, or corporate social responsibility policies from mining companies. However, I find little evidence that the local mining boom changes the education equilibrium. Women under the age of 14, 19 or 22 at the time of the first

mining year are not more likely to have higher education that their peers further away (Table 13). We can rule out that higher educational levels are driving the large increase in gender norms. However, it is possible that schooling respond only in the long run, and that I cannot detect such changes within the sample period.

Age at marriage is an important determinant of women's welfare and labor market participation. There are reasons to expect that a mine could change marriage patterns. For example, a mine could increase the number of available men looking for matrimony by spurring inward migration, or it could change the quality of men available. I do not find that women are older at first marriage if there was an active mine in the community before she turned 14, 19, or 22 (see Table 13, Panel A). However, the quality of men may have increased. Women who were young at the time of the mine opening marry men with 1.5-1.9 more years of education (significant for women under 19 and under 22). Additional results in Appendix Table B.10 show no significant changes in the age gap between partners, or prevalence of polygamous marriage. If anything, women aged below 22 at the time of the mine opening are 12.8 percentage points less likely to be in a polygamous marriage (marginally significant). Overall, it does not seem likely that changing marital patterns are part of the mechanisms behind the estimated impact of a mine opening on female empowerment, although we note that for partners of women who were relatively young when the mine opened to some extent have higher education and are less likely to form polygamous marriages.

The mining sector is associated with social concerns regarding the buying and selling of sexual services. Narratives from artisanal mining communities show that women seeking job opportunities are at risk of sexual violence (Werthmann, 2009). On the other hand, a study from Zambia shows that sexual risk-taking behavior among young women decreased in mining communities with the copper mining boom (Wilson, 2012). The results from Zambia are in line with findings that women's supply of sex and, especially, risky sex is elastic to income shocks, and sometimes a strategy to cope with negative income shocks (Dupas and Robinson 2012; Robinson and Yeh, 2012). I explore lifetime number of sexual partners for all women, and separately for women who were below the age of 14, 19, or 22 when the mine opened. I find little or no increase in the lifetime number of partners (Table 13, Panel D). Women under the age of 22 at the mine opening start have 0.48 more partners than their peers (marginally significant). Using a small subset of the women for whom information on transactional sex was collected, I confirm that there is no change in the likelihood of a woman

reporting having received money or gifts in exchange for sexual services (see Table 14, column 6).

A mine could also change women's fertility patterns—changing the opportunity cost of having children (by increasing income foregone), or by improving access to family planning and healthcare services—that in turn could affect labor market outcomes.[16] We observe a marginally significant decrease in total fertility in response to mine opening (Table 14, column 1), but there is no change in desire for more children, ideal number of children or contraceptive use.

While we can think of reasons why a mine would affect marriage behavior, education, engagement in prostitution, and fertility behavior, there is little evidence pointing toward changes in these factors as being the drivers of the main findings.

Wage Earnings

The DHS data does not collect data on wage earnings. For this reason, I complement the study with Living Standard Measurement Survey (LSMS) data for Ghana, collected by the World Bank together with the Ghanaian Bureau of Statistics. I use the rounds for which we have spatial information: 1998, 2005, and 2012. The LSMS data contains information on whether the individual has worked in the last 12 months (for cash, in-kind payment, or barter), in the last seven days, in what industry (agriculture, mining, and services), wage from main job (defined as the job the person spent the most time doing last week, with all non-paid employees having no wage), and number of hours worked per week. Table B.13, column 7 shows that wage rate is unchanged for men, but increases for women as indicated by the interaction term industrial*mine*woman, although women have lower wage rates to start with (as indicated by the coefficient for woman). We also confirm that men benefit from direct employment effects, i.e. in mining (column 6), whereas women benefit from indirect job creation in the service sector (column 5). The results suggest a decrease in work participation on the extensive margin, but an increase on the intensive margin as number of hours worked increases (insignificant). Column 8 indicates that household income increases significantly. These are important findings as they confirm that the large-scale mining boom raises local incomes, both for women and men. A major limitation of this analysis is,

[16] Additionally, potential pollution from mining could lead to increased risk of spontaneous abortions. There is no clear indication of this in the medical literature, but both arsenic and cyanide are lethal at high doses and infants are more sensitive than their carrying mothers due to their smaller size.

however, that only a subset of individuals earn any wages and that the sample is thus not representative of the whole local population.

Experience of Violence

Thus far, we have looked at justification of violence. Norms relating to violence do not need to correspond with experience of violence. DHS collects data on partner's control issues and the woman's experience of severe violence, sexual violence, less severe violence, and emotional violence. The data is collected using the gold standard for collection of sensitive private information, in one-on-one interviews and with clearly defined questions. Women in mining communities are 2.6 percentage points less likely to have experienced severe violence (insignificant), and 13.3 percentage points less likely to have experienced sexual violence - but 9.73 percentage points and 7.62 percentage points more likely to have suffered less severe and emotional violence (see Table 15). Women in mining communities are more likely to have partners with control issues (ranging from 0 to 8, with a mean of 1.46), partners who drinking alcohol (a dummy variable with mean 0.24). This may indicate a move away from more severe, and visible, types of violence (severe and sexual) to less severe and control related types of violence (less severe, emotional and control issues). The shift could be explained by a decrease in acceptance rate of violence. Exploring heterogeneity in these results, we find that the results are driven by women who were young (below age 22) when the mine opened, and women who migrated to these communities (see Appendix Table B.11). Young women are less likely to have experienced any violence in their relationships.

6 Discussion

In the cross-section, more industrialized countries have more gender equal norms. In this paper, I use a rapid, exogenous industrialization to answer this question causally. The analysis points toward rapid changes in local gender norms with industrialization: women in large-scale gold mining communities are 19% less likely to accept domestic violence, and 23% less likely to state a barrier to healthcare. The results are robust to different assumptions about trends, different distance measures, and exclusion of migrants, and withstand a spatial randomization placebo test.

Local gold mining booms are effective in raising women's employment in modern sectors such as services and sales. Randomized Control Trials that aim at increasing la-

bor participation rates of young women find magnitudes of 2.4 percentage points to 6.8 percentage points, at costs ranging from 12 USD per woman to 812 USD per woman[17]. The estimates of a 7-8 percentage point increase in service and sales employment are large compared with the literature and are similar to the effects of a rural electrification program in South Africa, where participation increased by 9 percentage points (Dinkelman, 2011). The implication is that large-scale mines are effective in stimulating women's engagement in non-farm employment. While service sector employment is correlated with more gender equal norms, the increase in service sector employment does not explain all the attitudinal changes. Moreover, I show that younger women, aged 15-30, as well as older women, aged 30-45, are more likely to work in the service sector in active gold mining areas. However, the strongest attitudinal changes are found among young women.

To quantify the economic benefit from a service sector job, I use the Ghana Living Standards Measurement Survey which records earnings. Women working in services and sales in Ghana have a mean daily wage rate 80% higher than women working in agriculture. This measure is, however, limited for the subset of women who report earning any cash income. Correcting for the longer workdays of women in the service sector—7.5 hours compared with 4.7 hours in agriculture— a substantial wage gap remains between agricultural and service sector workers. Women in services earn on average 12.3% more per hour. The wage gap is indicative of productivity differences across sectors, confirmed in the empirical literature on sectoral productivity in Africa (Gollin et al., 2014). By stimulating non-farm employment, large-scale mining can help decrease the sectoral productivity gap by pulling women from low-productivity agriculture to higher paying service sector jobs.

Intimate partner violence is a global issue. An estimated 30% of women worldwide have ever experienced intimate partner violence (Devries et al., 2013). The prevalence is among the highest in sub-Saharan Africa. The global costs of this problem are estimated to 5.18% of world GDP (Fearon and Hoeffler, 2014), and sexual violence against women costs an additional 0.078% of world GDP annually, including direct health costs, losses of current and future income, and the psychological burden. I estimate that women's acceptance rate of violence decreases from high mean value—

[17]Magnitudes range from 6.1 percentage point increase in employment (Attanasio et al., 2011) at the cost of 812 USD/person; 6.8 percentage point (72% increase) among teenage women (Bandiera et al., 2014), at the cost of 85 USD per participating woman or 17.9 USD per woman in the intention-to-treat group; 2.4 percentage point increase in women working away from home (11%) at the cost of 12 dollars per woman (Jensen, 2012). The rate of return on all these interventions were positive.

almost 1 in 2 women believe that wife beating can justified—by 19%. A limitation is that attitudes to domestic violence may only be weakly correlated with experiences of violence. However, I argue that changes in attitudes are necessary for a long-run transition to lower equilibrium levels of experienced violence. If a 19% reduction in acceptance of domestic violence leads to anything from a 1% to a 19% decrease in the prevalence of violence, the economic gains will be large.

There is increasing awareness that development policies need to be adapted to local gender norms to maximize the development impact. Less focus has been placed on how development policies themselves affect gender norms. In the cross-section, developed countries are more gender equal on average (Jayachandran, 2015), but we have scant evidence on how the processes of economic development affect gender norms. In this paper, I explore how industrial shocks—in this case brought by large-scale gold mining investment from multinational firms—affect local gender norms. I find that norms respond quickly to local economic development. Women in mining communities are significantly less likely to justify domestic violence, have better access to health care for themselves, work in non-farm sector, and more likely to access media that discuss women's issues. These effects are observed among both younger and older women, although younger women respond more strongly on average. Moreover, both women who migrated to the communities and those who were born there express more pro-female gender norms.

