Artisanal Mining, Female Empowerment, and Intimate Partner Violence*

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Abstract

This paper investigates the impacts of artisanal gold mining—the primary form of labor-intensive small-scale mining with hand tools—on intimate partner violence (IPV) against women in Sub-Saharan Africa, where female artisanal miners constitute a significant portion of the workforce. Exploiting cell-level spatial variation in gold suitability and an exogenous variation in international gold price for identification, we estimate the causal effects of artisanal gold mining conditional on industrial gold mining and other environmental factors. Based on nationally representative data covering over 30 countries from the region, we find that moderately severe physical IPV that are experienced less frequently by women decreases mainly due to improvement in women's bargaining power enhanced by an increase in their earning potential from extractive and sales or retail activities relative to husbands in response to the increased profitability of artisanal mining. The IPV-reducing short-run effects of artisanal gold mining, which are opposite from the impacts of industrial gold mining, tend to persist in the long term as its driving forces sustain over time. However, sexual IPV generally increases due to artisanal and industrial gold mining.

Keywords: gold mining, intrahousehold bargaining power, domestic violence, female labor supply

JEL Codes: D12, J16, O13, O55, Q32

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1 Introduction

Artisanal mining, a small-scale and labor-intensive form of natural resource extraction, directly and indirectly, provides at least 134 million jobs globally (World Bank, 2020), and supports the livelihood of 130-270 million people in more than 80 countries, most of which are in Africa (Girard et al., 2023).[1] Despite this widespread activity of artisanal mining, the existing studies focus on large-scale and capital-intensive industrial mining at the macro (Frankel, 2012; Sachs and Warner, 2001) and micro (Aragón and Rud, 2013; Kotsadam and Tolonen, 2016; Berman et al., 2017; Fafchamps et al., 2017; Benshaul-Tolonen, 2019) levels mainly due to limitation of granular-level data on artisanal mining. Due to recently collected data on artisanal mining and mining suitability, a few recent papers study the micro-level economic and environmental effects of small-scale artisanal mining (Bazillier and Girard, 2020; Sánchez De La Sierra, 2020; Girard et al., 2023). However, the impacts of artisanal mining on women's intrahousehold bargaining power, their autonomy in household decision-making, and, thus, intimate partner violence towards them have not been investigated yet, although female miners constitute a significant portion of the artisanal mining workforce.[2]

In this paper, we thus fill the gap in the literature by providing a continent-wide analysis of the causal effects of artisanal gold mining—the main form of artisanal mining—on women's intrahousehold bargaining power and intimate partner violence (IPV) against women in Africa. Specifically, we estimate the impacts of artisanal gold mining on IPV against women, which relate to women's bargaining power in the household, in over 30 countries from Sub-Saharan Africa that lead the world in terms of IPV.[3] First, we investigate the effects of artisanal gold mining (ASgM) on different types of IPV, including severe and less severe physical IPV and sexual violence and IPVs with different frequencies. Second, we investigate the potential mechanisms through which artisanal gold mining affects IPV by considering various individual- and household-level secondary

[1] Globally, more than one-fourth of the mining workforce is directly engaged in artisanal mining, which employs women more intensively than "traditional" industrial mining. Around 30% of the global artisanal mining workforce are women (Hinton et al., 2003), while 8-17% of the world's miners are women (Ellix et al., 2021). The share of women artisanal miners in Africa is the highest in the world at 40-50% of artisanal mining workforce (ASM Inventory, 2022; Eshun, 2020). Therefore, developments in the labor-intensive artisanal mining industry that extensively employs women are likely directly related to women globally and in Africa. A study in Burkina Faso shows that artisanal mines attract young girls and women as a source of social and economic independence, thus leading to different lifestyles and greater empowerment (Werthmann, 2009).

[2] The relationship between extractive industries and women's welfare, as well as gender equality in general, has been well documented in the literature (see Baum and Benshaul-Tolonen, 2021, for a detailed review). Those studies tend to either focus on industrial mining due to more readily available data to establish a credible identification strategy (e.g., Benshaul-Tolonen, 2024; Kotsadam et al., 2017; Kotsadam and Tolonen, 2016), or only focus on artisanal mining within a specific country (e.g., Rustad et al. (2016) in the Democratic Republic of the Congo, Werthmann (2009) in Burkina Faso, or Guimbeau et al. (2023) in India). None of them has conducted a rigorous study to establish a causal relationship between artisanal mining and women's welfare across the African continent.

[3] According to the World Health Organization, about one-fifth of women in Sub-Saharan Africa (SSA) experienced physical or sexual violence by their husbands or partners in the last 12 months, on average, between 2000 and 2018, and it is highest worldwide. Therefore, SSA is the ideal context to study the impact of mining shock on intimate partner violence.

outcomes, including several measures of women's intrahousehold bargaining power, gender- and industry-specific employment or economic activities, household wealth, and migration patterns.

We use nationally representative household surveys to estimate the effects of artisanal gold mining on IPV and examine the underlying channels. In particular, we use household- and individual-country-year level repeated cross-sectional data from the Demographic and Health Survey (DHS) of over 30 countries in Sub-Saharan Africa. Our individual-level datasets on IPV with individual and household characteristics allow us to control for determinants of IPV at the granular level and provide flexibility to conduct heterogeneity analysis at individual and household levels. We also use spatial information on gold suitability at the most granular possible grid cell level throughout Africa and international gold prices varying over time, which introduces temporal variation in ASgM.

Identifying the causal impact of artisanal gold mining (ASgM) on IPV is challenging since the mining activities are endogenous due to omitted variables bias and simultaneity bias. In terms of simultaneity bias due to reverse causality in the IPV regression, ASgM could reduce IPV against women due to increased women's labor supply, which might increase women's empowerment, making the ASgM region more attractive to women and thus creating more extractive activities at artisanal gold mines. Regarding omitted variables bias, some other unobserved characteristics can lead to heterogeneous trends across individuals living in areas with different suitability for gold mining. Such unobserved characteristics will be captured in the error term confounding with our measure of artisanal gold mining activities. We exploit spatial and temporal variations exogenous to the household's actions to get around these challenges and identify causal effects (Girard et al., 2023). First, leveraging granular-level spatial information on gold suitability, we control for fixed effects of widely used PRIO cells of 0.5×0.5 degrees or about 55×55 kilometers at the equator in addition to time-varying characteristics of individuals and households. Second, we use a temporal variation in ASgM generated from changes in international gold prices that are exogenous to potential revenues from ASgM activities. The potential revenue from ASgM directly depends on world prices of gold; however, local artisanal miners cannot affect the world price as they are small-scale and price-takers and follow the global market (Sánchez De La Sierra, 2020).

This study contributes to several strands of literature. First, we primarily contribute to the literature studying intimate partner violence (IPV). The literature suggests that women's empowerment and improvement in their economic conditions have ambiguous effects on IPV against them. Women's better employment opportunities and earning potential relative to husbands expand their outside options and enhance their intrahousehold bargaining power, which translates into a reduction in IPV against them (Farmer and Tiefenthaler, 1996; Stevenson and Wolfers, 2006; Anderberg et al., 2016). However, women's empowerment can have a backlash effect if husbands want to regain their intrahousehold power, leading to an increase in IPV (Bloch and Rao, 2002; Bobonis et al., 2013; Erten and Keskin, 2021; Field et al., 2021). Hence, the impact of artisanal gold mining, an industry where almost half of the workforce consists of women in Africa (Eshun, 2020), on IPV is an empirical question. No study has examined the effects of ASgM on women's empowerment and

intrahousehold bargaining power. Our paper is, therefore, the first to provide evidence on the impact of artisanal mining on the prevalence of intimate partner violence in the context of gold mining. Not only is this study the pioneer in linking ASgM and domestic violence, but the small-scale artisanal mining that we investigate in this paper also enables us to exploit a more compelling identification strategy to precisely estimate the causal impact and contribute to the literature on the mining-IPV relationship in general (Guimbeau et al., 2023). Our results suggest that less severe physical IPVs that have been experienced sometimes decrease in gold-suitable areas when the international gold price increases, potentially due to women's increased intrahousehold bargaining power through increased employment in mining and sales industries and subsequent rise in women's earnings. It implies that the bargaining power mechanism dominates the channel via a potential backlash effect in Sub-Saharan Africa[4] However, the incidence of women forced into unwanted sexual acts other than sex contemporaneously increases to a positive ASgM shock.

Second, our work is related to the literature that examines the economic impacts of mining by disentangling the micro effects of capital-intensive large-scale industrial mining and labor-intensive small-scale artisanal mining. The effects of industrial gold mines on structural transformation and sectoral shift in employment (Aragón and Rud, 2013; Kotsadam and Tolonen, 2016; Fafchamps et al., 2017), male and female employment (Kotsadam and Tolonen, 2016; Santos, 2018), and intimate partner violence (Guimbeau et al., 2023) are well documented in the existing studies. However, a few recent studies examine the heterogeneous micro effects of industrial and artisanal mining on deforestation and industry-specific employment in Sub-Saharan Africa (Girard et al., 2023), gender- and industry-specific employment in Liberia (Gräser, 2023), and violent conflicts in Africa (Rigterink et al., 2025). However, no study has estimated the heterogeneous effects of artisanal and industrial mining. Leveraging data on industrial gold mines combined with our unique data on gold suitability, we thus contribute the mining literature by distinguishing the impacts of artisanal and industrial mining on IPV. Interestingly and intuitively, industrial mining generally has the opposite effect on domestic violence towards women, i.e., industrial mining increases overall and less severe physical IPVs. Industrial mining also has positive effects on sexual IPVs, and the impacts are more significant than those of artisanal gold mining.[5]

Third, we provide new insights into the dynamic effects in the long run or persistence of contemporaneous impacts of a mining boom. We are unaware of any study that documents how mining,

[4]In a supplementary analysis, we found an increase in women's intrahousehold decision-making due to increasing potential employment opportunities from ASgM, indicating an improvement in women's relative bargaining power. However, we found no impact of ASgM on their attitude toward domestic violence, and we also found that household wealth is not the primary channel leading to a reduction in IPV.

