Structural change and wife abuse: A disaggregated study of mineral mining and domestic violence in sub-Saharan Africa, 1999–2013

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ABSTRACT

Mineral mining may be a mixed blessing for local communities. On the one hand, extractive industries can be a positive economic driver, generating considerable revenues, and opportunities for growth. On the other hand, mining is often thought to be associated with negative effects, such as pollution, and violent conflict. Existing research has shown that mine openings trigger a structural change in employment patterns in Africa, whereby women shift from agricultural work to the service sector, or leave the labor force. However, few if any systematic studies have addressed whether this structural shift may impact the level of violence within the household. Drawing on various versions of resource theory, we argue that mining — through such structural change — may increase women's risk of being abused by their partners. Recent advances in the literature on domestic violence (DV) suggest that prevailing gender norms moderate effects of resources. We test this empirically by matching georeferenced data on openings and closings of 147 industrial mines to individual data on abuse for up to 142,749 women from the Demographic and Health Surveys in 15 sub-Saharan African countries. We find no overall statistically significant effect of mine openings on the risk of partner abuse, although there are heterogeneous effects across countries. Furthermore, mining is associated with increased DV in areas with higher general acceptance of such abuse.

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1. Introduction

The extractive industry worldwide is undergoing unprecedented changes, with high volatility of commodity prices and rising exploration costs. In Africa, mineral mining has been going on since long before the colonial period, with substantial production of iron, copper, gold and salts. Today, the continent is home to about 30 percent of the world's total mineral reserves and even a higher share of deposits of diamonds, vanadium, manganese, platinum, cobalt and gold. Overall, Africa produces more than sixty different metal and mineral products, and has a huge potential with respect to mineral reserves exploration and production. (African Development Bank, 2012). By 2020 it is expected that only 4–5 countries in SSA will not be engaged in mineral resource extraction of some sort (World Bank, 2015).

On the positive side, extractive industries can be a significant driver of the economy, generating revenues, jobs and opportunities

for growth and development (e.g. Wise & Shtylla, 2007). Conversely, several studies indicate that natural resource extraction is often associated with violent conflict and poor economic performance (see e.g. Buhaug & Rød, 2006; Mehlum, Moene, & Torvik, 2006; Ramutsindela, 2013; Ross, 2015). Less attention has been paid to how natural resource extraction is related to crime, urban violence, social conflicts, and intimate partner violence in the local communities where the extraction takes place. Evidence from case studies indicates that the mining zones can indeed be a very hostile climate for women in general. For example, in a study of mining in Tanzania 90 percent of the girls interviewed felt threatened by abuse, neglect, or domestic violence (ILO, 2007).

Violence against women is considered to be one of the world's most pervasive human rights violations, and domestic violence, is by far its most important component (Garcia-Moreno, Jansen, Ellsberg, Heise, & Watts, 2006; Heise & Kotsadam, 2015).[1] Cross-country evidence from WHO suggests that lifetime prevalence

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[1] Although gender-based violence (including domestic violence) can also target men we focus in this article on domestic violence that targets females and is perpetrated by men.

rates of various forms of intimate partner violence (including sexual abuse) range from 15 to 71 percent across countries (Garcia-Moreno et al., 2006, p. 1937). In sub-Saharan Africa the prevalence of intimate partner violence ranks particularly high, even compared to other developing regions (McCloskey, Williams, & Larsen, 2005).

The topic of domestic violence (DV), or sexual violence more broadly for that sake, has been poorly covered within the field of political geography. As noted by Pain (2015, p. 64), 'this is unexpected in a discipline with a core interest in how spaces, places and scales produce and reproduce a whole range of social and political phenomena'. While the country-level effects of extractive industries are fairly well explored, the research on their local economic and social effects is scarce. In particular, there has been a lack of research on the impacts of mining and the mining industry on women (Jenkins, 2014).

Ross (2015, p. 253) recommends that more research should investigate the effects of natural resources on the status of women. It is widely held that one of the artifacts of the arrival of large scale mining, and the shift from subsistence agriculture to cash economies, is increased violence against women (Jenkins, 2014, p. 334). On the other hand, Tolonen (2016) finds that openings of gold mines in Africa are associated with decreased acceptance of abuse. However, while we know that attitudes towards abuse are an important mediator for violence against women, we also know that acceptance is a poor proxy for abuse in the sense that underlying factors are often not similarly correlated with the two (Cools & Kotsadam, 2015). To the best of our knowledge the direct effect from large scale industrial mining to partner abuse has not been tested. The current paper aims to fill this research gap. Our study is guided by the following research question: *Does mining increase domestic violence in sub-Saharan Africa, and if so, why*?

The central part of our study is the often abrupt societal change that is associated with the opening of a mine. This complements the conceptualization of domestic violence as an integrated aspect of local societies (Hume, 2008). Within feminist political geography, domestic violence is increasingly understood as a 'part of broader social, political, and economic processes that are embedded in state policies, public institutions, and the global economy' (Giles & Hyndman, 2004, p. 4). Our study taps into these wider debates by capturing the local dynamics in economies that develop around mine zones and how this may impact violence in the home.

Existing research has shown that mine openings trigger a structural shift in employment patterns in Africa, whereby women shift from agricultural work to the service sector, or out of the labor force. Drawing on theories on employment, resources and domestic violence, we argue that mining – through such structural change – increases women's risk of being abused by their intimate partners. In addition to theories related to employment and the distribution of resources we discuss other contextual factors assumed to mediate or moderate the effect mining has on DV. In particular, we examine the role of prevailing gender norms in society, which is argued to moderate the relationship between resources and DV (Cools & Kotsadam, 2015).

Our study is also informed by ongoing debates about asymmetrical power relations that tend to position women as subordinate to men across space and time (e.g. Fluri, 2015; Hyndman, 2004). For example, the so-called 'gendered resource theory' posits that the effect of relative resources is contingent on the husband's gender attitudes concerning the degree to which men

hold breadwinner ideals and/or accept wife abuse (Atkinson, Greenstein, & Lang, 2005; Krishnan et al., 2010).

In order to test the extent to which mining[2] affects abuse we match longitudinal production data on 874 industrial mines in Africa from The Raw Materials Database (SNL Metals & Mining, 2014) to household survey data from Demographic and Health Surveys for women aged 15–49, spanning over two decades using spatial information. This unique combination of datasets with more than 500,000 sampled women in 25 countries enables us to investigate the local effects of industrial mining on domestic violence by a difference-in-difference method. By exploiting the spatial and temporal variation in the data, we compare women living close to a mine with those living further away, and individuals living close to a producing mine with those who live in the vicinity of a mine that is yet to open. We include country fixed effects and thereby control for time-invariant differences between countries such as time-stable mining strategies, institutions, trade patterns, openness, sectoral composition, level of economic development, and gender norms.

For the whole sample, we find no statistically significant effect of mine openings on partner abuse. However, there seems to be heterogeneity in the effects whereby mining is associated with elevated risks of DV in areas with higher pre-existing acceptance of abuse. Finally, there are clear differences in effects across countries. We explore this further with a discussion of two countries where mining has shown opposing effects with regard to domestic violence, Zambia and Tanzania.

The remainder of the paper proceeds as follows: The next section provides a brief literature review and presents a conceptual framework for analyzing the relationship between mineral mining and domestic violence. The third section presents the data and research design. The fourth section presents our findings, and the final section concludes.

2. Structural change: Trajectories from mining to domestic violence

There is extensive spatio-temporal variation in terms of intimate partner violence in Africa, both across and within countries, suggesting that it is indeed a product of the local context (Cools & Kotsadam, 2015; Østby, 2016). Why should large scale industrial mining increase the level of violence among intimate partners? In order to tackle this question we explore how natural resources, and the associated structural change from subsistence farming to cash economies, may impact family dynamics and local communities. Ross (2008; 2012) argues that an increase of oil resources leads to less female employment since the petroleum revenues tend to crowd out low-wage and export-oriented factories (such as the textile industry) where women mainly work. However, these studies focus on petroleum resources. Hence, studies looking at women's employment and status in relation to other resources are needed (Norris, 2009; Ross, 2009). We start by reviewing theories that are linked to employment and then move on to discuss other factors.

2.1. Factors related to employment

In sub-Saharan Africa, the growth of the mining industry is producing a structural change in the economy whereby subsistence farming becomes less important for both men and women. The growth of the extractive industry often implies the conversion of new land to new uses – either for mining as such, or for supporting infrastructure (roads, ports, housing, clinics, offices etc.), which can imply the loss of subsistence agriculture (Eftimie, Heller, & Strongman, 2009). Moreover, extractive industries create new

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[2] The mining sector is remarkably diverse. Yet, as a first, general test of the mining-domestic violence nexus, we focus on the overall effect of *all* types of industrial mining in this study.

jobs, both in the industry itself and in the service sector. Below we discuss various theories that explain how the change from subsistent agriculture to industry can affect the level of DV.