The large-scale mining industry is a relevant industry to study this question—not only is it a large and expanding industry in many low-income countries—as it is not dependent on women's labor. Most previous contemporary evidence on the formation of gender norms study women-dominated industries—such as the textile manufacturing industry—or development policies more or less explicitly designed to empower women. The results in this study illustrates that local industrial development that was not designed to empower women and change gender norms, succeeded in just that. It proves that gender norms can respond quickly to economic growth, which may be part of the puzzle why more economically advanced countries are more gender equal.

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Tables and Figures

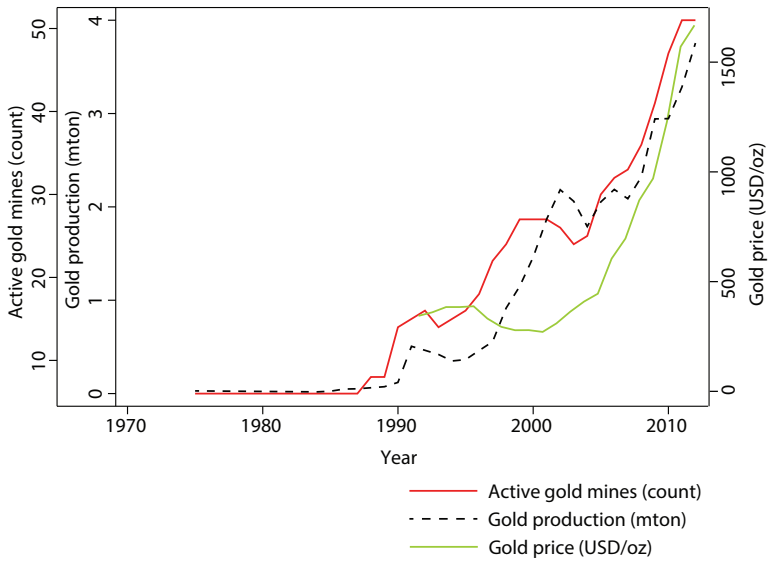

Figure 1: The Evolution of the Gold Mines, Production of Gold and the World Price of Gold in Burkina Faso, Cote d'Ivoire, DRC, Ethiopia, Ghana, Guinea, Mali, Senegal and Tanzania

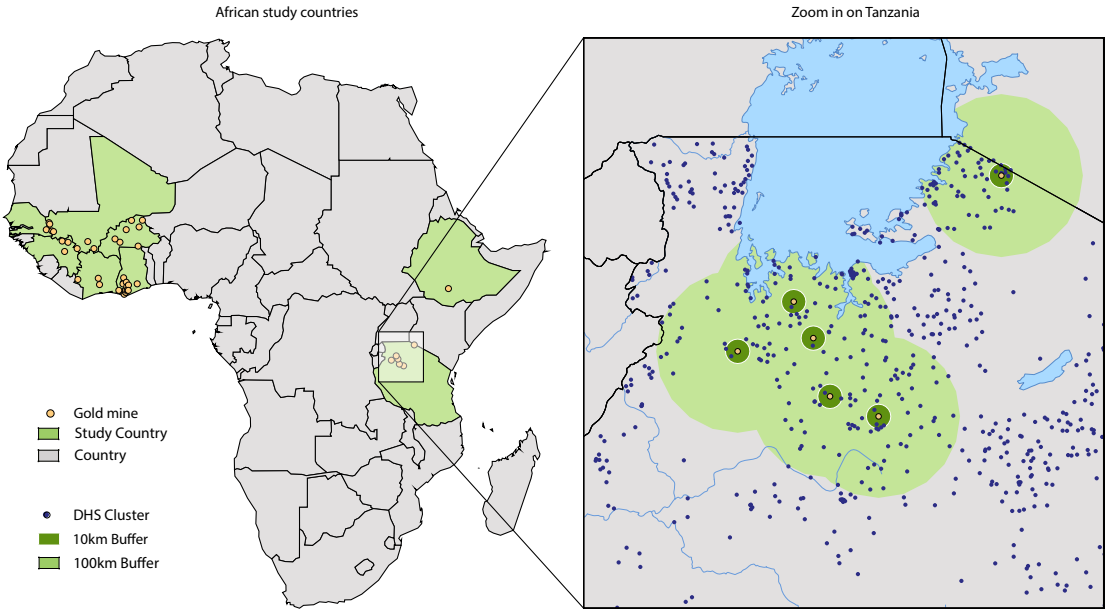

Figure 2: Map of Gold Mines and DHS Clusters in North-Western Tanzania

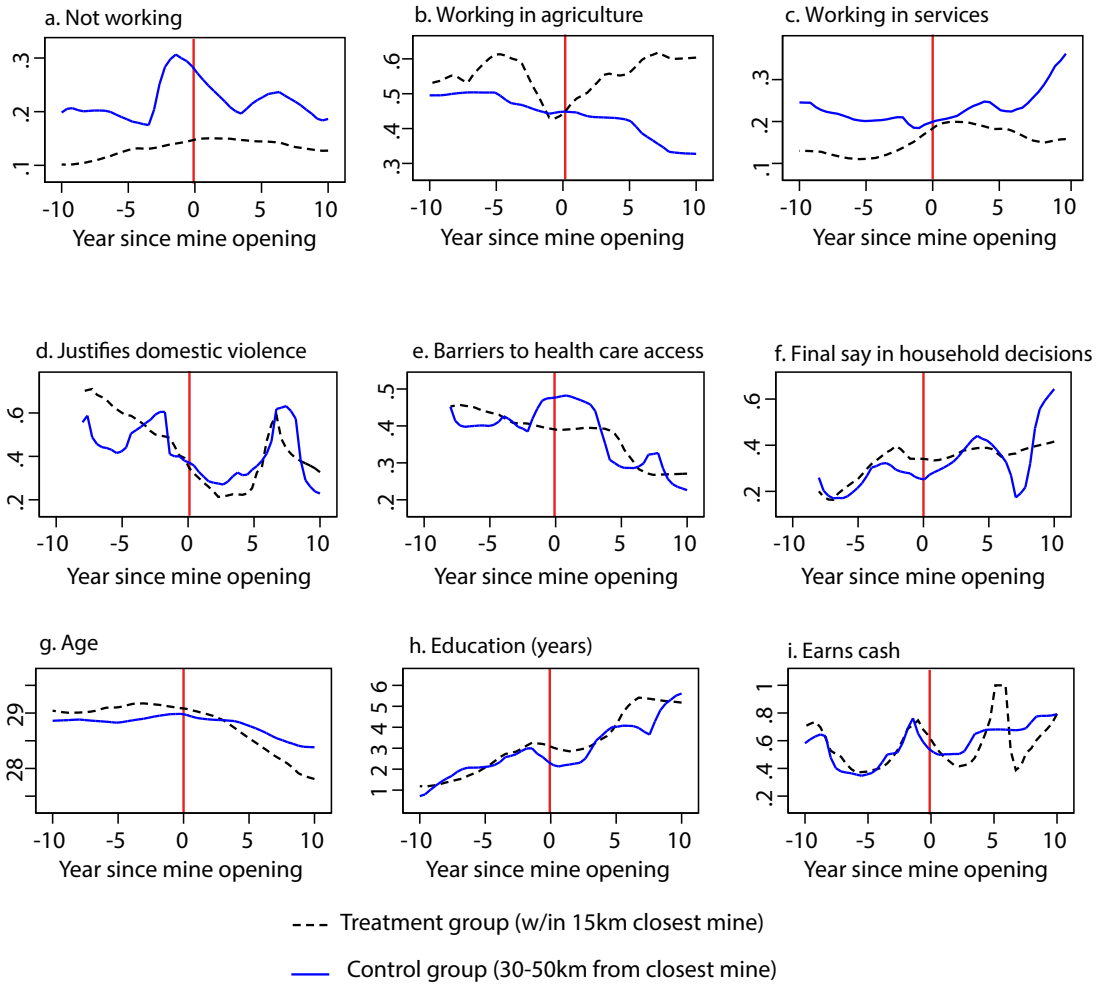

Figure 3: Non-parametric Investigation of Trends

Notes: Local polynomial smooth. Years since mine opening on the horizontal axis, ranging from ten years before to ten years after mine opening. The treatment group is drawn within 15 km from the closest mine, and the control group 30-50 km from the closest mine. The estimates are without control variables, and are not considering if an individual is close to several mines, or if the closest mine closes down production.

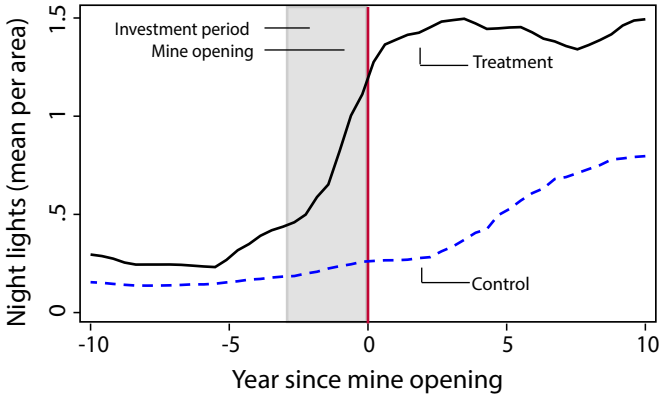

Figure 4: Non-parametric Investigation of Night Lights

Notes: Local polynomial smooth. Years since mine opening on the horizontal axis, ranging from ten years before to ten years after mine opening. The treatment group is drawn within 15 km from the closest mine, and the control group 30-50 km from the closest mine. Night lights on the vertical axis. The estimates are without control variables. The investment period (defined to two years) is highlighted in grey. Mine opening year illustrated by vertical red line.