[5]The results from estimating the heterogeneous effects of artisanal and industrial gold mining on our secondary outcomes that shed light on the underlying mechanisms of IPV effects suggest that individuals shift from agricultural to extractive activities when extractive activities become more profitable due to a rise in gold prices. Women's labor supply in the sales or retail industry weakly increases, indicating a potential increase in aggregate demand, which is consistent with a positive impact of ASgM on household wealth. These findings suggest a potential structural transformation in the economy in response to artisanal gold mining shock in the short term. However, industrial gold mining does not affect the economic activities conditional on artisanal gold mining.

particularly artisanal gold mining, affects IPV outcomes in the long term. We examine whether the current shock has a long-lasting impact by utilizing our source of temporal variation, or international gold price, at different periods in the past. Our analysis shows declines in IPVs, especially less severe physical IPVs with less frequency, tend to persist over time as female employment in the mining industry sustains in the long run due to increased profitability of ASgM. We also find that the null effect of ASgM on severe physical violence in the short run goes down to below zero in the long term. Additionally, we provide some suggestive evidence that the null effect of ASgM on sexual IPV tends to become positive in the long run.

The rest of the paper is structured as follows. Section 2 discusses a conceptual framework. Section 3 provides background on artisanal gold mining (ASgM), female labor supply, and IPV in Sub-Saharan Africa. Section 4 describes the data and descriptive statistics. Section 5 presents the empirical approach for identifying the causal impacts of the ASgM on employment and intimate partner violence. Section 6 discusses the results and potential mechanisms, while Section 7 presents robustness checks of our main findings on IPV and employment responses. Finally, Section 8 concludes.

2 Conceptual Framework

This section discusses theoretical frameworks to conceptually think about the effects of natural resource shock on intimate partner violence (IPV) against women under each of the two sources of variation: (i) for individuals living in cells with different levels of gold suitability and (ii) for those being available to work at artisanal gold mines in periods of high and low gold prices.

Before discussing the theoretical concepts on the relationship between mining and IPV against women, it is natural to consider the theoretical links between mining and "first-stage" outcomes that are directly associated with the mining shock, such as individuals' economic activities or employment in the extractive industry, that have further implications on women's likelihood of experiencing IPV. Each woman decides the amount of her work depending on her and her husband's wage (defined as the value of their work, not necessarily the actual market wage), household income, and other factors such as time and risk preferences. As ASgM tends to be labor intensive and less heavy than industrial mining, local growth in mining activities spurred by the discovery of a gold mine and an increase in international gold price entails *a priori* ambiguous effects on female labor supply. First, it can trigger a substitution effect that induces more women to join the mining sector from inactivity or traditional agriculture due to the higher opportunity cost of these activities. Moreover, the local multiplier effect could reinforce female labor response through reallocation to services and trade sector (Moretti, 2010). However, such increased demand for intermediate goods and services coexisting with mining production is likely negligible for ASgM as opposed to ISgM.[6] But the in-

[6]Opportunities for indirect employment in services and sales industries can increase as shown by Kotsadam and

direct employment effect of ASgM could be mainly through the increased total demand. Second, increasing returns to mining employment might reduce a woman's labor supply if the income effect dominates and women's leisure is a normal good. The income effect of the gold price can also be manifested through changes in her husband's income or changes in aggregate income pooled from the household members. In addition, although women consist of 40-50% of the artisanal mining workforce (ASM Inventory, 2022), mining communities are still related to the "hyper-masculine" subculture where women are substantially subject to sexual abuse by outsiders or even transactional sex (Rustad et al., 2016), thereby deterring women's labor supply through the fear channel (Siddique, 2022).[7]

The existing studies and theoretical concepts on IPV suggest that improvements in women's economic conditions and women empowerment have *a priori* ambiguous impacts on domestic violence against women. On the one hand, a decrease in a woman's labor supply due to the above would make her economically dependent on her husband, reducing her intrahousehold bargaining power and potentially increasing IPV. The opposite case applies if the ASgM boom increases a woman's employment opportunities and income relative to her husband, thus increasing her access to resources and expanding her outside options, which leads to a decline in IPV against women (Farmer and Tiefenthaler, 1996; Stevenson and Wolfers, 2006; Aizer, 2010; Hidrobo and Fernald, 2013; Anderberg et al., 2016).[8] On the other hand, even an improvement in female job opportunities can backfire if their partners do not want them to work or it challenges the prevailing masculinity norm (Field et al., 2021; Bhalotra et al., 2021; Rustad et al., 2016). Even if husbands want their wives to work, instrumental theories of violence suggest that an increase in the probability of female employment and resulting improvement in women's bargaining power and outside options could lead to more IPV by their husbands, who might use violence as an instrument of gaining their control over decision-making within the family (Bloch and Rao, 2002; Bobonis et al., 2013; Erten and Keskin, 2018, 2021). In addition, a strong masculinity subculture of a mining community might make women more tolerant towards domestic violence and likely increase IPV. However, the association between one's attitude to domestic violence and her experience of IPV is still unclear (Benshaul-Tolonen, 2024).

Tolonen (2016), Santos (2018) and Benshaul-Tolonen (2024) for ISgM. An empirical analysis for ASgM-induced sectoral reallocation is scant, except for Bazillier and Girard (2020), who suggested that households could take advantage of a boom in ASgM by catering to the miners' demand for goods and services.

[7] Sexual violence can be used strategically by the dominating armed force to gain control over valuable resources or to efficiently tax local populations on their mining production (Rustad et al., 2016; Fourati et al., 2022).

[8] Besides a direct change among the mining community's residence, a study by Benshaul-Tolonen (2024) also proposed a transmission channel of a new gender perspective from female migrants, who are more open and less tolerant towards domestic violence.

3 Background

In this section, we provide background on artisanal gold mining (ASgM) and intimate partner violence (IPV) in our context, Sub-Saharan Africa.

3.1 Artisanal Gold Mining in Africa

It is well-known that the continent of Africa is rich in mineral resources. The extraction and exploitation of mineral resources in Africa have also been increasing due to growing exploration activities in the region as there are many untapped reserves (Banerjee et al., 2015). Many African countries are highly dependent on mineral exports because of the abundance of these resources. In particular, 42 out of 54 African countries are characterized as resource-dependent, with 18 classified as dependent on non-fuel minerals. Africa produces more than 60 types of metals and mineral products, while it is assumed to have diamonds. There are several other minerals that the region hosts, including vanadium, manganese, platinum, cobalt, and gold. For example, Africa generates about 20% of the world's gold production, and Ghana and South Africa dominate the gold production within the continent (Signé and Johnson, 2021).

Although artisanal mining plays a central role in many individuals' lives and is largely prevalent in the region, the socio-economic implications of mining in Africa have been overlooked, mainly because data on mining is limited to industrial mining. Fortunately, Girard et al. (2023) propose a new measure of artisanal gold mining (ASgM) throughout Africa, enabling us to draw a clear and complete picture of small-scaled ASgM across the whole continent. We provide more details about the gold suitability data in the next section. As shown in Figure 1a, almost one-fifth or specifically 18% of the surface of the continent is suitable for gold and thus ASgM. In Figure 1b, we divide Africa into 10,628 grid cells of 0.5×0.5 degree or about 55×55 kilometers at the Equator (Tollefsen et al., 2012) and plot the share of each cell which overlaps with ASgM suitable bedrocks.

3.2 Intimate Partner Violence in Sub-Saharan Africa

A simple pairwise correlation between gold mining and intimate partner violence (IPV), shown in Column (1) of Table 1, indicates that IPV is positively associated with gold suitability. However, the positive correlation with IPV incidences that happen often is much smaller in magnitude. It indicates that such violent behavior is likely not driven by economic outcomes. As shown in Figure 2, IPV incidences are concentrated in Central Africa, and mild or less severe incidences of physical IPV are much more prevalent than severe physical IPV and sexual IPV, which also tend to be concentrated in the central region.

4 Data

For our empirical analysis, we combine three data sets for most African countries: Demographic and Health Surveys (DHS) for Sub-Saharan Africa, information on suitability of areas for gold mining, and gold prices in the international market over time. First, the DHS data for all countries of Sub-Saharan Africa provide individual-level repeated cross-section on the main outcome variable of women's experience of different types of intimate partner violence (IPV) by husband or partner with different frequencies and secondary outcomes that we use to examine the underlying potential mechanisms.[9] Second, geological information on gold suitability covering the entire African continent provides spatial variation in our key explanatory variable, artisanal gold mining (ASgM). Third, time-varying information on international gold prices provides temporal variation in ASgM, enabling us to capture the evolution of the number of people involved in ASgM and the revenues they collect from such activities over time.[10]

4.1 Intimate Partner Violence

The main outcome we investigate in this paper is intimate partner violence (IPV) against women by husbands or partners. The existing studies suggest that changes that strengthen women economically, e.g., via improving employment opportunities, could have significant but nuanced impacts on IPV as discussed in the previous section (see, for example, Aizer, 2010; Bloch and Rao, 2002; Field et al., 2021; Erten and Keskin, 2021).