2.1.1. Female dependency and -empowerment

In a study of mining and employment patterns in Africa, Kotsadam and Tolonen (2016) found that as a result of mine openings men shift to skilled manual labor, whereas women shift to service sector jobs. In most communities, formal jobs within the extractive industry (EI) go primarily to men. In fact, it is uncommon to find EI companies with higher than 10 percent female employment.[3] Sometimes, discrimination is based on a combination of stereotypes within the EI companies and within communities that mining is 'men's' work. For example, in many communities, superstitions and traditional beliefs dictate that women should not enter mines, for fear of explosions (Eftimie et al., 2009). Furthermore, in the masculine mythology surrounding the industry, mining is frequently described in sexual terms with the Earth imagined as a woman, 'only being capable of being penetrated by a male miner' (Lahiri-Dutt & Macintyre, 2006, p. 7).

One approach to understanding the causes of intimate partner violence focuses on the dynamics of women's and men's behavior and the resources that both partners bring to the conjugal union (McCloskey et al., 2005). Where women cannot access jobs, or when their wage decreases relative to their husbands' wages it may put them into a position of increased dependency on husbands (Eftimie et al., 2009, p. 10). Following the pioneering work by Blood and Wolfe (1960) researchers have maintained that men who bring home more resources than their female partners (in particular income) are likely to dominate in the relationship (Choi & Ting, 2008). Being economically dependent, women in such relationships lack the power to adopt economic or social sanctions against potentially abusive husbands (Choi & Ting, 2008, p. 835). Women's dependence on marriage and their overwhelming responsibility for child care further limit their ability to leave a violent relationship. In short, theories of marital dependence state that being economically dependent on a male partner increases a woman's risk of abuse since her dependency makes her less likely to exit the relationship (Vyas & Watts, 2009; Tauchen, Witte & Sharn, 1991). Given that we know that the mining sector mostly employs men, this leads to our first hypothesis:

H1. Mine openings, by increasing women's dependency on men, increase DV.

However, not all women become increasingly dependent on their husbands as a result of mining. In fact, quite a few women gain employment in the service sector surrounding the mine (Kotsadam & Tolonen, 2016). To what extent and how does this new position of women in the workforce alter the dynamics in the household and their relationships to their intimate partners?

If employed, a woman's risk of being abused could decrease, due to her growing economic independence (Choi & Ting, 2008, p. 835). In the context of mining, women who previously worked in agriculture may be key actors, not only as mine workers, but also in the wider economies that emerge in the mining communities, in particular in relation to provision of food, drink and accommodation. These new jobs imply some clear benefits. Women in the service sector are able to work all year round and not only during the agricultural high season, and they are more likely to receive cash for work (Kotsadam & Tolonen, 2016). Tolonen (2016) further finds that mine openings in Africa also have some wider positive

implications for women. She finds that as a result of gold mining, local women tend to have more control over resources and have better access to health care, which both seems to support the idea that mining may increase local female empowerment. Even more importantly, she finds that gold mining decreases acceptance of abuse. While we know that acceptance is an important mediator for violence, we also know that acceptance is a poor proxy for abuse in the sense that underlying factors are often not similarly correlated with the two (Cools & Kotsadam, 2015). To take some concrete examples from sub-Saharan Africa: Education and employment are negatively correlated with acceptance of abuse but education is related to actual abuse in a non-linear fashion (if at all) and employment is positively correlated with abuse (Cools & Kotsadam, 2015).

In feminist theory, DV is viewed as an outcome that results from the weak autonomy and bargaining power of women. One could argue that more opportunities for earning cash also for women can *decrease* their financial dependence on men. The resource theory version of feminist theory indeed predicts that women with more autonomy (e.g. because they earn independent income) would experience less DV than women with less autonomy (see e.g. Cools & Kotsadam, 2015; Goode, 1971; Jewkes, 2002). In other words, cash earnings could be empowering and protective against partner-violence. This leads to our second hypothesis, of which implication is the opposite of H1:

H2. Mine openings, by giving women employment and outside options, reduce DV.

2.1.2. Male status inconsistency

The relationship between resources and violence is not necessarily linear as described above. Some even argue for a 'backlash' whereby women's increased access to resources could lead to more abuse by their partners (Cools & Kotsadam, 2015; True, 2012). Choi and Ting (2008) propose an imbalance theory of resources and power in which men may abuse their spouses due to their economic advantage. According to traditional gender norms in most societies, men have the dominant provider role in terms of resource contribution. In reality, however, not all men are able to live up to these cultural expectations (Choi and Ting (2008)). The explicit hiring of women workers can create tensions in families and communities where this contradicts cultural and social norms, particularly if the men are not able to get employment, or if the economic expectations created by the mining activity are not met.

As a result of the increased power gained by women, men may use violence in order to reinstate their dominance (Clark et al., 2010). This also resonates with status inconsistency theories where atypical roles threaten male identities (Hornung, McCullough, & Sugimoto, 1981). Tauchen et al. (1991, pp. 6–12) propose an instrumental form of domestic violence whereby it aims to 'educate' the victim in line with the interest of the perpetrator. In a study of masculinity, violence and sexuality among the armed forces in the DRC, Baaz and Stern (2009, p. 507) found that the frustration of 'not being able to be a real man and provider for the family' is demonstrated in a sexualized and negative image of women, in which women in general are portrayed as opportunistic and unreliable. According to a feminist perspective, this, in turn, may lead to men increasingly using violence against their partners in order to reassert their social position of power in the family (Clark et al., 2010, p. 314). It is widely held that where there is a rapid shift from subsistence to cash economies, this can lead to tensions in the home. Where families have been accustomed to earning incomes in-kind, sudden cash incomes may lead to conflicts over how, and by whom, the money is spent, which in turn may lead to domestic violence (Eftimie et al., 2009, p. 14), as

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[3] The situation is very different when it comes to artisanal and small-scale mining (ASM), though.

articulated in our third hypothesis:

H3. Mine openings, by giving women employment and outside options, increase DV.

H3 may sound very similar to H1, but the underlying assumed mechanisms provide different observable implications. Whereas H1 suggests an increase in DV via increasing male wages, H3 postulates an increase in DV via increasing female employment. Also note that the main function of the different hypotheses is to highlight the different potential pathways that may link mining and abuse. As such, they cannot all be properly tested but we try to link the results to them by discussing the degree of consistency between results and hypotheses.

2.1.3. Local gender norms

Cools and Kotsadam (2015) propose a 'contextual acceptance employment hypothesis' whereby female employment leads to a relatively higher risk of abuse in settings where prevailing norms and values are such that wife-beating is considered acceptable. This seems very relevant for the mining context. First, mine openings create job opportunities for women, thus increasing women's individual resource level, and hence empowering them. Further, according to the 'contextual acceptance employment hypothesis', this increase of resources should be seen in relation to contextual variables and the women's position in the society. Some authors hold that violence against women is influenced by the macho- and inherently violent culture of the mining sector (e.g. Hinton, 2006; Eftimie et al., 2009; Jenkins, 2014). Hence, mining may create structural change in a very particular gender context. More generally, however, we suggest that the effects of mine openings will be different in different areas depending on the background condition of prevailing acceptance of abuse. We expect that:

H4. The effect of mine openings on DV is conditioned by the prevailing level of acceptance of abuse in the community.

2.2. Other factors

In the following sections we look at other factors (beyond those associated with structural change) which could also act as intermediate factors between mining and domestic violence.

2.2.1. Migration

With the introduction of large-scale mining the community goes through a process of social and cultural change resulting from a sudden inflow of economic revenues and opportunities, coupled with in-migration (Enloe, 2000). The migrant workers primarily consist of men who move into mining zones and construct temporary, basic homes in sites without running water, sewage, electricity, health services or schools. When the man has established a job and a shelter the may invite his family to join him, if they have not done so already (ILO, 2007).

Migrant workers may have problems adjusting socially to the new life in the mining community. The disruption of old living habits and customs along with cultural conflicts may cause personal identity crises and primary group breakdown, including less social control. We assume that such lack of social control, in particular, could contribute higher levels of DV among in-migrants. In the following analysis we test to what extent migration is driving our results by restricting the sample to women always having lived in the same area.

2.2.2. Alcohol

As men get increased access to cash working for mining companies (and due to compensation for lost land) this may lead to increased alcohol consumption. Alcohol abuse, in turn, is widely associated with a lack of moral responsibility and increased violent tendencies, such as e.g. with higher levels of domestic violence (see e.g. Hinton, 2006; Perks, 2011). The rapid shift from subsistence agriculture to cash economies can lead to tensions within families about e.g. how, and by whom money is managed and spent, which could in turn lead to increased DV, particularly if this is combined with increased access to alcohol. We investigate whether mining increases alcohol consumption and we also test if there are different effects of mining in areas with relatively more or less alcohol use.