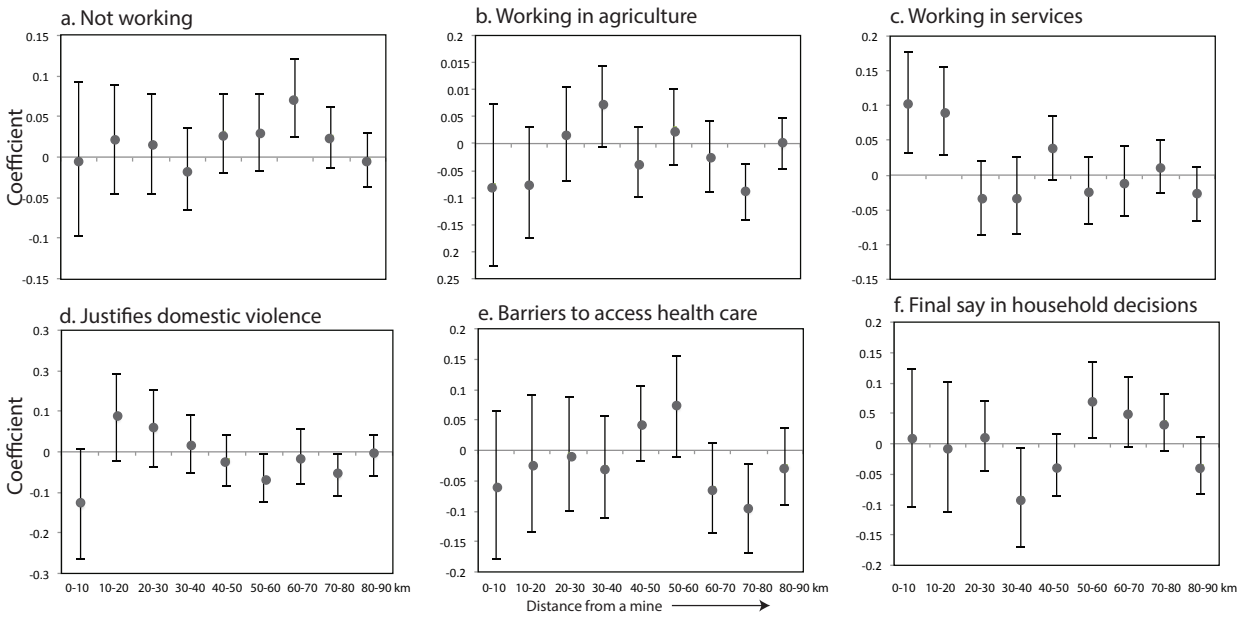

Figure 5: Spatial Lag Model: Main Outcomes

Notes: The figure shows the coefficients from a spatial lag model by 10 km distance bins with 95% confidence intervals. The omitted category is 90-100 km away from a mine.

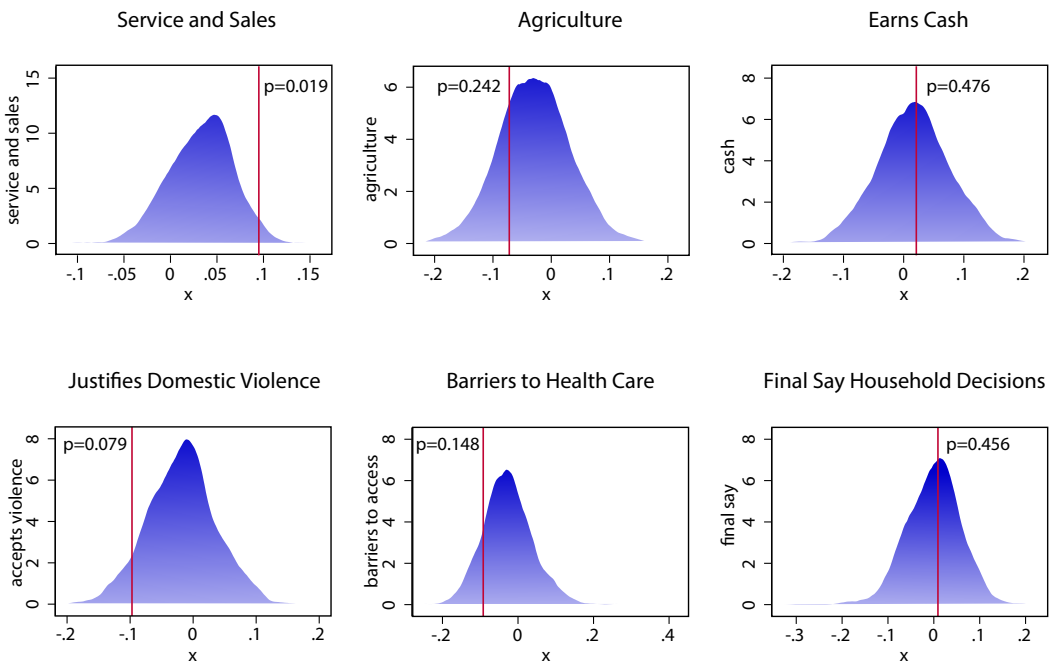

Figure 6: Spatial Randomization Placebo Test

Notes: Figure 6 shows the density distribution of point estimates from 1,500 re-estimations of the baseline specification with the mine location randomly moved up to 50 km from original mine location. The original estimate is shown by the red vertical lines.

Table 1: Summary Statistics

	Mean value					Min	Max
Sample:	whole sample	control group	treatment group	control group	treatment group		
Time period:	both	pre	pre	post	post		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Characteristics							
age	28.7	28.8	28.9	28.6	28.4	15	49
education	2.95	2.45	2.94*	3.26	4.55	0	22
fertility	3.26	3.25	3.60*	3.26	3.05	0	21
never mover	0.407	0.402	0.384	0.420	0.365	0	1
urban	0.27	0.301	0.130*	2.451	0.214	0	1
year	2006	2000	2001*	2005	2006		
Outcome variables							
justifies violence	0.404	0.437	0.437	0.386	0.298	0	1
barriers access healthcare	0.393	0.395	0.364*	0.395	0.327	0	1
final say in decisions	0.318	0.281	0.354*	0.339	0.414	0	1
agriculture	0.438	0.428	0.521*	0.443	0.449	0	1
service and sales	0.233	0.276	0.169*	0.202	0.228	0	1
earns cash	0.563	0.512	0.566*	0.602	0.621	0	1
Treatment variables							
industrial*mine	0.026					0	1
mine (15km)	0.047					0	1
active (100km)	0.559					0	1
intensity (#mines15)	0.031					0	3
gold price (USD/oz)	599.2					271	1571
N	57,676	24,772	1,052	30,218	1,634		

Notes: control group is within 15-100 km from a deposit; treatment group is 0-15 km from deposit
pre-treatment, control group has deposit = 0, and no active mine within 100 km
pre-treatment, treatment group has deposit = 1, but no active mine within 15 km
post-treatment, control group has deposit = 0, and at least 1 active mine within 100 km
post-treatment group has deposit = 1, and at least 1 active mine within 15 km
* $p<0.05$ for t-test between control group (2) and treatment group (3), pre-treatment

Table 2: Gender Norms and Female Empowerment

Dependent variable:	justifies domestic violence (1)	barriers access healthcare for self (2)	final say household decisions (3)	service sector job (4)	earns cash for work (5)
industrial*mine	-0.0777**	-0.0917**	0.0087	0.0720***	0.0282
	(0.0339)	(0.0465)	(0.0487)	(0.0246)	(0.0385)
mine	0.0438	0.0328	-0.0227	-0.0256	-0.0279
	(0.0308)	(0.0353)	(0.0376)	(0.0196)	(0.0297)
age	0.00002	0.0005***	0.008***	0.002***	0.004***
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0003)
years of schooling	-0.0135***	-0.0105***	0.0056***	-0.005***	0.008***
	(0.0008)	(0.0008)	(0.001)	(0.0008)	(0.0008)
urban	-0.0423***	-0.0866***	0.0231**	0.224***	0.158***
	(0.0116)	(0.0151)	(0.0113)	(0.0102)	(0.0144)
Mean value	0.404	0.393	0.318	0.233	0.563
Observations	30,693	31,485	27,482	55,944	35,020
R-squared	0.344	0.240	0.286	0.183	0.386

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. Columns 1-3 have index variables ranging from 0 to 1 as outcome variables. Column (1): "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Column (2): "Is money/distance/permission an obstacle to seeking healthcare for yourself?", Column (3): "Do you have, alone or together with your partner, a say in healthcare/large purchases/family visits decisions?" Column 4 shows results for binary occupational outcome, if the woman works in services or sales. Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table 3: Gender Norms and Female Empowerment by Age

Dependent variable:	justifies domestic violence (1)	barriers access healthcare for self (2)	final say household decisions (3)	service sector job (4)	earns cash for work (5)
Panel A. Under 30					
industrial*mine	-0.0909**	-0.125**	-0.0061	0.0645**	-0.0083
	(0.0409)	(0.0575)	(0.0609)	(0.0263)	(0.0463)
mine	0.0630	0.0600	-0.0294	-0.0244	-0.0079
	(0.0389)	(0.0477)	(0.0458)	(0.0215)	(0.0345)
Mean value	0.395	0.381	0.253	0.220	0.524
Observations	16,742	17,343	14,075	31,244	17,669
R-squared	0.347	0.239	0.278	0.169	0.350
Panel B. Above 30					
industrial*mine	-0.0309	-0.0381	0.0304	0.0896**	0.0601
	(0.0442)	(0.0480)	(0.0633)	(0.0352)	(0.0411)
mine	-0.00337	-0.0131	-0.0126	-0.0361	-0.0422
	(0.0392)	(0.0352)	(0.0541)	(0.0275)	(0.0348)
Mean value	0.413	0.408	0.392	0.252	0.605
Observations	12,506	12,691	12,018	22,223	15,632
R-squared	0.357	0.261	0.324	0.245	0.452