The DHS data provide information on different types of IPV experienced by the respondent or the woman, including severe physical violence, less severe physical violence, and sexual violence. We can further disaggregate these three aggregate types of IPV. First, less severe physical violence acts include whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, and (iv) had her arm twisted or hair pulled. Second, severe physical violence acts include whether a woman has been (i)-kicked or dragged, (ii)-strangled or burnt, and (iii)-threatened with a knife/gun or another weapon. Finally, sexual violence acts include whether a woman has been (i)-physically forced into unwanted sex, (ii)-forced into other unwanted sexual acts, and (iii)-physically forced to perform sexual acts the respondent didn't want to. We also examine these detailed types of IPV as the data set allows.

The DHS surveys also report IPV at the extensive margin in different periods (whether a woman ever experienced IPV in her life, before the past 12 months, and in the last 12 months) and the intensive margin (the frequency of IPV over the past 12 months). We have focused on IPV in the

[9] In Online Appendix A.1, we provide details on our secondary outcomes that we consider in addition to our primary outcome of IPV, including gender- and industry-specific labor supply and economic activities, household wealth, attitude to domestic violence, barriers to health care access, intrahousehold decision making, and migration.

[10] Refer to Appendix Table B.1 for a detailed list of the DHS rounds used in the analysis and the availability of our outcome variables in each round.

past 12 months at the extensive and intensive margins. Specifically, the data inform about IPV (i) sometimes and (ii) often experienced by a woman in the past year, allowing us to investigate how ASgM shock impacts extreme and less extreme violent behaviors.

4.2 Gold Mining

We use geographic information on gold suitability throughout Africa obtained from Girard et al. (2023), who identified bedrocks suitable for gold. Like Girard et al. (2023), we match the coordinates of the gold bedrock polygons to the PRIO-GRID 0.5×0.5 degrees cells and define dummy and continuous measures for each cell's gold suitability.[11] The dummy variable takes a value of 1 if a cell overlaps with a gold bedrock polygon and 0 otherwise. To construct the continuous measure of gold suitability, we calculate the share of overlapping area between the cell and gold bedrock. This measure takes continuous values between 0 (non-overlapping) and 1 (entirely overlapping), implying that a cell's gold suitability can range from totally to partially and entirely suitable.

We match these two measures of gold suitability to the DHS surveys by cells. We first determine the cell in which each DHS cluster lies and then use that information to match the gold suitability data with the DHS data at the cell level. The GPS coordinates of DHS clusters or primary sampling units (PSU) are randomly displaced by up to 2 kilometers for urban, and up to 5 kilometers for rural areas with a further displacement of 10 kilometers for 1% of the rural clusters. The displacement of DHS clusters can attenuate our estimates, but it should not bias our results as the displacement is random.

Industrial Gold Mining. Since industrial mining is also suitable in those gold-suitable cells, it is crucial to control industrial gold mining (ISgM) to isolate the impact of artisanal gold mining (ASgM) from that of ISgM. Hence, the effect of gold suitability will be the effect of ASgM on our outcomes after conditioning on ISgM in our regressions. For an area to be suitable for large-scale industrial mines, the concentration of gold deposits has to be high enough for the industrial mines that require a substantial investment to be profitable (Benshaul-Tolonen, 2019; Bazillier and Girard, 2020). We use data on industrial mining throughout Africa obtained from Berman et al. (2017), which comes from Raw Material Data (RMD, IntierraRMG). Berman et al. (2017) made their data on active mining areas and the type of minerals they produce available at the PRIO-Grid cells of 0.5×0.5 degrees between 1997 and 2010. The variable we use in our baseline analysis is a dummy variable indicating whether a cell has industrial mines of gold. Since the data on industrial mines, including gold mines, were only available until 2010, we kept cells with and without industrial mines constant for the periods since 2010 at the state the latest period available, assuming that the spatial distribution of industrial mines remains the same. Appendix Figure B.1 presents the distribution of industrial gold mines in Africa across PRIO-Grid cells, showing that (i) industrial gold mines concentrate in the south, and (ii) the spatial distribution of industrial gold mines hardly

[11] A 0.5×0.5 degrees cell is about 55×55 kilometers at the equator (Tollefsen et al., 2012).

changes over time until 2010. Therefore, it is reasonable to assume that the distribution of industrial gold mines across space has remained the same since 2010.[12,13]

4.3 International Gold Price

Similar to Girard et al. (2023), we introduce temporal variation in gold suitability measures defined at the cell level for a given year based on the international gold price. Introducing temporal variation in gold suitability measures is critical as it enables us to capture the changing nature of revenue from ASgM and employment at ASgM sites.

International gold price is exogenous to local gold mining activities as those small-scale artisanal gold miners are price takers in the global market. But, as the local gold price strongly correlates with the international price (Sánchez De La Sierra, 2020), the international gold price is highly relevant to ASgM activities at extensive and intensive margins. On the extensive margin, the opportunity cost of non-mining increases as the gold price increases. Then, ASgM becomes more profitable and attractive, leading to the start of gold-digging and exploring new sites. On the intensive margin, miners dig more by increasing their efforts at the existing artisanal gold mines to utilize the high price.

The yearly international gold price comes from the World Bank Commodity Price Data (Pink Sheet). Figure 3 illustrates the time evolution of gold prices in the international market between 1990-2019. Gold value increased substantially after 2005, peaked in 2012, and then slightly dropped. In the baseline analysis, we will use a 1-year lagged gold price index with base in 2010. In the robustness checks, we also use alternative measures of gold value, including the log of the lagged gold price or the current price.

4.4 Demographic and Environmental Controls

Following the relevant literature, we include several control variables in our regressions to account for other factors that affect male and female employment and IPV. Individual- and household-level demographics come from the DHS, whereas we obtain cell-level information from external sources. We discussed the cell-level factor of industrial gold mining above in this section, while Online Appendix A.2 provides a detailed description of the other environmental covariates we included in our regressions.

[12] As a robustness check, we also use industrial mines of the main minerals in each cell, including minerals other than gold. The spatial distribution of industrial mines of other minerals has also been stable between 1997-2010, especially between 2000-2010.

[13] In the next iteration of our analysis, we will use the data on the actual distribution of industrial mines across space in Africa since 2010 obtained from the S&P, which reports data on locations of all industrial mines and main minerals that they have produced each year since 1987.

4.5 Summary Statistics

We present the descriptive summary for individual and household characteristics in Table 2. The mean age for our women sample is 31.4 years. Nearly 70 percent of them live in rural areas, and more than half have a place of residence different from their place of birth. Since the sample consists of ever-married women and the DHS collects IPV experiences by either the husband or the partner, the women who have experienced IPV in the past 12 months could have been married or living with a partner during that period. The woman's current marital status also could differ from her marital status when she experienced IPV in the last 12 months. More than three-fourths of women in our sample are currently married, slightly above 10% live with a partner, and the remaining about 10% are widowed, divorced, or separated. Most women in our sample have primary education or below (78%) and are Christian or Muslim (95%). Most have also been employed in the last 12 months, particularly in agriculture, while almost all of their husbands/partners are working.

Table 3 presents the descriptive statistics on IPV experiences with different frequencies over the last 12 months. Panel A shows that about one-fourth of the women experienced domestic violence by their spouse or partner. Across various types of IPV, mild or less severe physical violence is the most common, and incidences of sometimes experiencing IPV are more prevalent than often experienced. In addition, Panel B further decomposes mild, severe, and sexual IPV into detailed categories, and we can see that being slapped, pushed, physically forced into unwanted sex, kicked or dragged, and punched with a fist by an intimate partner are the most common. But more severe incidents, such as having their partner strangled or burnt and threatening with a knife/gun, are rare.

Table 4 summarizes the cell-level characteristics for the 0.5×0.5 degrees PRIO-GRID cells that contain the DHS clusters. Across all DHS rounds, there are 3,948 cells. Nearly 60% of them overlap with the gold bedrock, and the mean share of overlapped area per cell is 26%. Most of them are classified as agriculturally suitable, whereas the criterion used to determine a cell's crop suitability is derived from FAO-GAEZ.[14] Our key explanatory variable, gold suitability share $\times$ gold price, which measures a cell's time-varying potential for gold, has a mean value of 0.21 and a standard deviation of 0.30.

5 Identification Strategy

In this section, we describe our empirical strategy for identifying the causal impacts of artisanal gold mining on outcomes of our interest. The approach that we use is consistent with the existing studies that quantify the effect of ASgM on environmental and economic outcomes in Africa (for example, Girard et al., 2023).

[14] See Section A.2 for a description of the dataset used to construct the crop suitability index and how to classify a cell as agriculturally suitable.