3. Research design

In order to assess the relationship between mining and domestic violence we spatially link detailed data on openings and closings of industrial mines to georeferenced survey data on domestic violence attitudes as well as experiences and other background factors for women from the Demographic and Health Surveys. For our largest sample, the sample on attitudes, we are able to match 147 mines to 518,508 women in 25 countries[4] over the period 1999–2013. For actual abuse we only have data from 17 countries for the period 2003–2013 and we are able to match 142,749 women to 91 mines. The data sources and our strategy to test the postulated hypotheses are described in more detail below.

3.1. Data on mining

Our data on large-scale mines in Africa stem from a new longitudinal dataset, The *Raw Materials Database* (RMD) from SNL Metals & Mining (2014).[5] This includes information on all types of past and current industrial mines, as well as future mines with industrial-scale development potential, geocoded with point coordinates for the mine locations and yearly information on production levels. The database excludes artisanal and small-scale mines. Hence, the validity of our results pertains exclusively to large-scale industrial mining. Mine production exists annually for 1975 and 1984–2013, hence covering our entire temporal domain, 1999–2013.

3.2. DHS survey data

We use micro-level data from the Demographic and Health Surveys (DHS)[6] to extract information on individual experiences with- and attitudes towards domestic violence, as well as a number of other background factors. The DHS are nationally representative surveys of women aged 15–49. They were conducted primarily to provide researchers and policy-makers with comprehensive and comparable data on fertility and child health and their determinants, and the DHS project has become the gold standard of survey data in the population and health sector in developing countries. However, the content of the surveys has changed over the years to adapt to changing circumstances and priorities. Apart from health and nutrition indicators, most of the surveys now also include a host of questions relating to socioeconomic background.

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[4] The following countries are included: Burkina Faso*, Burundi, Cameroon*, Congo DR*, Ethiopia, Gabon*, Ghana*, Guinea, Kenya*, Lesotho, Liberia*, Madagascar, Malawi*, Mali*, Mozambique*, Namibia, Nigeria*, Rwanda*, Senegal, Sierra Leone*, Swaziland, Tanzania*, Uganda*, Zambia*, Zimbabwe*. All countries listed have data on attitudes towards DV. Countries marked with '*' also have data on experiences with DV.

[5] See http://www.snl.com/Sectors/metalsmining/Default.aspx.

[6] The DHS data are available at www.measuredhs.com.

In the 1990s DHS began to collect information on the prevalence of domestic violence against women.

The DHS Domestic Violence Module uses a modified Conflict Tactics Scale (CTS) to measure violence. An important characteristic of CTS is the use of several different questions regarding specific acts of violence. By giving respondents multiple opportunities to disclose their experiences of violence and by asking about specific acts that are understood in the same way everywhere, CTS is also argued to reduce under-reporting (Cools, Flatø, & Kotsadam, 2016; Kishor, 2005). In fact, Palermo, Bleck, and Peterman (2014) show that only 7 percent of the women that reported domestic violence in the DHS surveys had reported it to a formal source. Hence, while under reporting may be an issue, it is likely less so in the DHS data than in other sources. Nonetheless, we may still worry that mining affects reporting in addition to or irrespective of the effects on actual abuse. Furthermore, structural change may affect reporting differently in different areas, which is a caveat we urge the reader to keep in mind when interpreting the results.

We use all DHS surveys in sub-Saharan Africa with available data on experiences with and/or attitudes towards domestic violence. The total dataset includes 142,656 women surveyed on experiences with domestic violence from 17 countries (and 518,508 women in 25 countries over the period 1999—2013 surveyed on attitudes towards domestic violence). Respondents were surveyed between 2003 and 2013 and live in 5353 (20,277) various survey clusters. The map in Fig. 1 displays the distribution of mines and DHS survey cluster locations (with domestic violence modules) used across sub-Saharan Africa.

In the DHS Domestic Violence module respondents are asked if they have ever (or during the last 12 months) been exposed to physical domestic violence by their current or last husband (including questions about whether they have ever been pushed; slapped; punched, kicked; strangled and/or threatened; and/or attacked with a gun/knife), or sexual domestic violence (i.e. if the husband has ever forced her to sexual intercourse or other sexual acts). Based on these questions we generate three different dependent variables to measure DV experiences: *Abuse last year* (a dummy for whether woman experienced any form of physical or sexual violence by partner during last 12 months prior to survey year), *Sexual abuse last year* (a dummy for whether woman experienced sexual violence by partner during last 12 months prior to survey year), *Abuse* (a dummy for whether woman has experienced any form of physical or sexual violence by partner during her lifetime). Further, as mentioned above, the DHS includes a series of questions related to when a woman feels that wife-beating is justified in various everyday situations (if she goes out without telling him; if she neglects the children; if she argues with him, if she refuses to have sex with him; or if she burns the food). We create a dummy, *Acceptance,* that takes the value 1 if the respondent answers yes to at least one of these questions, and 0 otherwise.

In the theoretical section we suggest that there are three factors that could act as intermediate factors between mining and domestic violence: female employment, migration history and husband's alcohol abuse. These are all included in the DHS surveys: *Work for cash* is a dummy that takes the value '1' if the respondent has been working outside the home during the last 12 months. "The variable *Husband gets drunk* takes the value '1' if the respondent's husband often gets drunk, and '0' otherwise. *Never moved* is a dummy that takes the value '1' if the respondent has always lived in the same place and '0'otherwise.

Finally, we include a set of control variables from DHS: All regressions control for year and country fixed effects. Also, most regressions control for marital status (cohabitant, divorced or separated, widowed or married), number of children, wealth in five income groups, and years of schooling.

3.3. Linking the mining- and survey data

We link the DHS survey data with the mining data based on spatial proximity. Point coordinates (GPS) for the surveyed DHS clusters (a cluster being one or several geographically close villages or a neighborhood in an urban area) allow us to match all survey respondents to one or more mineral mines. More specifically, from each survey cluster centroid we measure the distance to mines and register if at least one mine exists within radius of 50 km. Fig. 2 illustrates this with the example of DR Congo. The survey points that fall within the mine buffer-zones are defined as 'proximate to a mine'. The cut-off distance of 50 km is admittedly somewhat arbitrary but seems appropriate with regard to commuting distances in Africa. That is, within buffers of 50 km radii we believe that people are able to commute between their job and their homes on a regular basis, which is relevant given the focus on domestic violence. Furthermore, smaller cut-offs decrease the sample of individuals living close to an inactive mine making it harder to identify effects (Knutsen, Kotsadam, Olsen, & Wig, 2016). However, as robustness tests we also include 25 km buffer zones. The indicator variable *Active* captures whether at least one active mine lies within this distance. Further we code clusters (individuals) as *Inactive* if one or more future mines will be opened in the area (after the time of the survey). All other clusters (individuals) are coded as non-mining areas.

147 mines in Africa are matched to the DHS survey clusters in the sense that are within 50 km of at least one survey cluster. As seen in Table 1, the women in the abuse sample live on average 269 km away from the nearest mine and 7 percent of the women have an active mine within 50 km and 1 percent live within 50 km to a mine that has not yet opened. Table 1 also provides descriptive statistics for all independent and dependent variables used in the analyses.

3.4. Empirical strategy

The structure of the data allows us not only to compare women living in areas close to mining sites with other women. We can also use difference-in-difference method test whether these is a difference between women living in mining areas with those that are living in areas that in the future will become mining sites. The idea is that there it is not a coincidence where mines are opened, and that it is likely that mining sites are more similar to areas where there will be mining in the future than to other areas.

Our estimation builds on the spatial-temporal strategy presented in Kotsadam and Tolonen (2016) and Knutsen et al. (2016). Assuming that domestic violence is affected within a cut-off distance of a mine we consider the following three groups of people: Individuals who reside i) within 50 km from at least one *active* mine, ii) within 50 km from an *inactive* mine (but not close to any active or suspended mines), and iii) more than 50 km away from any mine. The baseline OLS regression takes the following form:

$$Y_{ivt} = \beta_1 \cdot active + \beta_2 \cdot inactive + \alpha_r + g_t + \lambda X_i + \varepsilon_{ivt},$$

where the outcome Y of an individual i, cluster v and for year t is regressed on active and inactive. The regression further includes country- (α_r) and year- (g_t) fixed effects and a vector (X_i) of individual-level controls. In all regressions we control for marital status, number of children, wealth in five income groups, and years of schooling). Standard errors are clustered on survey clusters to account for correlated errors.