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. Columns 1-3 have index variables ranging from 0 to 1 as outcome variables. Column (1): "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Column (2): "Is money/distance/permission an obstacle to seeking healthcare for yourself?", Column (3): "Do you have, alone or together with your partner, a say in healthcare/large purchases/family visits decisions?" Column 4 shows results for binary occupational outcome, if the woman works in services or sales. Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table 4: Access to Family Planning Shows by Media

Dependent variable:	heard family planning last months								
	on radio			on TV			in newspaper		
Sample:	all	under 30	above 30	all	under 30	above 30	all	under 30	above 30
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
industrial*mine	0.0956**	0.0377	0.147***	0.0132	-0.0248	0.0484	0.0394***	0.0518***	0.0247
	(0.0419)	(0.0461)	(0.0503)	(0.0356)	(0.0387)	(0.0429)	(0.0150)	(0.0173)	(0.0207)
mine	-0.0250	0.0101	-0.0542	0.0398*	0.0676***	0.0145	-0.0217*	-0.0251*	-0.0161
	(0.0374)	(0.0423)	(0.0417)	(0.0211)	(0.0228)	(0.0274)	(0.0119)	(0.0134)	(0.0147)
Mean value	0.470	0.455	0.491	0.231	0.246	0.212	0.074	0.082	0.065
Observations	46,028	25,604	18,335	46,008	25,589	18,331	42,917	23,755	17,218
R-squared	0.199	0.203	0.231	0.351	0.345	0.374	0.231	0.219	0.263

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. Samples vary by woman's age (below or above 30 years old at the time of the survey). The outcome variables are indicator variables that take a value of 1 if the woman has listened to family planning shows in the last months on the radio, the TV or read in the newspaper.

Table 5: Alternative Specifications: Justifies domestic violence

Specification:	control variables (1)	urban dummy (2)	country FE (3)	district FE (4)	baseline specification (5)	district trend (6)	mine FE (7)	district clustering (8)	mine clustering (9)
industrial*mine	-0.185***	-0.0709**	-0.0942**	-0.0772**	-0.0777**	-0.0780*	-0.0700**	-0.0777*	-0.0777*
	(0.0554)	(0.0347)	(0.0379)	(0.0339)	(0.0339)	(0.0407)	(0.0355)	(0.0416)	(0.0418)
mine	0.101**	0.0401	0.0311	0.0439	0.0438	0.0361	0.0463	0.0438	0.0438
	(0.0458)	(0.0321)	(0.0303)	(0.0308)	(0.0308)	(0.0350)	(0.0331)	(0.0302)	(0.0312)
Urban	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE			Yes						
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE		Yes			Yes		Yes	Yes	Yes
District trend						Yes			
Mine FE							Yes		
District cluster								Yes	
Mine cluster									Yes
Mean value	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404	0.404
Observations	30,735	30,693	30,735	30,693	30,693	30,693	30,693	30,693	30,693
R-squared	0.102	0.343	0.252	0.344	0.344	0.352	0.346	0.344	0.344

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year (except for Column 1). The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table 6: Alternative Specifications: Barriers to access healthcare for self

Specification:	control variables (1)	urban dummy (2)	country FE (3)	district FE (4)	baseline specification (5)	district trend (6)	mine FE (7)	district clustering (8)	mine clustering (9)
industrial*mine	-0.0500	-0.0778	-0.0518	-0.0922**	-0.0917**	-0.111**	-0.101**	-0.0917*	-0.0917
	(0.0434)	(0.0478)	(0.0437)	(0.0464)	(0.0465)	(0.0548)	(0.0499)	(0.0540)	(0.0574)
mine	-0.00469	0.0257	0.0207	0.0327	0.0328	0.0367	0.0282	0.0328	0.0328
	(0.0265)	(0.0379)	(0.0301)	(0.0353)	(0.0353)	(0.0392)	(0.0388)	(0.0297)	(0.0338)
Urban	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE			Yes						
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE		Yes			Yes		Yes	Yes	Yes
District trend						Yes			
Mine FE							Yes		
District cluster								Yes	
Mine cluster									Yes
Mean value	0.393	0.393	0.393	0.393	0.393	0.393	0.393	0.393	0.393
Observations	30,735	30,693	30,735	30,693	30,693	30,693	30,693	30,693	30,693
R-squared	0.102	0.343	0.252	0.344	0.344	0.352	0.346	0.344	0.344

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year (except for Column 1). The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table 7: Alternative Specifications: Service sector job

Specification:	control variables	urban dummy	country FE	district FE	baseline specification	district trend	mine FE	district clustering	mine clustering
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
industrial*mine	0.0607**	0.0710**	0.0946***	0.0959***	0.0720***	0.0746***	0.0687***	0.0720**	0.0720**
	(0.0291)	(0.0283)	(0.0267)	(0.0262)	(0.0246)	(0.0280)	(0.0255)	(0.0290)	(0.0296)
mine	-0.0449**	-0.0169	-0.0617***	-0.0364	-0.0256	-0.0258	-0.0253	-0.0256	-0.0256
	(0.0175)	(0.0239)	(0.0211)	(0.0223)	(0.0196)	(0.0233)	(0.0203)	(0.0232)	(0.0254)
Urban	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE			Yes						
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE		Yes			Yes		Yes	Yes	Yes
District trend						Yes			
Mine FE							Yes		
District cluster								Yes	
Mine cluster									Yes
Mean value	0.233	0.233	0.233	0.233	0.233	0.233	0.233	0.233	0.233
Observations	30,735	30,693	30,735	30,693	30,693	30,693	30,693	30,693	30,693
R-squared	0.102	0.343	0.252	0.344	0.344	0.352	0.346	0.344	0.344

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year (except for Column 1). The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table 8: Alternative Specifications: Justifies domestic violence

Specification:	baseline specification					intensity (nr. mines)	wealth control	service control	earns cash control
Sample:	all	non-mover sample	migrant sample	drop 15-30km	drop investment phase (2yr)	all	all	all	all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
industrial*mine	-0.0777**	-0.0989*	-0.0808	-0.0809**	-0.0838**	0.0614	-0.0682**	-0.0808**	-0.0596**
	(0.0339)	(0.0538)	(0.0511)	(0.0366)	(0.0360)	(0.0853)	(0.0317)	(0.0338)	(0.0296)
mine	0.0438	0.0272	0.0304	0.0339	0.0525	0.0445	0.0546*	0.0477	0.0409
	(0.0308)	(0.0371)	(0.0316)	(0.0397)	(0.0335)	(0.0308)	(0.0327)	(0.0304)	(0.0252)
intensity						-0.138*			
						(0.0779)			
wealth							-0.01***		
							(0.00267)		
service								-0.011**	
								(0.00550)	
cash									-0.013**
									(0.00674)
Mean value	0.404	0.493	0.433	0.401	0.405	0.404	0.404	0.404	0.404
Observations	30,693	8,523	11,340	28,107	30,604	30,693	27,955	30,294	24,867
R-squared	0.344	0.359	0.397	0.349	0.345	0.344	0.310	0.343	0.345

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year. Intensity measures the number of active mines in the survey year that are within 15 km from the household. Wealth measures household wealth according to the DHS index. Service is a dummy variable that is 1 if the woman reports working in services or sales. Cash is a dummy variable taking value 1 if she earns cash for work.

Table 9: Alternative Specifications: Barriers to access to healthcare for self

Specification:	baseline specification					intensity (nr. mines)	wealth control	service control	earns cash control
Sample:	all	non-mover sample	migrant sample	drop 15-30km	drop investment phase (2yr)	all	all	all	all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
industrial*mine	-0.0917**	-0.0760	-0.133**	-0.108**	-0.0928*	-0.0153	-0.0434	-0.0888*	-0.0619
	(0.0465)	(0.0672)	(0.0662)	(0.0460)	(0.0490)	(0.0681)	(0.0482)	(0.0463)	(0.0475)
mine	0.033	-0.0495	0.0634	-0.0008	0.0350	0.0331	0.0166	0.0348	0.0197
	(0.0353)	(0.0527)	(0.0394)	(0.0379)	(0.0380)	(0.0353)	(0.0418)	(0.0353)	(0.0376)
intensity						-0.0755*			
						(0.0436)			
wealth							-0.0261***		
							(0.00282)		
service or sales								-0.0294***	
								(0.00631)	
cash									-0.0354***
									(0.00745)
Mean value	0.393	0.384	0.361	0.387	0.393	0.393	0.393	0.393	0.393
Observations	31,485	8,801	11,732	28,844	31,393	31,485	28,987	31,076	25,591
R-squared	0.240	0.234	0.216	0.237	0.240	0.240	0.272	0.241	0.240

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year. Intensity measures the number of active mines in the survey year that are within 15 km from the household. Wealth measures household wealth according to the DHS index. Service is a dummy variable that is 1 if the woman reports working in services or sales. Cash is a dummy variable taking value 1 if she earns cash for work.