5.1 Empirical Specification

To examine the causal impact of artisanal gold mining (ASgM) on individual-level employment decisions and intimate partner violence (IPV), we estimate the following specification:

$$\begin{aligned} Y_{ict} = \beta_0 + \beta_1 \text{Gold Suitability}_c \times \text{Gold Price}_{t-1} + \\ + \boldsymbol{X}'_{ict}\boldsymbol{\gamma} + \boldsymbol{Z}'_{hct}\boldsymbol{\theta} + \boldsymbol{M}'_{ct}\boldsymbol{\delta} + \alpha_c + \pi_{country,t} + \varepsilon_{ict}, \end{aligned} \tag{1}$$

where Y_{ict} is one of the outcomes of IPV for individual i living in cell c at survey year t. The key explanatory variable is either a dummy or continuous variable of gold suitability for cell c interacted with the international gold price at time $t-1$, a time-varying measure of a cell's potential gold value or revenue.[15] We use the lagged value of the international gold price to capture that it takes time (i) for households and individuals to adjust their activities in response to changes in the local gold price and (ii) for the world price to pass through local price. In the previous section, we discussed the individual terms of the interaction term, Gold Suitability$_c$ and Gold Price$_{t-1}$, which we do not need to include in equation (1) because we control for cell and time fixed effects as we discuss below.

The vector $\boldsymbol{X}_{ict}$ contains a set of woman i's characteristics, including age, education, marital status, and religion, a vector $\boldsymbol{Z}_{hct}$ includes a set of household characteristics including place of residence and household size and a vector $\boldsymbol{M}_{ct}$ contains a set of cell-level factors including industrial gold mining, agricultural potential, and weather conditions. In Online Appendix A.2, we describe each time-varying variable in detail. To control for time-invariant factors at the treatment level, we include cell fixed effects, α_c.

Since states or provinces and districts or communes within a country tend to be not independent of each other in Africa, i.e., each country tends to have a unified system, it is sufficient to control for country$\times$year fixed effects to capture all unobserved time-varying characteristics at the level higher than cells, such as changes in institutions, changes in labor market policy and policies towards IPV, and the legal status of ASgM. As suggested in the literature investigating the macroeconomic effects of mining, the mining boom leads to exchange rate appreciation due to increased capital inflows (Arezki et al., 2014) and an increase in the price of non-traded goods due to the income effect (Corden and Neary, 1982). These changes affect the production of different industries depending on their production input structure and goods consumption in general. Controlling for country-by-year fixed effects also captures such effects of Dutch disease, leaving the resource movement effects, i.e., employment transition across industries. Therefore, we consider that the main part of the variation left in our treatment variable is an employment shock or a shock that reallocates resources across sectors.

Given that we control for country-by-time fixed effects, we do not need to include country and time-fixed effects. The error term, ε_{ict}, captures the remaining unobserved, time-varying, and

[15] In the main results, we report the interaction between the continuous gold suitability measure and the gold price. We use a gold suitability dummy for a robustness check. The results are very robust using both measures.

woman-specific determinants of outcomes, Y_{ict}. We cluster the standard errors at the cell level to allow for heteroskedasticity and serial correlation within cells, assuming that ASgM is varied across cells (Bertrand et al., 2004; Angrist and Pischke, 2009).

5.2 Identification Assumptions and Interpretation

We exploit spatial variation in suitability for gold mines and time variation arising from the international gold price to provide a causal interpretation of our estimates. The spatial variation comes from the difference between the cells suitable and non-suitable for gold on the extensive and intensive margins. Although a cell can be well suited for gold, there might be no gold-digging or mining in that cell unless such activity is profitable. Thus, we use international gold prices as a source of temporal variation that captures the dynamic profitability of mining activities. Exploiting changes in global prices is critical for identifying the causal effects of mining activities because it introduces exogenous time variation in local mining activities, as the international price is not affected by local conditions. Hence, the key identification assumption of global price exogeneity to interpret our estimate as causal is plausible in our setting.

The parameter of interest, β_1, captures the effect of ASgM, not that of gold mining, given that we partial out the impact of industrial gold mining (ISgM) in our regressions. Hence, controlling for ISgM is crucial for identifying the effect of ASgM, as the gold-suitable areas are suitable for both ASgM and ISgM. Similar to the gold suitability measure, we control for ISgM in our regressions by interacting it with the lagged value of the annual price of gold. Although it is an indirect way of identifying the effect of ASgM, the main advantage of using this indirect measure of ASgM is that we can capture both registered and non-registered artisanal mining. A direct measure of ASgM based on registered artisanal mines like in Gräser (2023), on the other hand, ignores the primary form of artisanal mining—non-registered mining.

As our identification relies on cells' gold suitability and their potential change in gold revenue rather than the actual gold production, it has some limitations that we discuss here. First, the estimated impact of ASgM is likely to be interpreted as a lower-bound estimate of the causal effect due to a potential attenuation bias (Girard et al., 2023). Some cells that are treated as gold suitable might not be well suited for gold because the river could have carried the ores of gold, which would also make some cells considered as not suitable for gold as actually suitable for gold. Second, gold-suitable cells might not practically posit any gold, or the gold in the cells might not be reachable. The gold-suitable cells with gold at some period could run out of gold in the subsequent periods. Therefore, our measure of gold mining is likely to be subject to measurement error to some extent, and thus, our estimates are likely biased toward zero. Third, the attenuation bias might also come from the random displacement of the DHS cluster, although this will not bias our estimates (Girard et al., 2023).

Another identification concern relates to the IPV reporting bias, which might be correlated

with changes in women's employment or earnings. Specifically, women might report IPV incidents more as they become more confident due to their better employment or earning potential, potentially resulting in a bias in our estimates.[16] Despite this potential increase in IPV experiences due to better employment and earning outcomes in response to positive mining shock, we identify a decline in IPV due to the ASgM shock, which we present in the following Section. Therefore, we find a significant reduction in IPV experiences even if there is a potential upward bias in the reported IPV incidents due to the treatment.

6 Results

In this section, we discuss the results from estimating the effects of artisanal gold mining (ASgM) on intimate partner violence (IPV). We also briefly discuss the impact of industrial gold mining (ISgM). Then, we examine the potential mechanisms through which the ASgM affects the IPVs and present the heterogeneous effects. We finally discuss the dynamic patterns of ASgM impacts in the long term, which speaks about the persistence of the effects over time.

6.1 Contemporaneous Effects of Artisanal Gold Mining

The impacts of ASgM shock on intimate partner violence (IPV) experienced by women in the last 12 months are reported in Table 5. Panel A shows that the probability of women experiencing overall IPV and less severe physical violence decreases significantly in gold-suitable zones when the gold price increases. However, the impacts of ASgM on severe physical and sexual IPVs experienced by women are essentially zero, although the coefficient estimates are negative. Then, we split the IPVs into two different frequencies: (i) IPV sometimes experienced in the last 12 months (Panel B), and (ii) IPV often experienced in the last 12 months (Panel C).[17]

Most of the negative effects of ASgM on ever-experienced IPV in the last 12 months come from the impacts on the less frequent IPV (Panel B of Table 5). The results shown in Panel C of Table 5 suggest that any of the IPV often experienced in the last 12 months are not affected by the ASgM shock. This finding is intuitive because such violent behaviors remain unchanged unless the shock significantly changes men's behavior. It is also generally consistent with results from studies on alcohol controls-IPV relationship (for example, Basu et al., 2025) that suggest that regulating alcohol consumption is less effective in reducing the likelihood of often experiencing IPV.

[16] Relatedly, the literature investigates the reporting bias of intimate partner violence (IPV) in surveys, such as Park et al. (2024) suggest that asking IPV questions via self-interviewing method increases the reported IPV incidents by 13 percentage points in Malawi and 4 percentage points in Liberia.

[17] The domestic violence-reducing impact of artisanal gold mining could be mechanical, i.e., IPV reduced because employment in mining and sales requires women to spend more time outside the home away from their husbands and lower the wife's exposure to their husband. Due to the absence of data on an individual's time use, we cannot directly check this possibility. But, in the next section, we investigate other potential mechanisms, given the data availability.

Although the effects of industrial gold mining (ISgM) are not our central focus, we present notable findings on ISgM effects. For IPV experience, the impacts of ISgM are the opposite of those of ASgM and are strongly significant (Table 5). In Appendix Table B.2, we present the effects of the other two cell-level covariates on broad categories of IPV. First, crop suitability is weakly associated with an increase in IPV, especially sexual violence that occurred sometimes in the last 12 months. However, severe physical IPV decreases in crop-suitable regions when crop prices increase. Second, temperature negatively affects intimate partner violence in general. The impacts of temperature on IPVs are not statistically significant; however, it significantly reduces the incidence of severe physical IPV (Column (3) of Panel A), particularly those that sometimes occurred in the last 12 months (Column (3) of Panel B). Like other shocks, IPV often experienced in the past 12 months does not respond to crop suitability and temperature (Panel C).