Interpreting the coefficient only for active implies the assumption that the mine location is not correlated with the population characteristics before production starts. However, this is a strong
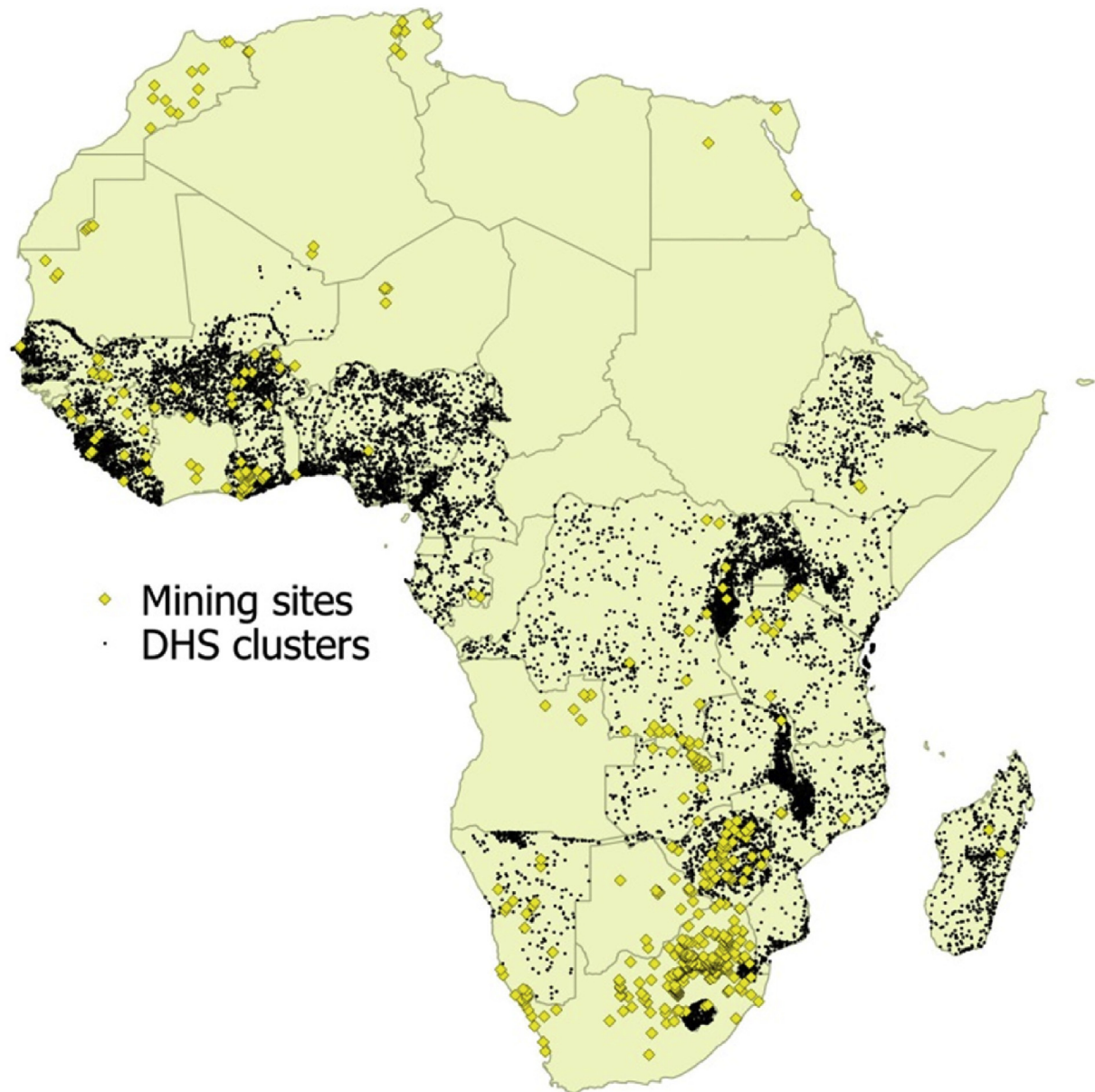
Fig. 1. Distribution of mines and DHS clusters with data on domestic violence.

assumption, as it may not be coincidental where a mine is opened. For example, employment and population density — factors that may also be related to domestic violence — may also influence mining companies' investment decisions. In fact, Kotsadam and Tolonen (2016) show that employment is lower in inactive areas and Knutsen et al. (2016) show that corruption is lower in such areas. Hence, we also include a dummy for *inactive* mine, which allows us to compare areas before a mine opens with areas after a mine has opened, and not only comparing areas close to and far from mines. For all regressions, we therefore calculate test results for the difference between active and inactive $(\beta_1 - \beta_2)$, which provides a difference-in-difference measure that controls for unobservable time-invariant characteristics that may influence the selection into being a mining area. The F-tests of difference between these two coefficients and the corresponding p-values are our main tests of the total effects of mining and they are presented

at the end of each table.

4. Results

The result section reports our results from the empirical tests of our hypotheses on how structural change due to mining may influence the risk of domestic violence. First, we explore overall effects of mining on experiences with- and attitudes towards domestic violence and contrast the employment explanations with other potential factors linking mining and abuse (migration and alcohol abuse). Next we test the hypothesis that prevailing gender norms condition the effect of mining on domestic violence. Finally, we present country-specific effects. We explore this heterogeneity further through short examinations of Tanzania and Zambia, two countries, where mining is found to have opposing effects with regard to domestic violence.
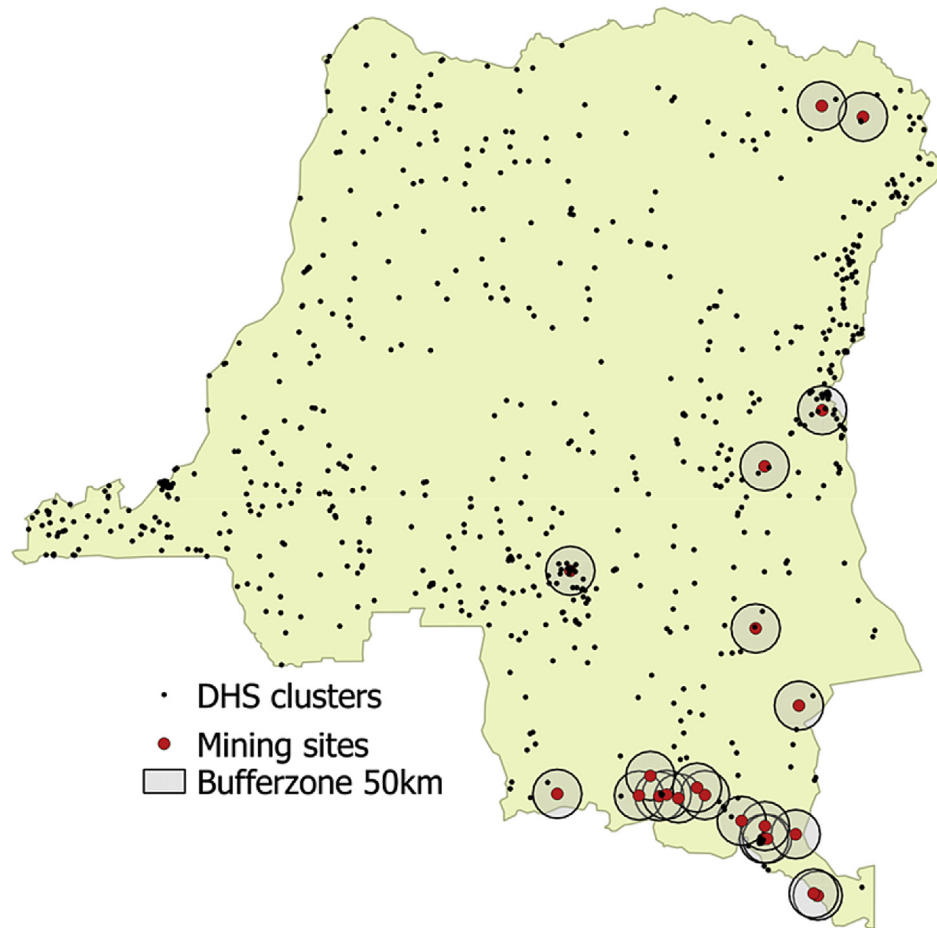
Survey points stem from DHS surveys in DR Congo conducted in 2007 and 2013-14.

Fig. 2. Linking mines to DHS survey points (Example from DR Congo).

4.1. Effects of mining on domestic violence in the whole sample

Our main research question is: *Does mining increase domestic violence in sub-Saharan Africa?* Thus our first task is to check whether there is an increase of violence in areas surrounding mines compared to areas where we know mines will open in the future.