Table 10: Alternative Specifications: Service sector job

Specification:	baseline specification					intensity (nr. mines)	wealth control	cash control
Sample:	all	non-mover sample	migrant sample	drop 15-30 km	drop investment phase (2 years)	all	all	all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
industrial*mine	0.0720***	0.0736*	0.131***	0.0617**	0.0793***	0.0155	-0.0216	0.116***
	(0.0246)	(0.0441)	(0.0426)	(0.0266)	(0.0253)	(0.0519)	(0.0343)	(0.0325)
mine	-0.0256	0.00705	-0.0231	-0.0209	-0.0360*	-0.0253	0.0495	-0.0247
	(0.0196)	(0.0262)	(0.0244)	(0.0233)	(0.0204)	(0.0195)	(0.0324)	(0.0244)
intensity						0.0546		
						(0.0422)		
wealth							0.0328***	
							(0.00278)	
cash								0.353***
								(0.0108)
Mean value	0.233	0.243	0.276	0.240	0.234	0.233	0.233	0.233
Observations	55,944	16,288	24,178	50,523	54,707	55,944	33,764	34,587
R-squared	0.183	0.189	0.188	0.184	0.183	0.183	0.200	0.361

Note: *** p<0.01, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year. Intensity measures the number of active mines in the survey year that are within 15 km from the household. Wealth measures household wealth according to the DHS index. Cash is a dummy variable taking value 1 if she earns cash for work.

Table 11: Using World Price of Gold

Dependent variable:	justifies violence (1)	barriers access healthcare (2)	final say decisions (3)	service sector (4)	earns cash (5)
price*industrial*mine	-0.174**	-0.0958	0.0175	0.213***	0.0541
	(0.0677)	(0.0889)	(0.103)	(0.0555)	(0.107)
price*mine	0.178**	0.0550	-0.0342	-0.150***	-0.0787
	(0.0706)	(0.0863)	(0.0948)	(0.0530)	(0.103)
price	-0.0589	-0.213*	-0.254***	0.0483**	0.333***
	(0.0737)	(0.113)	(0.0695)	(0.0191)	(0.0293)
Mean value	0.404	0.393	0.318	0.233	0.563
Observations	30,693	31,485	27,482	52,720	35,020
R-squared	0.338	0.233	0.281	0.147	0.349

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, education, urban, and fixed effects for district and a linear trend. The annual gold price comes from Raw Minerals Group and is available from 1992 to 2011. The gold price is interacted with the industrial*mine treatment dummy as well as with the mine-location dummy.

Table 12: Household Wealth and Characteristics

	household						
Dependent variable:	female headed	polygamous marriage	DHS wealth index	is poor bottom 40%	is rich top 40%	has electricity	has radio
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
industrial*mine	-0.00845	-0.00888	0.0379	0.00786	-0.0251	0.0261	0.0565*
	(0.0223)	(0.0298)	(0.141)	(0.0557)	(0.0509)	(0.0369)	(0.0311)
mine	-0.00394	-0.00770	0.235*	-0.0870	0.120**	-0.00592	0.00611
	(0.0190)	(0.0257)	(0.138)	(0.0549)	(0.0469)	(0.0303)	(0.0274)
Mean value	0.176	0.419	2.95	0.403	0.378	0.213	0.666
Observations	57,474	57,480	46,028	34,225	34,225	34,225	57,581
R-squared	0.556	0.113	0.199	0.482	0.308	0.408	0.189

Note: ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, urban, and fixed effects for district, and country-year. The first three variables, has electricity, has radio and heard radio family planning shows (FP) are dummy variables. A household is poor if it is in the fifth quintile, and rich if it is in the top quintile of the wealth distribution. The wealth score is a score value calculated by DHS, including household assets, dwelling characteristics etc. Female head takes a value of 1 if the household head is a woman, and zero otherwise. Polygamous marriage takes a value of 1 if the woman is one of several wives, and zero otherwise.

Table 13: Schooling, Age at Marriage, Total Sexual Partners and Partner's Education as Mechanisms

Sample:	under 14 (1)	under 19 (2)	under 22 (3)	all women (4)
Panel A. Schoolyears				
industrial*mine	0.0883	0.217	-0.195	-0.448
	(0.180)	(0.714)	(0.419)	(0.368)
mine	0.0962	-0.0262	0.375	0.600*
	(0.149)	(0.715)	(0.405)	(0.355)
Observations	57,581	11,761	18,477	23,042
R-squared	0.474	0.485	0.479	0.477
Panel B: Age at first marriage				
industrial*mine	0.287	0.133	-0.109	0.309*
	(0.511)	(0.340)	(0.430)	(0.181)
mine	0.0112	0.0822	0.267	-0.0803
	(0.508)	(0.331)	(0.431)	(0.157)
Observations	5,991	10,723	14,085	46,009
R-squared	0.305	0.293	0.283	0.204
Panel C. Partner's education (years)				
industrial*mine	1.496	1.942*	1.802***	0.347
	(1.537)	(1.114)	(0.654)	(0.248)
mine	-1.254	-1.581	-1.448**	-0.175
	(1.541)	(1.090)	(0.612)	(0.163)
Observations	5,013	8,844	11,629	39,181
R-squared	0.645	0.655	0.652	0.642
Panel D. Total sexual partners				
industrial*mine	-0.401	0.371	0.481*	0.175
	(0.353)	(0.323)	(0.272)	(0.300)
mine	0.201***	-0.382***	-0.511***	-0.741***
	(0.00861)	(0.0131)	(0.0281)	(0.0477)
Observations	4,745	7,867	9,726	19,120
R-squared	0.112	0.093	0.098	0.120

Note: ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, urban, and fixed effects for survey year, district, and country-year. Panel A and Panel C control for years of education.

Table 14: Fertility, Pregnancy and Contraception

Dependent variable:	total fertility	want no more children	last pregnancy wanted	total ideal children	uses modern contraceptive	received money/gift for sex
	(1)	(2)	(3)	(4)	(5)	(6)
industrial*mine	-0.167*	0.0138	-0.0007	0.0219	0.0064	-0.0013
	(0.0921)	(0.0243)	(0.0349)	(0.135)	(0.0153)	(0.0258)
mine	0.0274	-0.0248	-0.0036	-0.0753	-0.0022	-0.0017
	(0.0821)	(0.0200)	(0.0253)	(0.113)	(0.0112)	(0.0171)
Mean value	3.26	0.798	0.944	5.34	0.092	0.045
Observations	57,581	46,448	5,182	47,437	52,274	6,466
R-squared	0.672	0.036	0.164	0.293	0.071	0.154

Note: ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, urban, and fixed effects for district and country-year.

Table 15: Partner Behavior: Control issues, Violence and Alcohol

Dependent variable:	experienced violence				partner has control issues	partner drinks alcohol
	severe	sexual	less severe	emotional		
	(1)	(2)	(3)	(4)	(5)	(6)
industrial*mine	-0.0260	-0.133***	0.0937***	0.0762**	1.024***	0.278***
	(0.0160)	(0.0260)	(0.0304)	(0.0364)	(0.160)	(0.0376)
mine	0.0204***	0.143***	-0.0988***	-0.0929***	-1.067***	-0.276***
	(0.00311)	(0.00352)	(0.00638)	(0.00709)	(0.0274)	(0.00829)
Mean value	0.17	0.045	0.17	0.16	1.47	0.243
Observations	8,864	8,864	8,865	8,866	8,871	8,861
R-squared	0.132	0.120	0.182	0.207	0.269	0.310

Note: ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, urban, and fixed effects for district and country-year. Control issues is an index variable between 0 and 8, if the woman's partner has specific control issues. Severe violence is a dummy variable if the woman has ever experienced severe violence from her partner. The other violence variables are similar. Partner drinks alcohol is a dummy variable that takes value 1 if partner drinks alcohol.

7 Appendix

Multinomial Logit

The occupational outcomes are using the DHS standard classifications, but I have focused on three large groups: not working, working in agriculture, and working in services and sales. The respondent will only belong to one category, which is the category identified as the main occupation in the last 12 months. As a robustness check, I run a multinomial logit since the individual sorts into one of several occupational categories. To ensure that the choices sum to 1, I include "Other," consisting of those smaller categories not included in the main analysis (skilled and unskilled manual labor, professional and clerical categories, in total making up roughly 10% of the labor force).

Table B.8 presents the marginal effects. The effects have the same directionality as the baseline results[18], magnitudes are slightly larger, and all coefficients except "not working" are significant at $\alpha = 0.01$. The coefficients for deposit show that the deposit is associated with higher levels of work participation, mostly in agriculture. Panel B shows that the likelihood of a woman earning cash or a combination of cash and in-kind increases with a mine, whereas the likelihood of not being paid for work decreases.

Multiple Inference Hypothesis Testing

We have analyzed women's empowerment using three clusters of indicators: (1) attitudes to domestic violence, (2) barriers to healthcare, and (3) bargaining power within the household. As discussed earlier, I constructed the three indexes to avoid issues with multiple inference testing. All original variables with more than 27,000 respondents, which excludes 'final say over daily purchases' and 'final say over husband's salary' from the bargaining power index, are included. These two indicators have 19,072 and 9,516 observations respectively. Limited overlap between the variables when these two indicators are included in the index prohibits analysis of the data. The summary statistics are presented in Table B.1, and the exact questions in Table B.16.