To examine the impact of ASgM on IPV in more detail, we further dis-aggregate the three broad categories of IPVs into ten types of IPVs, and Table 6 reports the estimation results. We highlight the main findings. First, we find that, among less severe physical violent activities, the likelihood of women being slapped and punched with a fist or hit by something harmful drives the IPV-reducing impact of ASgM identified above (Columns (2) and (3) of Panel A). Second, similar to the results above, these effects mainly come from decreases in violence experienced sometimes (Columns (2) and (3) of Panel B), but the negative impact on the likelihood of being slapped holds for experience occurred often in the last 12 months as well (Column (2) of Panel C). Third, the probability of women being forced into sexual acts other than sex is strongly higher in gold-suitable cells when the gold price increases (Column (9) of Panel A). However, the impact of ASgM shock on broadly defined sexual violence was not significant and negative. This result holds for experiences that occurred sometimes and often (Column (9) of Panels B and C). It is also generally consistent with previous findings that a rise in artisanal gold mining increases sexual violence (Fourati et al., 2022; Rustad et al., 2016; Kotsadam et al., 2017). As suggested by studies on the link between artisanal mining and sexual violence such as Rustad et al. (2016), the main reason for sexual violence against women by an intimate partner to grow in areas near artisanal mining is the subcultures of hyper-masculinity associated with mining. Additionally, we find that the probabilities of women sometimes being threatened with a knife/gun or other weapons (Column (7) of Panel B) and often being physically forced into unwanted sex (Column (8) of Panel C) decrease; however, these effects are weakly significant at the 10% level.

Similar to our results for broadly defined IPVs, the effects of industrial gold mining on some of the detailed types of IPVs are positive, i.e., opposite to that of artisanal gold mining, and the impacts are more significant for IPVs experienced sometimes by women. For the three types of sexual violence under consideration, industrial gold mining increases the two types on which ASgM does not significantly affect. Put differently, ISgM increases the likelihood of women being physically forced into unwanted sex and physically forced to perform sexual acts the wife did not want (Panel

A of Table 6).[18]

6.2 Mechanisms

In this section, we argue that improvement in women's bargaining power within the household due to their increased earning potential from extractive and sales or retail activities mediates the impact of ASgM on intimate partner violence (IPV) against women. In doing so, we first show that ASgM improves various measures of women's intrahousehold bargaining power. Second, we examine the underlying reason for enhancing women's intrahousehold bargaining power due to the ASgM shock by estimating the effects on industry- and gender-specific employment and household wealth. Third, we rule out the changes in household wealth due to the ASgM as a potential channel. Finally, we show that decreases in IPVs due to the ASgM are not because of the compositional changes.

Intrahousehold Bargaining Power. Our finding on a decrease of less severe physical IPVs in cells more suitable for ASgM could be due to an improvement in women's intrahousehold bargaining power. To evaluate this mechanism, we estimate the effect of artisanal gold mining on various measures of intrahousehold decision-making. The results in Table 7 suggest this channel is plausible. Specifically, ASgM improves women's final say in the decisions on their healthcare, household's large and daily purchases, and family visits.[19] An improved women's bargaining power combined with a decline in IPV indicates that the bargaining power channel dominates the potential backlash effect, which is consistent with Heath and Riley (2024), who suggest no backlash effect of digital money treatment in Tanzania.

Female Employment and Earnings. We now move to the results on the employment effects of artisanal gold mining (ASgM) to investigate the impact of ASgM on women's intrahousehold bargaining power. As we discussed in Section 2, women's intrahousehold bargaining power and IPV against them depend on the wife's employment and earnings relative to the husband. Table 9 shows the estimated effects of ASgM on overall (panel A), male (panel B), and female (panel C) employment in the aggregate economy and across different industries, including mining, agriculture, services, and sales or retail.[20] The overall employment effects mirror the results in Girard et al.

[18] Appendix Table B.3 first shows that the positive relationship between agricultural productivity and sexual IPV is driven by an increased incidence of women sometimes being physically forced to perform sexual acts the woman did not want (Column (10) of Panel B). The negative link between crop suitability and physical IPV is concentrated among incidences of women having had their arms twisted or hair pulled (Column (4) of Panels A and B) and kicked or dragged (Column (5) of Panels A-B). Second, the high temperature reduces the likelihood of women being kicked or dragged (Column (5) of Panels A and B) and strangled or burnt (Column (6) of Panel B). However, it increases the probability of women being physically forced to perform sexual acts respondents did not want (Column (10) of Panels A and B).

[19] Unlike Benshaul-Tolonen (2024), we do not find any effects of ASgM on women's attitude toward domestic violence or healthcare access, as shown in Table 8. However, we found that ISgM significantly reduces the overall barriers to women's medical access, especially in getting permission, and the effect is much stronger than ASgM.

[20] Additionally, employment in mining and agriculture is negatively correlated with a correlation coefficient of -0.10 (p-value: 0.00), which confirms that agricultural employment can be used as a proxy for non-mining employment.

(2023). Our innovation in employment effects of ASgM is thus the heterogeneous effect by gender, which is essential for our analysis. Aggregate and gender-specific labor supply decrease in response to a positive shock of ASgM; however, the negative impact is not statistically significant (Column (1)). It indicates that employment is not the main channel. But overall employment in mining or extractive activities significantly increases due to ASgM shock, as expected. The magnitude of the positive impact of ASgM on female labor supply is twice as much as that on male labor supply. The statistical significance of the ASgM effect is more significant for women than men. These indicate that women supply their labor to artisanal gold mining more than men when the industry becomes more profitable (Column (2)).

As shown in Column (3) of Table 9, in contrast, agricultural activities by men and women or male and female employment in agriculture decreases, and the effects are statistically significant at the 5% and 10% level, respectively. The magnitude of the coefficient estimates on agricultural employment effects are the same for men and women. The impact of ASgM on the probability of either a man or woman being employed is negative but not statistically significant. The contrasting changes in mining and agricultural employment suggest that (i) employment increase in mining comes from agricultural employment and (ii) there is likely a structural transformation from non-mineral to mineral industry when mining becomes more profitable according to the Dutch disease hypothesis (van der Ploeg, 2011; Aragón and Rud, 2013).

In Column (4) of Table 9, we show the results on employment response in services due to mining shock. The result suggests that the effects of ASgM on overall and gender-specific labor supply in the services industry are negative. However, the impact on female employment in services is not statistically significant. It indicates a potential transition from services to extractive industry, which is plausible because it could be relatively less costly to leave the services industry, particularly for men. The reason that female employment in services does not significantly decrease could be because of a positive impact of increased aggregate demand from positive mining shock in services than in the agricultural industry. Considering that women can have a comparative advantage in services, they will be the last to leave the industry, consistent with the essentially null employment effects in services for women. Finally, as shown in Column (5), female employment in sales or retail industry increases, while an increase in male employment in sales is not significant. One of the reasons that women get into non-mining industries like sales/retail after the positive mining shock is that women are not allowed to go to mining sites in some countries, such as Liberia, due to traditional gender-based beliefs. This result is consistent with Gräser (2023), who show an overall pattern of women entering the sales/retail industry in response to the opening of artisanal mining.

Given that the underlying mechanism for strengthening women's intrahousehold bargaining power is not higher employment, at least on the extensive margin, we further explore other potential mechanisms. Several mechanisms could have increased women's bargaining power within the

The correlation coefficient between employment in mining and agriculture industries is -0.15 (p-value: 0.00) and -0.07 (p-value: 0.00) for male and female workers, respectively.

household, mainly by increasing their earnings relative to their husbands or partners. As theoretically modeled in Basu (2006), a woman's bargaining power or "balance of power" can be influenced by the household's decision, for example, through what she earns rather than the female wage rate or employment status. First, female employment in mining and sales industries increased, which could have led to a rise in women's earnings.[21] Second, although we cannot empirically check due to the data limitation, women's hours and days spent on mining activities and retail work could have intensively increased, leading to a rise in their total earnings. Third, male employment increased only in mining and decreased in two industries (agriculture and services), while female employment increased in mining and sales and decreased only in agriculture. So, earning potential might have improved more for women than men, strengthening women's intrahousehold bargaining power relative to men.

We cannot directly check if the wife's income increased more than her husband's since we do not have individual-level data on income. However, we estimate the effect of ASgM on household wealth combined with the employment effects above to indirectly examine a channel of increase in a woman's income relative to her husband or partner. The effect of ASgM on household wealth in Sub-Saharan Africa has been estimated in Girard et al. (2023); however, we re-estimate the wealth effects under five different scenarios to offer some validity and robustness. We document a significantly positive impact of ASgM on household wealth (see Table 10). We do not know the contribution of the wife and husband to the household wealth growth. However, we conjecture that the wife's income increases more because (i) household wealth increases, (ii) the employment effect is more significant in magnitude and statistical significance, and (iii) women's employment increases in more industries, such as sales or retail. Thus, the household wealth-increasing impact of ASgM and our results on employment responses indicate that the increase in payrolls or income from extractive activities was substantial, especially for women. An increase in overall and female employment in the sales or retail industry, shown in Column (5) of Table 9, could also indicate an improvement in aggregate demand through higher income.

Household Wealth. We further check whether a reduction in IPV is mediated through a change in household wealth because Haushofer et al. (2019) show that changes in household income affect the IPV in the context of a cash transfer program in Kenya. Thus, we run the baseline regression on IPV outcomes with household wealth index as an additional covariate, and we report the results in Tables 11 and 12. Higher household wealth significantly reduces all types of IPV incidents. However, since the magnitude of ASgM coefficients hardly changes, except for a slight decrease, household wealth is not the primary channel through which ASgM affects IPV.