Table 2 shows our baseline results. *Abused last year* is a dummy for having been physically abused (including sexually) last year. The dummy active 50 shows that there is 1.2 percentage points more abuse in areas within 50 km of an active mine, compared to those that do not live close to a mine. This difference is not statistically significant, however. As we may suspect, and as Kotsadam and Tolonen (2016) as well Knutsen et al. (2016) have shown, there is likely a selection into mining areas as local conditions determine where there is exploration. Therefore, the simple difference estimator should not be taken at face value. The selection can be shown by looking at the second variable, *Inactive 50*, which shows the difference between areas that have not yet started mining but where we know mining will start in the future and areas further away. We see that there is 2 percentage points less violence in such areas. We can now get the difference in differences estimate of the effect of mining on abuse last year by taking active-inactive (i.e. before and after mine openings as the first difference and close and further away as the second one). This gives the number shown in "Difference-in-difference" and it is 3.2 percentage points. The F-test tests if this difference is statistically significant and the p-value is given in the row below. We see that there is no statistically significant effect on abuse last year for the whole sample.

We see in column 2 that sexual violence seems to increase as an effect of mining as the DD estimate (again, at the bottom of the table) is significant at the 10 percent level. Note, however, that it is not the case that active mining areas have much more sexual violence than other areas, only 0.006 more, but the negative value of −0.022 for inactive mines drive the result. In Column 3 we see that the *Abuse* variable (which includes lifetime experiences with physical and sexual violence) does not yield a significant difference between active and inactive areas. Column 4 interestingly shows that acceptance of abuse decreases with mine openings. This shows that the result in Tolonen (2016) seems to hold for mining in general, and not only gold mining.

In an online appendix we present robustness tests and extra regressions for the baseline results. We show very similar results without control variables at the individual level (Table A1) and when we add employment last year to the vector of controls (Table A2).[7] We also split up the violence variable in severe, less severe, and emotional abuse but find no effects on these different

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[7] We also perform analyses of the effects of mining on the control variables in Appendix Tables A13 and A14.

Table 1
Descriptive statistics.

	Abuse sample		Attitudes sample	
	Mean	SD	Mean	SD
Respondent deems beating justified if wife				
goes out without telling	0.35	−0.48	0.37	−0.48
neglects the children	0.36	−0.48	0.4	−0.49
argues with him	0.31	−0.46	0.35	−0.48
refuses to have sex	0.27	−0.45	0.29	−0.45
burns the food	0.16	−0.37	0.2	−0.4
Any of the above (variable Accept)	0.5	−0.5	0.54	−0.5
Respondent has during last year been exposed to				
less severe violence	0.21	−0.41	0.21	−0.41
severe violence	0.03	−0.17	0.03	−0.17
sexual violence	0.09	−0.28	0.09	−0.28
Any of the above (variable Abuse last year)	0.25	−0.43	0.25	−0.43
Ever abused (variable Abuse)	0.31	−0.46	0.32	−0.47
Mining variables				
Kilometers to nearest mine	269.29	−205.39	247.07	−205.59
Active 50 km	0.07	−0.25	0.08	−0.27
Inactive 50 km	0.01	−0.09	0.01	−0.12
Active 25 km	0.03	−0.16	0.03	−0.18
Inactive 25 km	0	−0.04	0	−0.06
Control variables				
Cohabitant	0.11	−0.31	0.08	−0.28
Divorced	0.06	−0.24	0.06	−0.23
Widow	0.03	−0.17	0.03	−0.17
Number of children	3.74	−2.64	2.96	−2.87
Poorest	0.22	−0.41	0.19	−0.39
Poor	0.21	−0.4	0.19	−0.39
Middle	0.2	−0.4	0.19	−0.4
Rich	0.2	−0.4	0.2	−0.4
Richest	0.18	−0.38	0.23	−0.42
Years of Schooling	4.48	−4.54	4.61	−4.5
N	142,749		518,508	

The first sample consists of everyone with data on actual abuse and the second sample entails everyone with data on attitudes.

Table 2
Effects of mine openings across the continent. 50 km buffer zones.

Variables	(1)	(2)	(3)	(4)
	Abuse last year	Sexual Abuse	Abuse	Acceptance
Active 50	0.012	0.006	0.015	−0.008
	(0.014)	(0.008)	(0.014)	(0.015)
Inactive 50	−0.020	−0.022	−0.018	0.069***
	(0.028)	(0.015)	(0.029)	(0.020)
Observations	142,656	142,471	143,391	462,358
R-squared	0.077	0.050	0.103	0.157
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Baseline controls	YES	YES	YES	YES
Difference in difference	0.0319	0.0288	0.0329	−0.0774
F test: Active 50-Inactive 50 = 0	1.147	3.185	1.123	10.38
p value	0.284	0.0746	0.290	0.00130

Robust standard errors clustered at the DHS cluster level in parentheses. All regressions control for marital status dummies, number of children, wealth quintile dummies, and years of education; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

types of violence either (see Table A3). When limiting the sample to 25 km around the mines we note that the effect on sexual abuse is no longer present (cf. Table A4). The interpretation of the results is similar if we use probit models instead of OLS (Table A10) and also if we include sub-national-region fixed effects (Table A11).

The overall conclusion at this point is that mining does not seem to increase abuse in general. We know from the literature review above, however, that it is likely that the effects are different in different areas. Table 2 above is not suited to answer the second part of our research question *(why and when mining should affect domestic violence)*. Below we investigate whether mining seems to have an effect on the variables that we deem interesting as

mechanisms which might explain the relationship between mining and abuse, i.e. employment, migration, and husbands' alcohol abuse. We see in Table 3 that there is an effect on working for cash, i.e. increased employment, as found by Kotsadam and Tolonen (2016), but it is only statistically significant at the 10 percent level. So, what about our proposed hypotheses on the way structural change impacts domestic violence through employment in different ways? Table 2 shows a positive (albeit not statistically significant at the 5 percent level) relationship between mining and domestic violence, and Table 3 shows that female employment seems to increase with mine openings. Hence, the dependency explanation (H1) is less likely to be supported by the data: When

women earn more cash they are likely to become less dependent on their partners. Also, H2 (which postulated that increased female employment should lead to less domestic violence due to empowerment) is not supported. Neither is there any support for H3, which stated that mine openings, by giving women employment *increases* domestic violence. As for the alternative explanations to the employment factors, these seem to be of little (if any) importance: We find no effects on whether the husband gets drunk more often, nor on the probability of being a migrant.

4.2. Testing the contextual gender hypothesis

According to the contextual gender hypothesis developed by Cools and Kotsadam (2015) the effects of female employment on abuse should be seen in relation to contextual variables and women's position in society. We argue that this is particularly relevant for mining areas, as many authors have argued that mining areas are associated with a particular masculine and violent culture (see e.g. Rustad, Østby, & Nordås, 2016). Thus according to the contextual gender hypothesis women earning cash income in these areas should be particularly vulnerable for abuse. In particular, Cools and Kotsadam (2015) find that the effects of female employment on abuse hinges on the contextual level of acceptance for wife beating in an area. We explore this potential heterogeneity and show effects for areas with above the median level of acceptance (55 percent acceptance) in Table 4. We see that the effect is indeed large and statistically significant in such areas. The effect size suggests that mine openings increase abuse last year by 7.2 percentage points in these areas. That effect is larger than the correlation between abuse last year and any of the control variables included (see Table A16). This is consistent for all the three operationalizations of experiences with domestic violence. In sharp contrast, there is no effect on any of the domestic violence measures in areas where violence is less accepted as seen in Table 5. If anything, the results are in opposite direction. The difference in effects across the two areas is statistically significant in an interaction model where we pool the sample, include a variable for acceptance, and interact the acceptance variable with active as well as inactive (see Table A12 in the Appendix). Hypothesis 4, hence, is strongly supported.

In Table A15 in the appendix we investigate the effects of mine closings as well. In particular, we show the results for abuse last year in the sample where we have clear effects of mine openings, i.e. in the sample with high acceptance of abuse. We see in this table that the coefficient for suspended mines seem to lie in between the

coefficients for active and inactive and we also note that there is no statistically significant difference between suspended mines and active mines, nor between suspended mines and inactive mines. We still note the difference between active and inactive mines, however.

In the appendix we show that these results are robust to limiting the sample to individuals that have never moved and there is no corresponding difference in the effects when we compare areas where many husbands get drunk to areas where relatively fewer husbands get drunk (see Tables A5–A8).

4.3. Country specific results

As a final statistical test, we estimate the effects by country in our sample. We note that there are indeed strong differences in the effects across countries. Fig. 3 shows the results by country for all countries where we have data from both before and after mine openings. In Congo DR there seems to be a positive effect on sexual abuse but the results are driven by a lower level of such abuse in mining areas before there is mining. Also in Ghana there is an increase but there are very few observations living close to mines that have not yet opened (in fact only 5 women). In particular, there is a strong effect of mine openings leading to more abuse in Zambia, while there is a negative effect in Tanzania. These effects are shown in Tables 6 and 7. Tables with individual results for all other

Table 4
Effects of mine openings in areas with high acceptance. 50 km buffer zones.