For transparency, the results for all indicators are shown in Table B.9, Panel A, B, and C. The point-estimates in Panel A, exploring effects on bargaining power (final say), are insignificant and fairly small (from negative 2.2 pp to positive 2.7 pp). In Panel B, we find that women are less likely to accept domestic violence for all stated reasons except burning food, which is insignificant. Women are less likely to consider either distance, money, or permission a barrier to seeking healthcare for herself, although these are weakly significant or non-significant (Panel C).

We should be cautious in interpreting these results, as the risk of observing a significant result due to chance increases with the number of hypotheses tested. If $\alpha = 0.05$ and there are five outcomes (like Panel B), the risk of getting a significant

[18] The specification includes linear time trend but no country year fixed effects.

result by chance is:

$$P(at\ least\ one\ significant) = \ 1 - (1 - 0.05)^5 \approx 0.23$$

One solution to this issue is of course to use an index, which is the preferred method in this paper (see Casey et al., 2012 for a longer discussion). An alternative solution is to use the Bonferroni-corrected p-values on the original estimates. The Bonferroni correction redefines the significance cut-off level as $\alpha/n = 0.05/5 = 0.0025$, which is a more conservative level than before. The new significance levels are presented in Table B.9, Panels A, B, and C. Only two coefficients remain significant: whether a husband can beat his wife if she refuses sex (Panel B, Column 2) or neglects the children (Column 4). Given that the point estimates for the independent regressions are mostly significant (with the exception of final say) and in the same direction as for the index regressions, we can feel quite confident that the results are not driven only by chance.

8 Appendix: Tables and Figures

Table B.1: Extensive Summary Statistics

Variable		Mean	Std. Dev.
domestic violence	*husband has right to beat wife if she....*		
burns the food	... burns food	0.232	0.422
refuses sex	... refuses sex	0.369	0.482
argues	... argues with him	0.454	0.498
neglects children	... neglects the children	0.481	0.500
goes out	... goes out without permission	0.471	0.499
barriers to healthcare			
distance	... is a barrier to seek healthcare	0.407	0.491
money	... is a barrier to seek healthcare	0.599	0.490
permission	... is a barrier to seek healthcare	0.172	0.377
final say			
healthcare	has final say on healthcare	0.292	0.454
large purchase	has final say on large purchase	0.274	0.446
daily purchase	has final say on daily purchase	0.388	0.487
husband salary	has final say on spending husb. salary	0.171	0.377
family visits	has final say on family visits	0.406	0.491
food	has final say on food	0.543	0.498
N		57.685	

Table B.2: Alternative Specifications: Final say in household decisions

Specification:	control variables (1)	urban dummy (2)	country FE (3)	district FE (4)	baseline specification (5)	district trend (6)	mine FE (7)	district clustering (8)	mine clustering (9)
industrial*mine	0.0369	0.00499	-0.0279	0.00755	0.00869	-0.00210	-0.000106	0.00869	0.00869
	(0.0614)	(0.0491)	(0.0504)	(0.0488)	(0.0487)	(0.0440)	(0.0527)	(0.0689)	(0.0699)
mine	0.0300	-0.0206	0.0380	-0.0229	-0.0227	-0.0300	-0.0149	-0.0227	-0.0227
	(0.0505)	(0.0384)	(0.0408)	(0.0377)	(0.0376)	(0.0342)	(0.0412)	(0.0452)	(0.0482)
Urban	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE			Yes						
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE		Yes			Yes		Yes	Yes	Yes
District trend						Yes			
Mine FE							Yes		
District cluster								Yes	
Mine cluster									Yes
Observations	27,519	27,482	27,519	27,482	27,482	27,482	27,482	27,482	27,482
R-squared	0.111	0.286	0.194	0.286	0.286	0.301	0.289	0.286	0.286

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year (except for Column 1). The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table B.3: Alternative Specifications: Earns cash

Specification:	control variables (1)	urban dummy (2)	country FE (3)	district FE (4)	baseline specification (5)	district trend (6)	mine FE (7)	district clustering (8)	mine clustering (9)
industrial*mine	-0.00647	0.0136	0.0435	0.0180	0.0282	0.0397	0.0205	0.0282	0.0282
	(0.0595)	(0.0394)	(0.0388)	(0.0451)	(0.0385)	(0.0480)	(0.0410)	(0.0385)	(0.0365)
mine	0.0398	-0.0200	-0.0342	-0.0191	-0.0279	-0.0257	-0.0240	-0.0279	-0.0279
	(0.0430)	(0.0317)	(0.0260)	(0.0360)	(0.0297)	(0.0361)	(0.0309)	(0.0323)	(0.0310)
Urban	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE			Yes						
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE		Yes		Yes	Yes	Yes	Yes	Yes	Yes
Country-year FE		Yes			Yes		Yes	Yes	Yes
District trend						Yes			
Mine FE							Yes		
District cluster								Yes	
Mine cluster									Yes
Observations	35,069	35,020	35,069	35,020	35,020	35,020	35,020	35,020	35,020
R-squared	0.123	0.377	0.306	0.356	0.386	0.371	0.388	0.386	0.386

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year (except for Column 1). The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table B.4: Alternative Specifications: Final say in household decisions

Specification:	baseline specification					intensity (nr. mines)	wealth control	service control	earns cash control
Sample:	all	non-mover sample	migrant sample	drop 15-30km	drop investment phase (2yr)	all	all	all	all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
industrial*mine	0.00869	-0.00580	0.00259	0.0201	0.0119	-0.0284	-0.0151	0.00419	0.00562
	(0.0487)	(0.0559)	(0.0533)	(0.0552)	(0.0517)	(0.0703)	(0.0667)	(0.0491)	(0.0546)
mine	-0.0227	0.0357	0.00440	-0.0110	-0.0293	-0.0229	-0.000154	-0.0254	-0.0251
	(0.0376)	(0.0429)	(0.0375)	(0.0440)	(0.0408)	(0.0376)	(0.0568)	(0.0378)	(0.0420)
intensity						0.0366			
						(0.0450)			
wealth							0.00513*		
							(0.00274)		
services								0.0823***	
								(0.00733)	
earns cash									0.110***
									(0.00868)
Observations	27,482	8,064	10,851	25,094	27,390	27,482	25,005	27,264	23,001
R-squared	0.286	0.361	0.372	0.286	0.285	0.286	0.281	0.293	0.327

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year. Intensity measures the number of active mines in the survey year that are within 15 km from the household. Wealth measures household wealth according to the DHS index. Service is a dummy variable that is 1 if the woman reports working in services or sales. Cash is a dummy variable taking value 1 if she earns cash for work.

Table B.5: Alternative Specifications: Earns cash

Specification:	baseline specification					intensity (nr. mines)	wealth control	service control
Sample:	all	non-mover sample	migrant sample	drop 15-30km	drop investment phase (2yr)	all	all	all
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
industrial*mine	0.0282	0.0228	0.123***	0.0421	0.0236	0.167***	0.0114	-0.0233
	(0.0385)	(0.0660)	(0.0431)	(0.0394)	(0.0405)	(0.0637)	(0.0482)	(0.0362)
mine	-0.0279	0.00534	-0.0458	-0.0168	-0.0225	-0.0281	-0.0410	-0.0140
	(0.0297)	(0.0517)	(0.0320)	(0.0364)	(0.0319)	(0.0296)	(0.0419)	(0.0296)
intensity (nr. mines)						-0.133***		
						(0.0443)		
wealth							0.0310***	
							(0.00375)	
service								0.348***
								(0.0102)
Observations	35,020	10,685	15,685	31,874	34,433	35,020	23,568	34,587
R-squared	0.386	0.379	0.446	0.383	0.386	0.386	0.400	0.465

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. The outcome variable is an index created from the following questions: "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year. Intensity measures the number of active mines in the survey year that are within 15 km from the household. Wealth measures household wealth according to the DHS index. Service is a dummy variable that is 1 if the woman reports working in services or sales. Cash is a dummy variable taking value 1 if she earns cash for work.

Table B.6: Gender Norms and Female Empowerment

Dependent variable:	justifies violence (1)	barriers access healthcare (2)	final say decisions (3)	service sector (4)	earns cash (5)
industrial*mine	-0.0783**	-0.0920**	0.00990	0.0696***	0.0266
	(0.0340)	(0.0466)	(0.0499)	(0.0248)	(0.0388)
mine	0.0447	0.0331	-0.0243	-0.0225	-0.0259
	(0.0309)	(0.0355)	(0.0387)	(0.0198)	(0.0297)
age	0.001	-0.003**	0.0351***	0.0233***	0.0256***
	(0.0013)	(0.0013)	(0.0017)	(0.0013)	(0.002)
age square	-0.0001	0.0005**	-0.0004***	-0.0003***	-0.0004***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
years of education	-0.0074***	-0.009***	-0.001	0.019***	0.0097***
	(0.0017)	(0.0017)	(0.002)	(0.0015)	(0.0018)
years of education square	-0.0006***	-0.0001	0.0007***	-0.002***	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
urban	-0.0430***	-0.0868***	0.0239**	0.223***	0.158***
	(0.0116)	(0.0151)	(0.0112)	(0.0100)	(0.0143)
Mean value	0.404	0.393	0.318	0.233	0.563
Observations	30,693	31,485	27,482	55,944	35,020
R-squared	0.344	0.240	0.286	0.183	0.386

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, age square, education, education squared, urban, and fixed effects for survey year, district, and country-year. Columns 1-3 have index variables ranging from 0 to 1 as outcome variables. Column (1): "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Column (2): "Is money/distance/permission an obstacle to seeking healthcare for yourself?", Column (3): "Do you have, alone or together with your partner, a say in healthcare/large purchases/family visits decisions?" Column 4 shows results for binary occupational outcome, if the woman works in services or sales. Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table B.7: Comparison with schoolyears