Changes in the Compositions. We check if the baseline results reflect the changes in the composition of the mining communities over time in response to the gold price shock. For example, a

[21]The DHS does not report an individual's wage and earnings, so we cannot examine how artisanal gold mining (ASgM) affects women's earnings relative to men. But, we have shown that household wealth increased due to the ASgM.

boom in ASgM could trigger more inflows of migrants, particularly young women, to the communities, and those women carry different gender attitudes that help to transmit to the host communities (Werthmann, 2009; Benshaul-Tolonen, 2024; Kotsadam and Tolonen, 2016). They are also less likely to engage in traditional agriculture and more likely in mining or services/trade activities. We, therefore, regress women's characteristics on the explanatory variable controlling for the same cell-level covariates and fixed effects, and Table 13 reports the results. We found no significant impact of ASgM on all characteristics except that, after the gold price increase, women living in gold-suitable areas are less likely to live together with their unmarried partner and more likely to be separated from a consensual union (Columns (3) and (6)). It could happen in two cases. First, the number of couples who are separated or not living together could have increased if more women in such situations migrated into the area. Second, couples who used to live together start to live separately when the economic and employment opportunities rise due to a gold price hike.

To evaluate the first possibility, we examine the women's migration pattern in more detail. In Table 13, we classify a woman as a migrant if her place of residence is different from her birthplace, which could be too broad to capture migration flow in response to a contemporary local demand shock. Thus, we show alternative regression results when we code a person's migration status based on how many years she has lived in her location (Table 14). We observe a weakly significant increase in new migrants, those who arrived in the community less than a year ago, especially among ever-married women. The effects on more established migrants are insignificant and attenuate over time. These results suggest that the composition of the communities is generally stable in response to the shock.

Given no major changes in the population composition, the first channel described above is less plausible. So, the IPV could have been reduced via a "separation" effect due to less interaction between partners as they are not living together.

6.3 Heterogeneous Effects

We further investigate the mechanisms by analyzing heterogeneous effects. First, we estimate the heterogeneous impacts of ASgM on IPV by household's place of residence. Since artisanal mining sites are more likely to be located in rural areas, we expect impacts to be concentrated among rural households.[22] Most of the changes in IPVs (both broad and detailed categories) in response to ASgM shock are concentrated in rural households (Figures 4 and 5). For example, decreases in overall and less severe physical IPV experiences in the last 12 months in response to mining shock that we found in our baseline estimation (Panel A of Table 5) concentrate among rural households (panel (a) of Figure 4). The negative impacts of ASgM on IPVs sometimes occurred in the last 12 months are also significant in the rural sample, while the effects are not statistically significant in

[22] According to our data, more than 60% of rural regions are suitable for gold, while about half of the urban areas are suitable for gold.

the urban sample (panel (b) of Figure 4). As shown in panel (c) of Figure 4, the IPVs often experienced by women are still not responsive for rural and urban households. These results are intuitive and consistent with our expectations.

Second, we perform heterogeneity by woman's age, which is likely a significant factor for intra-household bargaining power. The results, shown in Figure 6, suggest that the IPV-reducing effects of ASgM are statistically significant across various age groups (panel (a)), which is consistent with our finding that an increase in female labor supply in the extractive sector due to ASgM is significant for all age groups. However, the ASgM effects on IPVs experienced sometimes are relatively stronger in both magnitude and significance for older women (panel (b)). The IPVs experienced often do not change (Panel (c)), consistent with the results from heterogeneity analysis by place of residence. Figure 7 presents the results for detailed categories of IPV.

Third, we analyze heterogeneity by household wealth since the treatment might have affected the individuals and households differently, e.g., individuals with low income could be the first to choose to work on artisanal mining sites when the extractive activity becomes more profitable. Figure 8 shows the heterogeneous employment effects. An increase in mining employment is higher for low-wealth households, and the positive impact on mining employment by either men or women is at least weakly significant for low- and middle-wealth. These results are mainly driven by females, whose labor supply strongly increased even among middle-wealth households (panel (c)), while men's mining employment weakly increases only in low-wealth households (panel (b)). Then, we estimate the IPV effects heterogeneous by household wealth. Figure 9 presents the results, suggesting that the negative impacts of artisanal gold mining on IPV, particularly less severe physical IPV, are concentrated among households with middle wealth, where female mining employment increased more than male mining employment. This result supports our findings above on the primary mechanism, indirectly suggesting that higher female earnings from more female employment in the mining industry relative to men leads to a decline in IPV against women.

Finally, we estimate the heterogeneous effects on IPV by the age difference between the woman and her partner, and results are shown in Figure 10. This heterogeneity also allows us to consider men's characters in our analysis. We find that the IPV-reducing impacts of ASgM come from women whose age differences from their husbands or partners are in the third tercile, i.e., women with age close to their partners (panels (a) and (b)).[23] The IPV rate is higher as couples' age gets closer: the fraction of women experiencing any IPV in the last 12 months is 0.21, 0.25, and 0.27 in the first, second, and third terciles of the age difference. So, the regression results suggest that IPV incidents have reduced the most for women who generally experienced IPV.

[23]The women in the first, second, and third tercile are approximately 18, 7, and 2 years younger than their husbands or partners, on average.

6.4 Persistence of the Contemporaneous Effects

In the previous part of this section, we show that some types of IPVs in gold-suitable regions respond to a concurrent increase in international gold prices. But, in this part, we examine whether these contemporaneous effects persist over time by estimating the IPV outcomes on the value of international gold price up to 10 years before the survey year, including one year before (one year lagged) being our baseline regression.

The dynamic effects of ASgM on broadly defined IPVs are shown in Figure 11, and the results suggest nuanced effects that significantly evolve over time. These results include (i) the negative effect of ASgM on less severe physical IPV tends to be sustained in the long run, (ii) the statistically insignificant effect of ASgM on severe physical IPV turns negative and statistically significant at the 5% level in the long run, and (iii) statistically insignificant effect of ASgM on sexual IPV becomes positive and statistically significant at the 10% level in the long run. The negative impact on overall IPV lasts only two years and becomes statistically insignificant starting from the third year after the price shock (Panel (a)). When we consider IPVs with different frequencies, similar to our results in the previous part, the main findings for overall IPV in the last 12 months are driven by those for IPV sometimes experienced in the past 12 months. The only exception is that the negative impact of ASgM on overall IPV sometimes tends to persist in the long run (Panel (b)). As presented in Panel (c), the null effects of ASgM on different types of IPV experienced often remain at zero. However, the point estimates tend to turn positive despite the statistical insignificance.

For detailed typologies of IPV, we focus on five types of IPV that the ASgM shock has a significant contemporaneous impact on, including women being (i) slapped, (ii) punched with a fist or hit by something harmful, (iii) threatened with knife/gun or other weapons, (iv) physically forced into unwanted sex, and (v) forced into other unwanted sexual acts. Figure 12 presents the results. In terms of overall IPV experience in the last 12 months shown in panel (a), the decrease in the likelihood of women being slapped is persistent over time. However, the impacts in different periods are weakly significant at the 5% level. For the other less severe physical violence, i.e., women being punched with a fist or hit by something harmful, the weakly significant contemporaneous effect deepens in the medium term and becomes strongly significant. But it vanishes in the long run and becomes essentially zero. The significant positive impact of ASgM on women's likelihood of being forced into other unwanted sexual acts persists for about eight years, but it eventually becomes zero afterward. For IPV that happens sometimes, persistency of contemporaneous effects stays relatively longer (panel (b)). Finally, for IPV that happens often, we find that those changes do not last long, except for unwanted sexual acts, which persist for about five years after the shock (panel (c)).

7 Robustness Checks

In this section, we conduct several robustness checks of our main results on the concurrent effects of artisanal gold mining (ASgM) on intimate partner violence.

7.1 Gold Suitability Dummy

In our baseline analysis, we used the share of the cell's area suitable for gold as the spatial treatment. In the first robustness check, we replace this continuous measure of gold suitability with a dummy indicating whether a cell is generally suitable. The results in Tables 15 and 16 are consistent with the baseline. For the detailed types of IPVs, statistical significance changes for a few outcomes, but the signs for those coefficients are generally similar to the main results.

7.2 Alternative Gold Prices

We checked the robustness of the ASgM effects in the previous part by changing the spatial portion (cell's gold suitability) of the variation in the treatment. Now, we test the robustness of our estimates by changing the time-varying part of the variation, i.e., gold price. The baseline analysis uses the 1-year lagged gold price. This section replaces the baseline price variable with either (i) the log price to account for the possibility that mining can have a concave effect on our outcomes or (ii) the current price at the survey year (Berman et al., 2017). The estimates in Tables 17 and 19 suggest that the results are remarkably robust.

7.3 Industrial Mineral Mining

The next robustness check considers replacing industrial gold mining (ISgM) with industrial mining of multiple minerals, including gold,[24] since mineral prices tend to be correlated. We redefine the industrial mining variable by interacting the dummy for a cell's main mineral extracted in an industrial mine with its international price. We report the results in Tables 20 and 21. The coefficient estimates on the effect of artisanal gold mining remain qualitatively the same. The impact of ISgM on IPV that we found in our baseline analysis is also robust to an alternative measure of industrial mining, i.e., ISgM increases domestic violence towards women by their husbands and partners who are likely to gain more intrahousehold bargaining power in response to improvements in large-scale and capital-intensive industrial mining.

[24] Other minerals include aluminum, coal, copper, diamond, iron, lead, nickel, phosphate, platinum, silver, tantalum, tin, and zinc.