Variables	(1)	(2)	(3)
	Abuse last year	Sexual Abuse	Abuse
Active 50	0.024	0.012	0.024
	(0.017)	(0.009)	(0.017)
Inactive 50	−0.048*	−0.044**	−0.048
	(0.028)	(0.018)	(0.032)
Observations	62,724	62,611	63,041
R-squared	0.084	0.056	0.113
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Baseline controls	YES	YES	YES
Difference in difference	0.0716	0.0554	0.0720
F test: Active 50-Inactive 50 = 0	5.407	8.150	4.442
p value	0.0203	0.00439	0.0353

Robust standard errors clustered at the DHS cluster level in parentheses. All regressions control for marital status dummies, number of children, wealth quintile dummies, and years of education; ***p < 0.01, **p < 0.05, *p < 0.1.

Table 3
Effects of mine openings on other outcomes. 50 km buffer zones.

Variables	(1)	(2)	(3)
	Work for cash	Husband gets drunk	Never moved
Active 50	0.002	0.019	−0.026
	(0.011)	(0.014)	(0.018)
Inactive 50	−0.036*	0.050	−0.024
	(0.020)	(0.040)	(0.017)
Observations	467,246	135,082	265,170
R-squared	0.108	0.141	0.083
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Baseline controls	YES	YES	YES
Difference in difference	0.0381	−0.0311	−0.00242
F test: Active 50-Inactive 50 = 0	2.891	0.602	0.0124
p value	0.0893	0.438	0.911

Robust standard errors clustered at the DHS cluster level in parentheses. All regressions control for marital status dummies, number of children, wealth quintile dummies, and years of education; ***p < 0.01, **p < 0.05, *p < 0.1.

Table 5
Effects of mine openings in areas with low acceptance. 50 km buffer zones.

Variables	(1)	(2)	(3)
	Abuse last year	Sexual Abuse	Abuse
Active 50	−0.002	0.000	0.007
	(0.014)	(0.008)	(0.014)
Inactive 50	0.026	0.019	0.036
	(0.048)	(0.020)	(0.040)
Observations	79,856	79,784	80,334
R-squared	0.060	0.038	0.085
Country FE	YES	YES	YES
Year FE	YES	YES	YES
Baseline controls	YES	YES	YES
Difference in difference	−0.0282	−0.0181	−0.0293
F test: Active 50-Inactive 50 = 0	0.335	0.856	0.490
p value	0.563	0.355	0.484

Robust standard errors clustered at the DHS cluster level in parentheses. All regressions control for marital status dummies, number of children, wealth quintile dummies, and years of education; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

countries are shown in the Appendix (Table A9). For the other countries for which we have data on both active and inactive mining areas (Mali, Malawi, Liberia, and Burkina Faso) there is no statistically significant effect.

4.4. Exploring other mechanisms for heterogeneous effects: Zambia vs. Tanzania

To further explore the heterogeneous effects of mining with regard to domestic violence we take a closer look at two neighboring countries where we find significant differences: Zambia and Tanzania. These two cases are used to shed light on some on the findings in the large-N analysis and contribute to the discussion of potential mechanisms linking mining and domestic violence.

Table 7 shows that in Tanzania the likelihood of experiencing domestic violence is higher in the inactive mining areas than in non-mining areas. This suggests that establishing an industrial mine should in fact reduce the level of domestic violence. On the contrary, in Zambia we see a clear increase of domestic violence when we compare inactive to active mining areas (Table 6). However, there is very little case specific literature focusing on women in mining areas, the vast majority focusing on male miners (Bryceson, Fisher, Jønsson, & Mwaipopo, 2014), and even less related to industrial mining. Thus we draw on the literature

Fig. 3. Abuse last year by mine activity for respondents close to mines in selected countries.

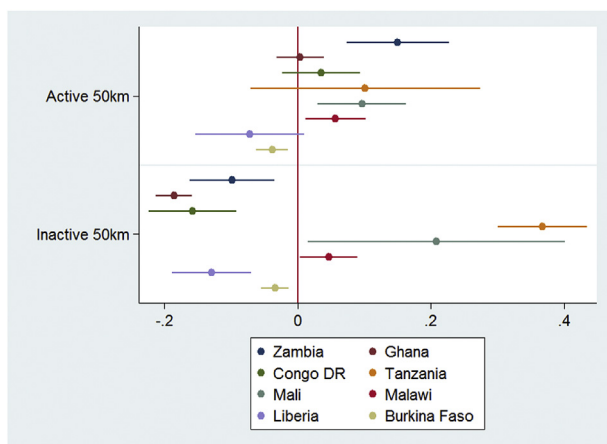discussing mainly ASM mining to inform our discussion.

The map in Fig. 4 overlays the share that experienced domestic violence last year by region with the location of mines in Zambia and Tanzania. The map corresponds well with the results in Tables 6 and 7. In Zambia we see that the areas indicating the highest level of domestic violence is the 'Old Copperbelt' where most of the mines are situated. The 'New Copperbelt' slightly to the east has a lower share of women reporting that they experienced domestic violence last year. In Tanzania on the other hand, the mining areas seem to have relatively low levels of domestic violence.

So, why does mining seem to increase the risk of domestic violence in Zambia whereas the opposite is the case in Tanzania? Revisiting the historical developments of the mining sectors in these two countries can shed some light on this question.

In Zambia the copper production has been an important commodity since the Second World War, and in 1964, copper accounted for 40 percent of GDP, and 93 percent of exports (ISG, 2011). By the 1970s and 1980s the Zambian copper community was well established in the Copperbelt area. However, in the late 2000s the copper prices fell and many workers were laid off. This lead to a decline in welfare within the towns in the Copperbelt and the standard of living went down. Many of the former copper towns became more 'village-like'. Instead there was a development of 'rurban' slums with very little infrastructure surround the new mining sites, often referred to as the 'New Copperbelt', in the Northwestern region, offering less opportunities and more job insecurity (Mususa, 2014). What our data indicate is that the level of violence was higher in the old Copperbelt compared to the New Copperbelt, before industrial mining was established there. This suggests that it is something about the mining as such, and not the area where mines are developed that is related to increased violence towards women.

The economic downturn in the Zambian mining industry resulted in many (male) miners being laid off, and as a result of this the service sector was also harmed by the economic downturn providing fewer employment opportunities for women (Mususa, 2014). On one hand, this change probably led to more women becoming more dependent on men as they lost their job in the service sector. On the other hand, the situation with a lot of unemployed men unable to provide for their families also meant that in many instances the women looked for alternatives ways of earning money. Many women worked on the copper mine dumpsites, jobs that men were less willing to do, to be able to feed the families (Mususa, 2014). This change may have weakened the status of the man as the main breadwinners of the family, and hence created tension and increased levels of DV. While these two mechanisms seem contradictory, we believe that both may happen in the same local context, albeit not simultaneously in the same household. In families where only the women lost her job the first mechanism is relevant, while in cases where the husband lost his job or both the husband and wife lost their jobs due to the closing of a mine, the second mechanism should be superior, as women seem more likely to look for alternative ways of earning income, taking on jobs that men were less willing to do.

In Tanzania there has been goldmining since the 1930s. However, in many areas of the country there was a gold rush around 2000s when new gold ores where discovered, leading to a massive population expansion in these areas. For example, the village of London where they struck gold in 2004, originally had a population of 1,600, but in a few months expanded to a settlement with over 10,000 (Jønnson & Bryceson, 2009). Most of the mining sites were located in remote areas, which all experienced an enormous expansion when the mining started, with lots of young men and women moving from rural to new-urban areas to seek better economic opportunities. Often young men migrated first, and then women followed fairly soon after (Bryceson, 2014; Bryceson et al.,

Table 6
Effects of mine openings in Zambia. 50 km buffer zones.

Variables	(1)	(2)	(3)	(4)
	Abuse last year	Sexual Abuse	Abuse	Acceptance
Active 50	0.150***	0.076***	0.113***	0.099
	(0.039)	(0.013)	(0.042)	(0.076)
Inactive 50	−0.098***	−0.044**	−0.008	0.005
	(0.032)	(0.020)	(0.058)	(0.044)
Observations	4138	4130	4164	6905
R-squared	0.033	0.018	0.024	0.041
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Baseline controls	YES	YES	YES	YES
Difference in difference	0.249	0.120	0.120	0.0946
F test: Active 50-Inactive 50 = 0	31.27	39.18	3.030	1.545
p value	2.03e-07	1.02e-08	0.0849	0.217

Robust standard errors clustered at the DHS cluster level in parentheses. All regressions control for marital status dummies, number of children, wealth quintile dummies, and years of education; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 7
Effects of mine openings in Tanzania. 50 km buffer zones.