Dependent variable:	justifies domestic violence			barriers to access healthcare		
Sample:	all	under 30	above 30	all	under 30	above 30
	(1)	(2)	(3)	(4)	(5)	(6)
industrial*mine	-0.0777**	-0.0909**	-0.0309	-0.0917**	-0.125**	-0.0381
	(0.0339)	(0.0409)	(0.0442)	(0.0465)	(0.0575)	(0.0480)
mine	0.0438	0.0630	-0.00337	0.0328	0.0600	-0.0131
	(0.0308)	(0.0389)	(0.0392)	(0.0353)	(0.0477)	(0.0352)
years of education	-0.014***	-0.015***	-0.012***	-0.011***	-0.011***	-0.011***
	(0.0008)	(0.0009)	(0.0011)	(0.0008)	(0.001)	(0.001)
Observations	30,693	16,742	12,506	31,485	17,343	12,691
R-squared	0.344	0.347	0.357	0.240	0.239	0.261

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. Regressions include controls for age, education, urban, and fixed effects for survey year, district, and country-year. Samples vary with woman's age across the columns. Columns (1) - (3): "Is a husband justified to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children?" Column (4) - (6): "Is money/distance/permission an obstacle to seeking healthcare for yourself?" Industrial*mine takes a value of 1 if there is an actively producing mine within 15 km from the household locality in the survey year.

Table B.8: Marginal Effects from Multinomial Logit

	(1)	(2)	(3)	(4)
Panel A. Occupation				
Dependent variable:	not working	agriculture	service and sales	other
industrial * mine (ME)	0.014	-0.070***	0.115***	-0.058***
	(0.016)	(0.016)	(0.017)	(0.011)
mine (ME)	-0.046***	0.051***	-0.068***	0.013***
	(0.013)	(0.012)	(0.014)	(0.008)
Panel B: Earnings				
Dependent variable:	not paid	cash and in-kind	only in-kind	
industrial * mine (ME)	-0.116***	0.089**	0.027	
	(0.029)	(0.029)	(0.023)	
mine (ME)	0.100***	-0.06**	-0.041**	
	(0.023)	(0.024)	(0.019)	
controls	Y	Y	Y	Y
country FE	Y	Y	Y	Y
year FE	Y	Y	Y	Y
country*year FE	Y	Y	Y	Y

Average marginal effects (dy/dx) calculated after multinomial logit. Panel A has 56,011 observations, Panel B 25,835 observations. The multinomial logit controls for age, education, and urban and fixed effects for country, year, and country by year.

Table B.9: Female Empowerment Estimated with Initial Variables and Bonferroni p-values

	(1)	(2)	(3)	(4)	(5)
Panel A: Justification of violence					
Dependent variable:	a husband has the right to beat the woman if she...				
	burns food	refuses sex	argues	neglects kids	goes out
industrial*mine	0.008	-0.123***	-0.099**	-0.110***	-0.083**
	(0.042)	(0.036)	(0.050)	(0.042)	(0.040)
p-value	0.841	0.001***	0.047	0.009**	0.038
(Bonferroni sign.)					
Observations	31,423	31,038	31,396	31,426	31,455
Panel B: Barriers to access healthcare					
Dependent variable:	is ... a barrier to seeking healthcare?				
	distance	money	permission		
industrial*mine	-0.146*	-0.086*	-0.043		
	(0.079)	(0.050)	(0.047)		
p-value	0.065	0.084	0.353		
(Bonferroni sign.)					
Observations	31,485	31,488	31,486		
Panel C: Final say					
Dependent variable:	she has a final say on (how to spend on)...				
	healthcare	large purchase	daily purchase	family visit	husband wage
industrial*mine	-0.003	0.008	0.027	0.017	-0.022
	(0.057)	(0.050)	(0.053)	(0.060)	(0.066)
p-value	0.960	0.870	0.610	0.773	0.740
(Bonferroni sign.)					
Observations	27,582	27,565	19,072	27,505	9,516

Note: Bonferroni sign (0.99) for Panel A and C is 0.002,*** or Panel B 0.0033,***

Bonferroni sign. (0.95) for Panel A and C is 0.01,** for Panel B 0.0016**

Bonferroni sign. (0.90) for Panel A and C is 0.02,* or Panel B 0.033*

Clustered standard errors at DHS cluster level. All regressions include controls for age, education, urban, and fixed effects for survey year, district, year and country-year fixed effects. Panel A shows results binary outcomes for seven variables on final say in household decisions. Three of these, with sufficient sample size and overlapping surveying, were used in the household decision but here the whole set are presented. Panel B shows the results from using the outcome variables on domestic violence. The questions are the type: "is a husband justify to beat his wife if she burns the food/refuses sex/goes out without his permission/neglects the children. Panel C shows if the woman thinks that distance, money or getting permission are barriers to access healthcare for herself. The questions are "is money/distance/permission a hinder to seek healthcare for yourself?"

Table B.10: Age at Marriage, Age Gap and Partner's Education and Polygamy as Mechanisms

Sample: age at mine opening	below 14 (1)	below 19 (2)	below 22 (3)	all women (4)
Panel A. Age difference spouses (years)				
industrial*mine	-0.571	0.401	0.940	0.430
	(0.524)	(1.898)	(0.872)	(0.714)
Observations	32,124	4,778	8,494	11,136
R-squared	0.138	0.163	0.174	0.171
mean value	9.637	9.784	9.872	10.486
Panel B. Polygamous marriage				
industrial*mine	-0.200	-0.092	-0.128*	-0.012
	(0.169)	(0.077)	(0.068)	(0.030)
Observations	5,579	9,936	13,033	42,198
R-squared	0.195	0.192	0.187	0.178
mean value	0.299	0.310	0.316	0.419
controls	Y	Y	Y	Y
survey year FE	Y	Y	Y	Y
country-year	Y	Y	Y	Y
district FE	Y	Y	Y	Y

Note: *** p<0.01, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, urban, and fixed effects for survey year, district, and country-year. Panel A and Panel C control for years of education.

Table B.11: Experience of Violence: Heterogeneity

Dependent variable:	control issues	severe violence	sexual violence	less severe violence	emotional violence	partner drinks alcohol
	(1)	(2)	(3)	(4)	(5)	(6)
Sample: below 22 years old						
industrial*mine	-0.198***	-0.208***	-0.0404	-0.259***	-0.616***	0.259***
	(0.0390)	(0.0408)	(0.0506)	(0.0524)	(0.206)	(0.0372)
mine	0.254***	0.252***	0.0539***	0.271***	0.476***	-0.197***
	(0.00262)	(0.00408)	(0.00715)	(0.00693)	(0.0275)	(0.00722)
Observations	4,110	4,108	4,110	4,108	4,111	4,107
R-squared	0.136	0.114	0.223	0.179	0.279	0.372
Sample: non-migrants						
industrial*mine	0.0139	-0.000768	0.0118	-0.0103	0.292	0.533***
	(0.0346)	(0.0748)	(0.0823)	(0.0992)	(0.591)	(0.0370)
mine	0.00764	0.00793	0.00823	0.00143	-0.492***	-0.500***
	(0.00716)	(0.00982)	(0.0194)	(0.0215)	(0.0992)	(0.0133)
Observations	1,121	1,122	1,122	1,121	1,122	1,122
R-squared	0.116	0.114	0.215	0.129	0.266	0.485
Sample: migrants						
industrial*mine	-0.211***	-0.350***	-0.183***	-0.0188	0.798**	0.176***
	(0.0148)	(0.0285)	(0.0676)	(0.0599)	(0.315)	(0.0374)
mine	0.179***	0.334***	0.189***	0.0332**	-0.604***	-0.133***
	(0.00680)	(0.00952)	(0.0183)	(0.0160)	(0.0629)	(0.0175)
Observations	1,729	1,728	1,728	1,728	1,730	1,727
R-squared	0.106	0.084	0.169	0.099	0.241	0.330

Note: ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, urban, and fixed effects for district, and country-year. Control issues is an index variable between 0 and 8, if the woman's partner has specific control issues. Severe violence is a dummy variable if the woman has ever experienced severe violence from her partner. The other violence variables are similar. Partner drinks alcohol is a dummy variable that takes value 1 if partner drinks alcohol.