7.4 Controlling for Temperature-Induced Push Factor

While an increase in potential gold value acts as a pull factor that drives labor toward mining employment, following Girard et al. (2023), we then use changes in annual temperature as a push factor inducing the movement out of agriculture and potentially into mining due to the sector's low entry barrier (Hilson, 2016). While adverse weather conditions can have detrimental effects on agricultural production, employment, and food security, those living near the artisanal gold mines might be able to adjust their labor supply to other sectors faster, which alleviates the negative weather effect and influences the bargaining position and interaction of household members. We include an interaction between the cell's gold suitability measure and average annual temperature to capture the weather-induced push factor. Incorporating the push factor still preserves our main findings regarding the ASgM effects since the coefficient estimates on ASgM effects are remarkably similar to the baseline results. Moreover, a temperature rise in gold-suitable areas reduces the incidence of IPVs, except for overall and less severe physical IPVs often experienced by women on which the temperature in gold-suitable areas has positive impacts (Tables 22 and 23). The IPV-reducing effects of temperature in gold-suitable areas are consistent with the employment shift from agriculture to mining in response to higher temperatures in gold-suitable areas.

7.5 Using Alternative ASgM Data

In this robustness check, we use an alternative data of ASgM from Rigterink et al. (2025) in place of Girard et al. (2023) to check how much these two datasets agree with each other in classifying cell's gold suitability. Instead of predicting a cell's ability to host gold, Rigterink et al. (2025) predict how feasible it is to have artisanal mining activities in a 0.25×0.25 degrees grid cell. Using real artisanal mining data from 3 countries—Eastern Democratic Republic of the Congo, Western Tanzania, and Burkina Faso—to train their machine learning model, they predict the suitability for artisanal mining in other cells that have similar geological characteristics to those of the three countries. The outcome is a dummy equal to one if a cell is suitable and zero otherwise.[25] As the data is at the 0.25×0.25 degrees cell-level, we aggregate them to 0.5×0.5 degrees grid cells. We classify this cell as gold suitable if it contains any smaller cell that is feasible for artisanal gold mining.[26]

Figure B.3 compares the spatial distribution of the cells classified as ASgM feasible using the two datasets. While the patterns are very similar, Girard et al. (2023) assigned more cells to be gold suitable than Rigterink et al. (2025). It is likely because the former aims to predict the overall

[25] Rigterink et al. (2025) refer to these areas with similar geological characteristics as 'common support' areas, which cover 78% of the African continent.

[26] It should be noted that Rigterink et al. (2025) not only predict the feasibility for artisanal gold mining but also other minerals such as diamond, copper-cobalt (2T), coltan (tantalum)-tin-tungsten (3T). Since the ASM suitability is presented as a dummy variable, we cannot know which mineral (or minerals group) is the dominant mineral when aggregating to a larger cell. Thus, we consider a cell suitable for ASgM if it does host any 0.25×0.25 degrees cell that is ASgM feasible. It is not a major concern as 98% of the 0.5×0.5 degrees cells are suitable for only one mineral.

suitability of a cell to host any gold. The latter only aims for the possibility for a cell to host *artisanal gold mining*. Thus, we should expect a higher number of ASgM-suitable cells in Girard et al.'s (2023) data.[27] For the robustness regressions, we only take the overlapping cells that are classified as ASgM suitable (or unsuitable) by *both* datasets and leave out the rest. Table 24 shows the results for broad IPV categories. The signs of the ASgM effects on IPV remain the same; however, they lose the statistical significance for several outcomes (i.e., less severe IPV ever or sometimes experienced in the last 12 months). However, the effect on overall IPV is still robust but noisier, and the impact on sexual IPV reduction is now slightly significant. Overall, this robustness exercise does not invalidate our baseline findings as the two datasets predict different aspects of gold suitability, which causes us to leave out plenty of observations to narrow down to the overlapping areas.

8 Conclusion

This paper examines the impact of artisanal gold mining (ASgM) on intimate partner violence (IPV) towards women in Sub-Saharan Africa. Since data on gold mining have been limited to industrial mines only, the literature on the socio-economic impact of mining so far has been restricted from investigating the impact of artisanal mining at the micro and macro levels. Leveraging continent-wide information on gold suitability along with industrial gold mines at the granular or cell level and exogenous variation from international gold price, we provide the first estimates on the causal effects of artisanal gold mining on intrahousehold bargaining power with a focus on IPV. Using nationally representative individual and household-level repeated cross-sectional survey data from more than 30 countries in Sub-Saharan Africa, we provide evidence with strong external validity.

Our analysis shows that the IPV experienced by women declines in gold-suitable areas when the profitability of gold mining increases. In the short term, less severe physical IPVs with less frequency decrease, which drives the negative impact of ASgM on overall IPV. Women's intrahousehold bargaining power improved due to the ASgM, indicating that the bargaining power channel dominates the potential backlash effect. The overall employment does not change for men and women in response to increased profitability of extractive activities; however, women's employment increased with higher magnitude in more industries, including mining and sales or retail, than men.[28] Combining these with a result suggesting that artisanal mining increases household wealth, we argue that the primary underlying mechanism that strengthens women within the household is a potential rise in women's earnings relative to husbands or partners. This result is in line with

[27] To be specific, there are 4,758 out of 10,632 cells that are classified as ASgM-suitable by either dataset, in which only 1,812 cells (or 38%) are classified by both. For the rest, there are 2,702 cells (or 57%) that are ASgM suitable in Girard et al.'s (2023) data only.

[28] The increases in male and female employment in the mining industry mainly come from the agriculture industry, which presents a shrinking employment due to mining boom, indicating a potential structural transformation in the short term.

a theoretical framework where women's better economic conditions improve their intrahousehold bargaining power and reduce violence by their intimate partners. The incidence of women being forced into unwanted sexual acts other than sex by their husbands or partners, however, increases when the value of artisanal gold mining rises, suggesting a highly heterogeneous impact of artisanal gold mining. The declines in overall IPV and less severe physical IPV tend to be sustained over time. However, our results show that severe physical IPV eventually decreases in the long run while the incidence of sexual violence increases. Given the unique nature of our data, we also disentangle the effects of industrial gold mining from artisanal gold mining and show that industrial mining and artisanal mining have opposite impacts on IPV. Industrial gold mining, which is less inclusive and highly dependent on heavy machines operated by men, increases IPV towards women.

This evidence provides three critical implications for understanding the socio-economic impacts of mining. First, it is crucial to distinguish the effect of artisanal mining from that of industrial mining because they have different implications due to the operational differences between the two sectors. Second, we show that women's empowerment via better earning potentials from employment opportunities in artisanal gold mining contributes to their well-being by reducing domestic violence. This impact seems to dominate the potential backlash effects in our context. Third, policymakers should also consider the heterogeneous impacts of artisanal gold mining on various types of IPVs, especially sexual violence.

We conclude with some caveats and directions for future research. This paper shows an improvement in women's intrahousehold bargaining power. However, we fail to find a significant and positive impact of artisanal mining on overall and gender-specific overall employment. Since our results suggest that household income increases in regions suitable for gold when the price increases, we argue that the potential underlying mechanism through which ASgM affects women's intrahousehold bargaining power and IPV against them is an increase in women's total earnings relative to men. Women's total earnings could increase due to (i) a relative increase in their employment on the intensive margin—they work longer hours or for more days, and (ii) wages or payouts per unit of labor increases. Therefore, first, because the DHS offers information on an individual's economic activities only on the extensive margin (whether an individual is involved in an economic activity), future research can use better employment data, e.g., with information on an individual's employment on the extensive and intensive margins, to confirm our null overall employment effect and provide evidence on the employment effects on the intensive margin. Second, one can explore data on individual-level earnings and wages to directly investigate the underlying mechanism via a relative increase in women's earnings that we propose based on indirect evidence. Third, more generally, future research can use the rich data on gold suitability combined with industrial gold mining or direct measures of artisanal mining to study other socio-economic issues around artisanal mining.

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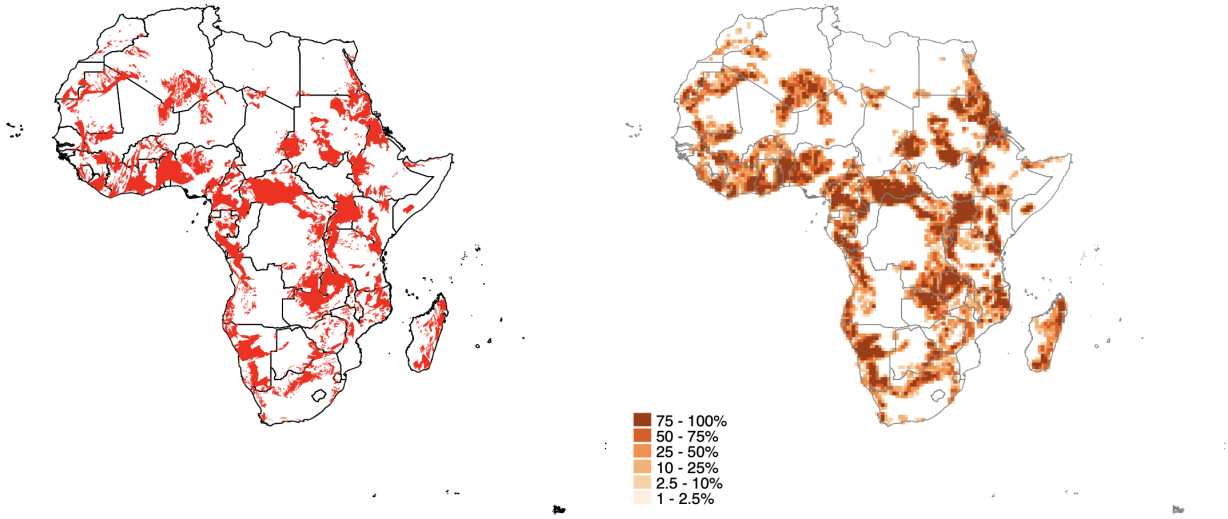
Figures