Variables	(1)	(2)	(3)	(4)
	Abuse last year	Sexual Abuse	Abuse	Acceptance
Active 50	0.101	0.058	0.123	0.087
	(0.087)	(0.049)	(0.090)	(0.084)
Inactive 50	0.367***	0.171***	0.329***	0.185***
	(0.034)	(0.014)	(0.039)	(0.043)
Observations	5490	5485	5509	9665
R-squared	0.021	0.012	0.036	0.042
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Baseline controls	YES	YES	YES	YES
Difference in difference	−0.266	−0.113	−0.206	−0.0978
F test: Active 50-Inactive 50 = 0	10.48	5.658	6.100	1.678
p value	0.00159	0.0191	0.0150	0.198

Robust standard errors clustered at the DHS cluster level in parentheses. All regressions control for marital status dummies, number of children, wealth quintile dummies, and years of education; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

2014). While these mines are fairly new, in our dataset they are coded as active as most of the DHS surveys were conducted after 2000, thus the positive effect the mine opening had will be attributed to active mines. On the contrary, in Zambia the mines in the New Copperbelt were opened later and thus account for inactive mines.

Like in Zambia, in Tanzania there is the tendency that men mostly work in the mines and women in the service sector. As a result of the expanding mining industry in Tanzania the service sector also enlarged, thus there seems to be more economic opportunity for both men and women in Tanzania compared to Zambia (Bryceson, 2014). This could imply that women in the mining areas in Tanzania are more economically independent than women in Zambian mining areas, and thus more able to leave violent relationships. Based on a study of women working on markets in Tanzania, Vyas, Mbwambo, & Heise (2015) argue that when women have an income this stabilizes the relationship, as the tension around women asking for money is reduced, which in turn reduces the risk of domestic violence.

Over the last decades the evolvement of the mining industries in Tanzania and Zambia have taken different paths, related to the declining copper prices in Zambia versus the (new) gold rush in Tanzania. These differences have in turn seemingly affected the way the mining societies in the two countries have developed. The main difference between the two countries seems to be that the establishment of new mining sites in Tanzania was associated with a fresh start and optimism, bringing economic opportunities to both men and women, while in Zambia the mining sector has been characterized by economic downsizing, unemployment and insecurity. This in turn may have led to more domestic violence in the mining areas in Zambia and less so in the mining areas in Tanzania.

Another important difference is that the level of acceptance of wife beating in the two countries is substantially different. In Zambia 62 percent of the interviewed women accepted wife beating, while in Tanzania 'only' 48 percent of the women accept wife beating. While both of these numbers are alarmingly high, they also suggest that there are differences in the prevailing norms between the two countries.

5. Conclusion

The expanding extractive industry in Africa can be a positive driver of the economy and the structural change from subsistence farming to cash economies may bring optimism and hopes of a better future for millions of people. At the same time mining is often associated with negative consequences, such as increased levels of violence against women, including domestic violence, one of the world's most pervasive human rights violations. Establishing the prevalence and the associated patterns of the risk of domestic violence is essential to addressing women's health and development in general. The current study provides the first systematic test of the direct effect of industrial mining on partner abuse.
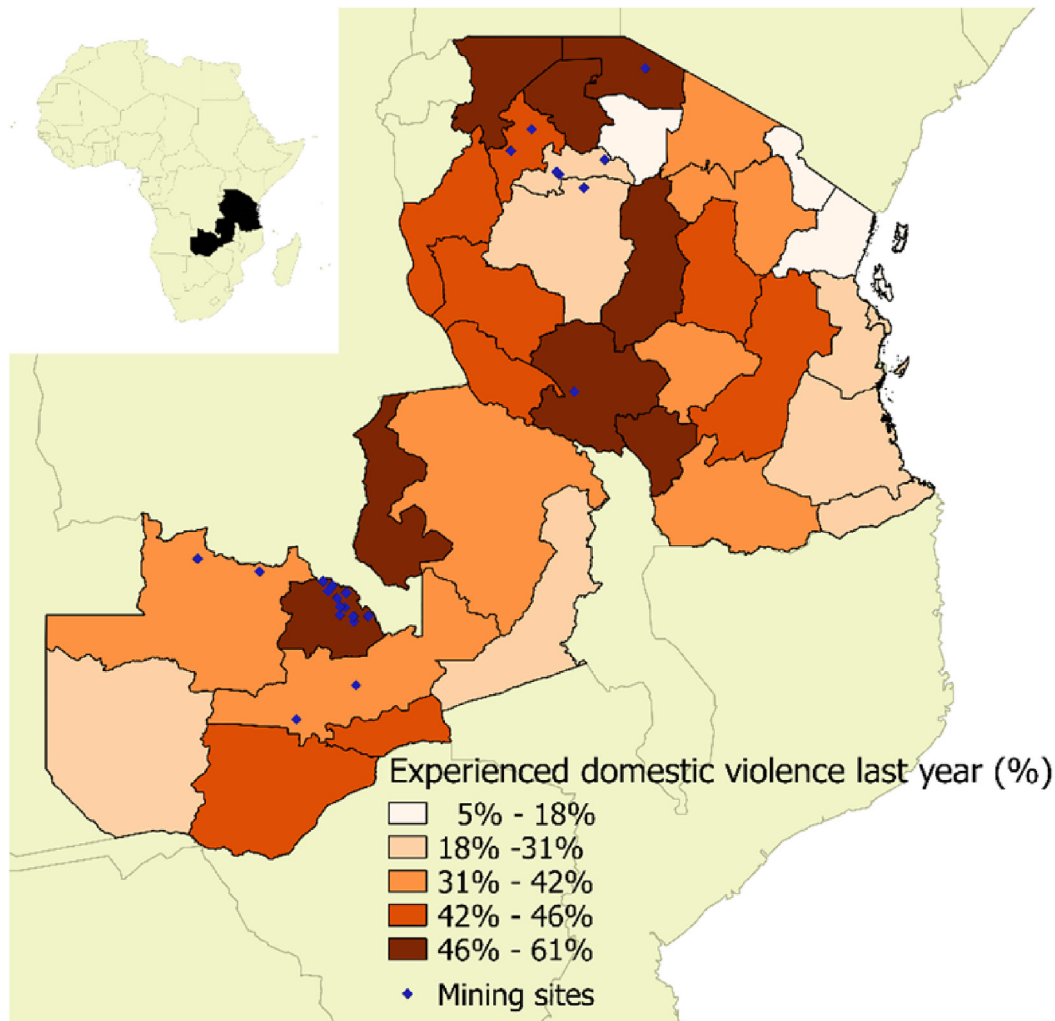
Fig. 4. Domestic violence and mining locations in Tanzania and Zambia.

Linking detailed data on the location and production of mines in sub-Saharan Africa with micro-level survey data on exposure to domestic violence we explore whether living close to an active mine increases a women's risk of experiencing violence by her intimate partner. Using a difference-in-difference strategy comparing the effect of active vs. inactive mines on domestic violence we find no effect of mine openings on domestic violence. However, there seems to be strong heterogeneity of the effects. In particular, mining seems to have particularly strong effects on domestic violence in areas where such abuse is widely accepted. Furthermore, we find clear differences in effects across countries.

In order to further explore potential mechanisms accounting for this heterogeneity we took a closer look at the cases of Zambia and Tanzania, two countries with opposing effects of mining on domestic violence. These cases studies suggest that mining is more likely to result in domestic violence in settings of a downsized mining sector and resulting grievances, such as in Zambia, as opposed to mine openings in Tanzania, which are associated with the more recent gold rush and a generally more optimistic outlook and less traditional life style. Further, we also see that the acceptance of wife abuse is much higher in Zambia than in Tanzania, which also concurs with the findings in the large-N analysis.

Our study is a first test of the total effects of industrial mining on domestic abuse in different settings. We strongly urge future studies to investigate the causal pathways of our findings. Future studies should pay more attention to the diversity of the mining sector, and look into the violence potential of different types of mining resources. Furthermore, it is not certain that other types of structural changes would have the same effects, or even other types of natural resources (in particular oil).

Acknowledgements

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.polgeo.2016.11.004.

References

African Development Bank. (2012). *Mining industry prospects in Africa*. http://www.afdb.org/en/blogs/afdb-championing-inclusive-growth-across-africa/post/

mining-industry-prospects-in-africa-10177/ Accessed 30.09.16.

Atkinson, M. P., Greenstein, T. N., & Lang, M. M. (2005). For women, breadwinning can be dangerous: Gendered resource theory and wife abuse. *Journal of Marriage and Family, 67*(5), 1137−1148.

Baaz, M. E., & Stern, M. (2009). Why do soldiers rape? Masculinity, violence, and sexuality in the armed forces in the Congo (DRC). *International Studies Quarterly, 53*(2), 495−518.

Blood, R. O., & Wolfe, D. M. (1960). *Husbands and wives*. Glencoe, IL: Free Press.

Bryceson, D. F. (2014). *Youth in Tanzania's urbanizing mining settlements: Prospecting a mineralized future*. WIDER Working Paper, No. 2014/008.