Table B.12: Sample Size and Survey Rounds by Country

Country	Year	Type	Observations all	Observations w/in 100km	Clusters w/in 100km	Active Mines
Burkina Faso	1993	Standard	5,599	2,808	73	1
	1998-1999	Standard	5,779	3,818	67	1
	2003	Standard	10,468	6,813	68	1
	2010	Standard	14,898	8,752	67	7
Cote d'Ivoire	1994	Standard	3,714	3,073	81	2
	1998-1999	Standard	1,836	704	54	2
Ethiopia	2000	Standard	10,513	331	30	1
	2005	Standard	9,767	273	36	1
	2011	Standard	11,385	329	35	1
Ghana	1993	Standard	2,168	3,180	32	9
	1998	Standard	3,233	3,577	33	13
	2003	Standard	3,805	4,012	31	7
	2008	Standard	2,968	3,425	24	11
Guinea	1999	Standard	5,650	799	45	2
	2005	Standard	6,165	882	45	3
Mali	1996	Standard	5,841	1,796	66	1
	2001	Standard	12,839	2,501	56	3
Senegal	1992-1993	Standard	5,419	114	43	0
	1997	Standard	6,997	233	32	0
	2005	Standard	10,569	216	44	0
	2010	Standard	12,008	479	60	2
Tanzania	1999	Standard	2,975	451	34	1
	2007	Standard	7,104	1,918	55	5
	2010	Standard	7,672	1,292	40	6
	2012	AIS	8,273	3,284	73	7
N	-	-	208,223	57,676	1,224	-

Notes: Standard refers to Standard DHS survey. AIS refers to AIDS Indicator Survey, also collected by the DHS Program. More information about the survey types can be found at: http://www.dhsprogram.com/What-We-Do/Survey-Types/index.cfm

Table B.15: Main Results by Country

Dependent variable:	not working (1)	agri-culture (2)	service sales (3)	earns cash (4)	barriers to healthcare (5)	accepts violence (6)	bargaining power (7)
Burkina Faso							
industrial*mine	0.003	-0.012	0.066	-0.064	0.039	-0.093*	0.028
	(0.054)	(0.094)	(0.058)	(0.078)	(0.092)	(0.053)	(0.118)
Observations	20,784	20,784	20,784	14,911	15,553	14,937	13,799
R^2	0.240	0.389	0.199	0.346	0.218	0.275	0.171
Cote d'Ivoire							
industrial*mine	-0.177*	0.011	0.166*	0.094			
	(0.094)	(0.173)	(0.091)	(0.159)			
Observations	3,770	3,770	3,770	751			
R^2	0.163	0.411	0.151	0.363			
Ghana							
industrial*mine	0.019	-0.131***	0.108***	0.041	-0.012	-0.028	-0.096
	(0.028)	(0.047)	(0.032)	(0.034)	(0.059)	(0.041)	(0.067)
Observations	14,058	14,058	14,058	10,728	7,368	7,186	5,849
R^2	0.223	0.345	0.120	0.114	0.196	0.194	0.288
Mali							
industrial*mine	0.194*	0.047	0.223**	0.269***	-0.337***	-0.113	0.084*
	(0.108)	(0.102)	(0.105)	(0.099)	(0.060)	(0.085)	(0.050)
Observations	6,833	6,833	6,833	5,469	5,098	4,947	5,069
R^2	0.114	0.394	0.104	0.132	0.086	0.095	0.152
Senegal							
industrial*mine	0.082	-0.022	-0.286***				
	(0.098)	(0.095)	(0.048)				
Observations	1,040	1,040	1,040				
R^2	0.170	0.249	0.135				
Tanzania							
industrial*mine	-0.116**	0.058	-0.016	0.132*			
	(0.049)	(0.108)	(0.021)	(0.070)			
Observations	6,872	6,872	6,872	1,582			
R^2	0.180	0.362	0.116	0.372			
controls	Y	Y	Y	Y	Y	Y	Y
survey year FE	Y	Y	Y	Y	Y	Y	Y
district FE	Y	Y	Y	Y	Y	Y	Y

Note: *** p<0.01, ** $p < 0.05$, * $p < 0.1$. Clustered standard errors at DHS cluster level. All regressions include controls for age, education, urban, and fixed effects for survey year and district fixed effects. Ethiopia and Ghana are excluded, as well as certain results for countries, as the sample size of treated individuals was too small to run the full model.

Table B.13: Occupation on Intensive and Extensive Margin and Wage Rate

	worked last 12 month (1)	worked last 7 days (2)	hours worked 7 days (3)	works in agriculture (4)	works in service & sales (5)	works as miner (6)	ln wage rate (7)	ln hh household income (8)
industrial*mine	-0.096**	-0.078*	5.160	0.064	-0.053	0.036	-0.099	0.589**
	(0.048)	(0.044)	(3.509)	(0.087)	(0.042)	(0.075)	(0.216)	(0.246)
mine	-0.001	-0.009	-5.956**	-0.092	-0.010	0.139**	0.090	-0.071
	(0.040)	(0.034)	(2.889)	(0.071)	(0.030)	(0.063)	(0.139)	(0.165)
industrial*mine	0.052	0.061	-3.458	-0.054	0.115**	-0.035	0.836**	
*woman	(0.037)	(0.042)	(3.377)	(0.058)	(0.056)	(0.064)	(0.373)	
mine	-0.009	-0.030	-1.567	0.069*	-0.037	-0.108**	-0.637**	
*woman	(0.032)	(0.036)	(2.632)	(0.039)	(0.041)	(0.050)	(0.267)	
woman	-0.027***	-0.052***	-4.033***	-0.092***	0.140***	-0.012***	-0.315***	
	(0.007)	(0.008)	(0.665)	(0.010)	(0.010)	(0.002)	(0.048)	
Observations	8,188	8,592	5,423	5,776	5,776	5,776	1,476	6,226
R-squared	0.355	0.332	0.123	0.303	0.141	0.081	0.315	0.153
mean dep var	0.585	0.587	41.3	0.514	0.030	0.012	40,363	5,057k
controls	Y	Y	Y	Y	Y	Y	Y	Y
year FE	Y	Y	Y	Y	Y	Y	Y	Y
district FE	Y	Y	Y	Y	Y	Y	Y	Y

Note: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors at village level. All regressions include controls for age, education, urban, and fixed effects for survey year and district. The outcome variable in Column 8 is annual household income from salaries and wages, and I also control for household size. The data comes from the Living Standards Measurement Survey for Ghana.

Table B.14: Mining companies

Company name	Country origin	Mines (in dataset)	Countries active
Akrokeri-Ashanti	Canada	2	Ghana
Al-Amoudi fam	Saudi Arabia	1	Ethiopia
Amara	UK	2	Burkina Faso, Cote d'Ivoire
Anglogold	South Africa	12	Ghana, Guinea, Mali, Tanzania
Avnel Gold	UK	1	Mali
Avocet	UK	1	Burkina Faso
Banro	Canada	1	Congo (Dem Rep)
Barrick	Canada	4	Tanzania
Bassari	Australia	1	Senegal
Eden Roc	Canada	1	Cote d'Ivoire
Endeavour	Canada	3	Burkina Faso, Ghana, Mali
Ghana Petroleum	Ghana	1	Ghana
Gold Fields	South Africa	2	Ghana
Golden Star Res	USA	2	Ghana
Iamgold	Canada	3	Burkina Faso, Mali
Kinross Gold	Canada	1	Ghana
LionGold	Singapore	1	Ghana
MDN	Canada	1	Tanzania
Newcrest	Australia	1	Cote d'Ivoire
Newmont Mining	USA	1	Ghana
Noble Min Res	Australia	1	Ghana
Perseus Mining	Australia	1	Ghana
Prestea Resource	Ghana	1	Ghana
PMI Gold	Canada	1	Ghana
Randgold Res	South Africa	4	Cote d'Ivoire, Mali
Resolute	Australia	2	Mali, Tanzania
Semafo	Canada	2	Burkina Faso, Guinea
Severstal	Russia	2	Burkina Faso, Guinea
Shanta Gold	UK	1	Tanzania
State of Cote d'Ivoire	Cote d'Ivoire	2	Cote d' Ivoire
State of Mali	Mali	6	Mali
Teranga Gold	Canada	1	Senegal
Weather II	Egypt	1	Cote d'Ivoire

Notes: Some mines are double counted if the ownership is shared. This is true for operations by State of Cote d'Ivoire, State of Mali, Ghana Petroleum, Iamgold, Anglogold, Barrick, MDN, Eden Roc, Randgold Res, Resolute and Weather II. Missing company information for Esasse and Dunkwa mines in Ghana and Poura in Burkina Faso.

Table B.16: DHS Survey Questionnaire

Survey question	**answer**
Barriers to healthcare access	
Many different factors can prevent women from getting medical advice or treatment for themselves. When you are sick and want to get medical advice or treatment, is each of the following a big problem or not?	
1. Getting permission to go?	big problem/not a big problem
2. Getting money needed for treatment?	big problem/not a big problem
3. The distance to the health facility?	big problem/not a big problem
4. Having to take transport?	big problem/not a big problem
5. Not wanting to go alone?	big problem/not a big problem
6. Concern that there may not be a female healthcare provider?	big problem/not a big problem
Justification of domestic violence	
(Sometimes a husband is annoyed or angered by things that his wife does). In your opinion, is a husband justified in hitting or beating his wife in the following situations:	
1. If she burns the food?	yes/no/dk
2. If she refuses to have sex with him?	yes/no/dk
3. If she argues with him?	yes/no/dk
4. If she neglects the children	yes/no/dk
5. If she goes out without telling him?	yes/no/dk
Earnings and decision making	
6. Who usually decides how the money you earn will be used: mainly you, mainly your husband/partner, or you and your husband/partner jointly?	respondent/partner/jointly/other
7. Who usually decides how your husband's/partner's earnings will be used: you, your husband/partner, or you and your husband/partner jointly?	respondent/partner/jointly/ husband has no earnings/other
8. Who usually makes decisions about your healthcare: you, your husband/partner, you and your husband/partner jointly, or someone else?	respondent/partner/jointly/ somebody else/other
9. Who usually makes decisions about major household purchases? you, your husband/partner, you and your husband/partner jointly, or someone else?	respondent/partner/jointly/ somebody else/other
10. Who usually makes decisions about purchases for daily household needs? you, your husband/partner, you and your husband/partner jointly, or someone else?	respondent/partner/jointly/ somebody else/other
11. Who usually makes decisions about visits to your family or relatives? you, your husband/partner, you and your husband/partner jointly, or someone else?	respondent/partner/jointly/ somebody else/other