Bryceson, D. F., Fisher, E., Jønsson, J. B., & Mwaipopo, R. (2014). *Mining and social transformation in Africa: Mineralizing and democratizing trends in artisanal production*. New York: Routledge.

Buhaug, H., & Rød, J. K. (2006). Local determinants of African civil wars, 1970−2001. *Political Geography, 25*(3), 315−335.

Choi, S. Y. P., & Ting, K.-F. (2008). Wife beating in South Africa: An imbalance theory of resources and power. *Journal of Interpersonal Violence, 23*(6), 834−852.

Clark, C. J., Everson-Rose, S. A., Suglia, S. F., Btoush, R., Alonso, A., & Haj-Yahia, M. M. (2010). Association between exposure to political violence and intimate-partner violence in the occupied palestinian Territory: A cross-sectional study. *Lancet, 375*(9711), 310−316.

Cools, S., Flatø, M., & Kotsadam, A. (2016). *Weather shocks and violence against women in sub-Saharan Africa*. https://andreaskotsadam.files.wordpress.com/2012/02/weather-and-violence-august-2016.pdf Accessed 29.09.16.

Cools, S., & Kotsadam, A. (2015). *Resources and domestic violence in sub-Saharan Africa*. https://andreaskotsadam.files.wordpress.com/2012/02/resources-and-intimate-partner-violence.pdf Accessed 29.09.16.

Eftimie, A., Heller, K., & Strongman, J. (2009). *Gender dimensions of the extractive industries: Mining for equity*. Working paper, Extractive Industries and Development Series #8. World Bank.

Enloe, C. H. (2000). *Bananas, beaches and bases: Making feminist sense of international politics*. London/Berkeley, CA: University of California Press.

Fluri, J. L. (2015). Feminist political geography. In J. Agnew, V. Mamadouh, A. J. Secor, & J. Sharp (Eds.), *The Wiley blackwell companion to political geography* (pp. 235−247). Oxford: John Wiley & Sons.

Garcia-Moreno, C., Jansen, H. A. F. M., Ellsberg, M., Heise, L., & Watts, C. H. (2006). Prevalence of intimate partner violence: Findings from the WHO multi-country study on women's health and domestic violence. *Lancet, 368*(9543), 1260−1269.

Giles, W., & Hyndman, J. (Eds.). (2004). *Sites of violence: Gender and conflict zones*. Berkeley, CA/London: University of California Press.

Goode, W. (1971). Force and violence in the family. *Journal of Marriage and the Family, 33*(4), 624−636.

Heise, L., & Kotsadam, A. (2015). Cross-national and multilevel correlates of partner violence: An analysis of data from population-based surveys. *Lancet Global Health, 3*(6), e322−340.

Hinton, J. J. (2006). *Communities and small scale mining: An integrated review for development planning*. Washington, DC: World Bank.

Hornung, C., McCullough, C., & Sugimoto, T. (1981). Status relationships in marriage: Risk factors in spouse abuse. *Journal of Marriage and the Family, 43*(3), 679−692.

Hume, M. (2008). The myths of violence: Gender, conflict, and community in El Salvador. *Latin American Perspectives, 35*(5), 59−76.

Hyndman, J. (2004). Mind the gap: Bridging feminist and political geography through geopolitics. *Political Geography, 23*(3), 307−322.

ILO. (2007). Girls in mining: Research findings from Ghana, Niger, Peru, and United Republic of Tanzania. Working paper. In *Bureau for gender equality, international programme on the elimination of child labour, ILO* http://www.ilo.org/public/portugue/region/eurpro/lisbon/pdf/girlsmining.pdfkim Accessed 29.09.16.

ISG (International Study Group). (2011). *Minerals and Africa's development: The International Study Group Report on Africa's Mineral Regimes*. Addis Ababa: United Nations Economic Commission for Africa.

Jenkins, K. (2014). Women, mining and development: An emerging research agenda. *Extractive Industries and Society, 1*(2), 329−339.

Jewkes, R. (2002). Intimate partner violence: Causes and prevention. *Lancet, 359*(9315), 1423−1429.

Jønsson, J. B., & Bryceson, D. F. (2009). Rushing for gold: Mobility and small-scale mining in East Africa. *Development and Change, 40*(2), 249−279.

Kishor, S. (2005). *Domestic violence measurement in the demographic and health surveys: The history and the challenges*. Technical report, United Nations Expert Paper 1−9.

Knutsen, C. H., Kotsadam, A., Olsen, E. H., & Wig, T. (2016). Mining and local corruption in Africa. *American Journal of Political Science*. http://dx.doi.org/10.1111/ajps.12268. forthcoming.

Kotsadam, A., & Tolonen, A. (2016). African mining, gender, and local employment. *World Development, 83*, 325−339.

Krishnan, S., Rocca, C. H., Hubbard, A. E., Subbiah, K., Edmeades, J., & Padian, N. S. (2010). Do changes in spousal employment status lead to domestic violence? Insights from a prospective study in Bangalore, India. *Social Science & Medicine, 70*(1), 136−143.

Lahiri-Dutt, K., & Macintyre, M. (2006). *Women miners in developing countries: Pit women and others*. Aldershot: Ashgate Publishing.

McCloskey, L. A., Williams, C., & Larsen, U. (2005). Gender inequality and intimate partner violence among women in Moshi, Tanzania. *International Family Planning Perspectives, 31*(3), 124−130.

Mehlum, H., Moene, K. O., & Torvik, R. (2006). Institutions and the resource curse. *Economic Journal, 116*, 1−20.

Mususa, P. N. (2014). *There used to be order: Life on the copperbelt after the privatization of the Zambia consolidated copper mines*. PhD thesis. University of Cape Town.

Norris, P. (2009). Petroleum patriarchy? A response to Ross. *Politics & Gender, 5*(4), 553−560.

Østby, G. (2016). *Violence begets violence: Armed conflict and domestic sexual violence in sub-Saharan Africa*. HiCN Working Paper 233 http://www.hicn.org/wordpress/wp-content/uploads/2012/06/HiCN-WP-233.pdf Accessed 30.09.16.

Pain, R. (2015). Intimate war. *Political Geography, 44*(1), 64−73.

Palermo, T., Bleck, J., & Peterman, A. (2014). Tip of the iceberg: Reporting and gender-based violence in developing countries. *American Journal of Epidemiology, 179*(5), 602−612.

Perks, R. (2011). Towards a post-conflict transition: Women and artisanal mining in the Democratic Republic of Congo. In K. Lahiri-Dutt (Ed.), *Gendering the field: Towards sustainable livelihoods for mining communities* (pp. 177−195). Canberra: Australian National University E Press.

Ramutsindela, M. (2013). Violent political and economic geographies of mining. Guest Editorial. *Political Geography, 33*(1), A1−A2.

Ross, M. (2008). Oil, islam, and women. *American Political Science Review, 102*(1), 107−123.

Ross, M. (2009). Does oil wealth hurt women? A reply to Caraway, Charrad, Kang and Norris. *Politics & Gender, 5*(4), 575−582.

Ross, M. (2012). *The oil curse: How petroleum wealth shapes the development of nations*. Princeton/Oxford: Princeton University Press.

Ross, M. (2015). What have we learned about the resource curse? *Annual Review of Political Science, 18*, 239−259.

Rustad, S. A., Østby, G., & Nordås, R. (2016). Artisanal mining, conflict, and sexual violence in Eastern DRC. *Extractive Industries and Society, 3*(2), 475−484.

SNL Metals and Mining. (2014). *Raw Materials database*. http://www.snl.com/Sectors/metalsmining/Default.aspx Accessed 30.09.16.

Tauchen, H. V., Witte, A. D., & Long, S. K. (1991). *Domestic violence: A non-random affair* (pp. 1−37). National Bureau of Economic Research. Working Paper Series 1665.

Tolonen, A. (2016). *The non-persistence of gender norms: Evidence from Africa's extractive industries*. Mimeo Barnard College, Columbia University.

True, J. (2012). *The political economy of violence against women*. Oxford: Oxford University Press.

Vyas, S., Mbwambo, J., & Heise, L. (2015). Women's paid work and intimate partner violence: Insights from Tanzania. *Feminist Economics, 21*(1), 35−58.

Vyas, S., & Watts, C. (2009). How does economic empowerment affect women's risk of intimate partner violence in low and middle income countries? A systematic review of published evidence. *Journal of International Development, 21*(5), 577−602.

Wise, H., & Shtylla, S. (2007). *The role of the extractive sector in expanding economic opportunity*. Corporate Social Responsibility Initiative Report No.18. Cambridge, MA: Kennedy School of Government, Harvard University.

World Bank. (2015). *Extractive industries: Overview*. http://www.worldbank.org/en/topic/extractiveindustries/overview Accessed 30.09.16.