Figure 1: Artisanal gold mining in Africa

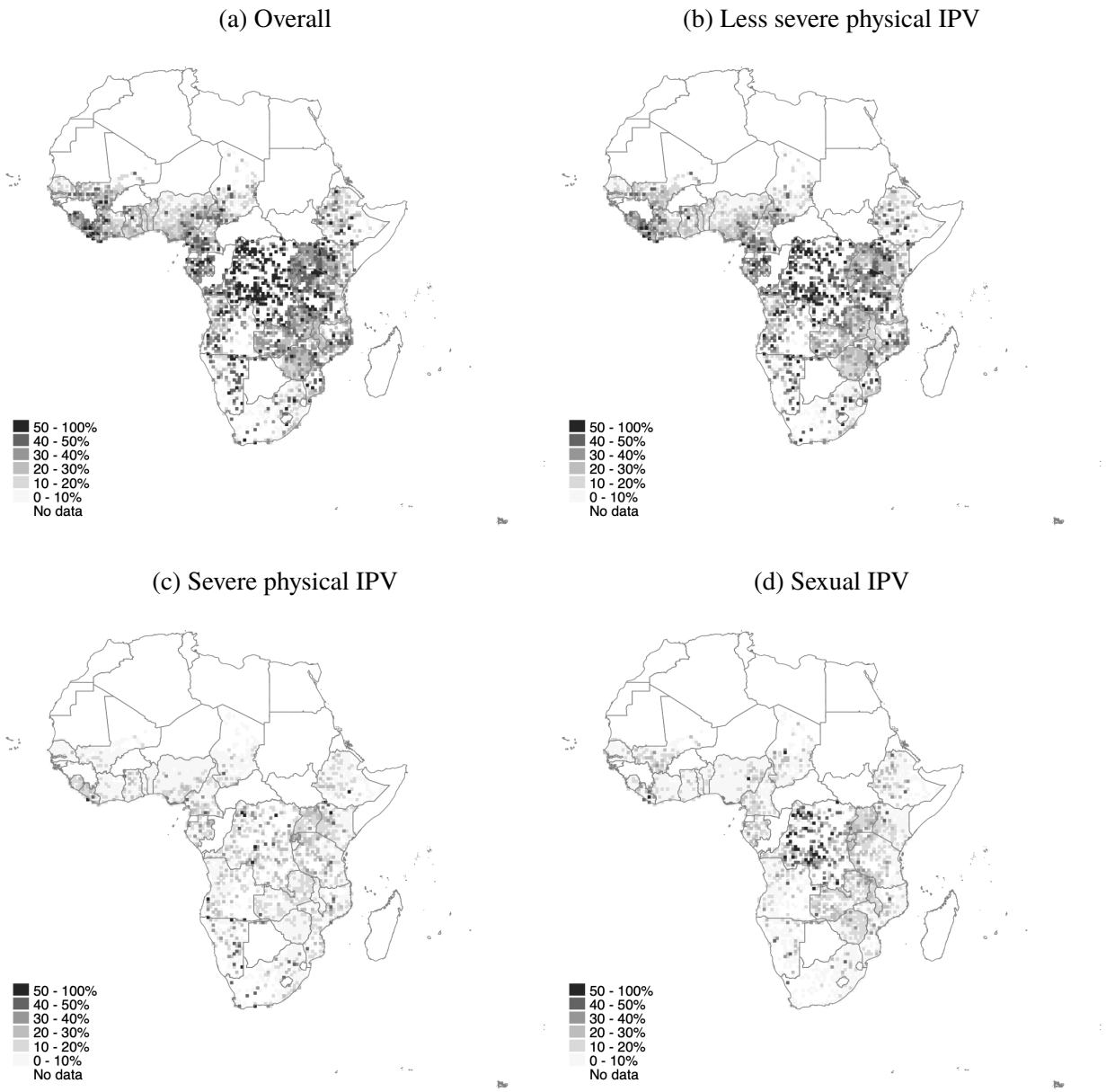
(a) Gold suitable bedrocks

(b) Share of the cell area suitable for gold



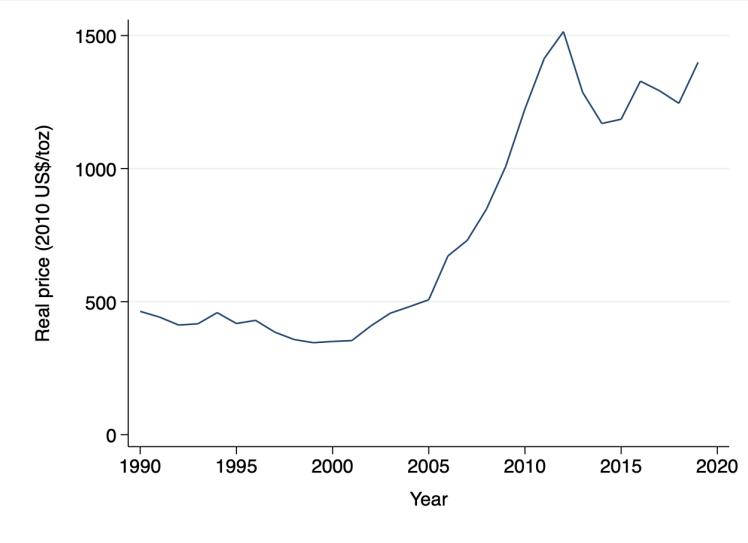
Notes: Panel (a) depicts the geological bedrocks suitable for artisanal gold mining based on data from Girard et al. (2023). Panel (b) shows the percentage of areas suitable for artisanal gold mining in the PRIO-Grid cells of 0.5×0.5 degrees or 55×55 kilometers at the Equator.

Figure 2: Intimate partner violence in the last 12 months



Notes: The figure plots the average share of women who have experienced intimate partner violence (IPV) in the last 12 months by husband or partner in each cell between 1990 and 2019 using DHS data for Sub-Saharan African countries. Panel (a) shows the fraction of women who have experienced an IPV. Panels (b)-(d) show the share of IPV-experienced women for different types of IPVs, including less severe or mild physical IPV (panel (b)), severe physical IPV (panel (c)), and sexual IPV (panel (d)).

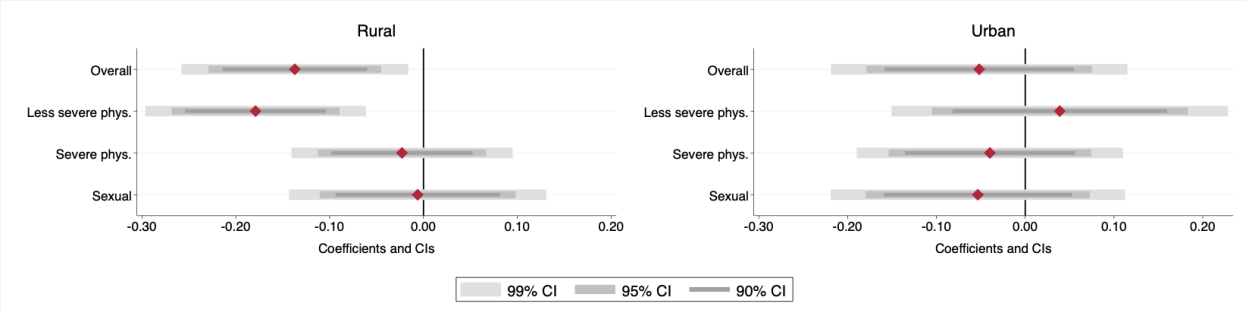
Figure 3: Global price of gold, 1990-2019



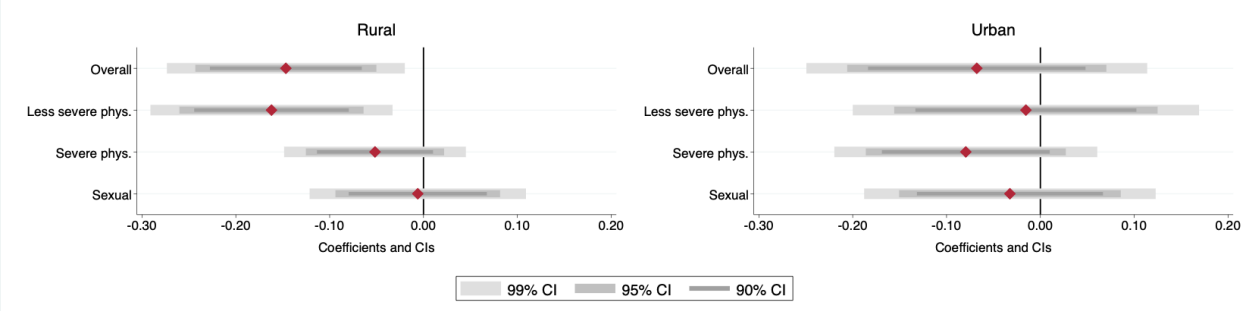
Notes: Using data from the World Bank's Pink Sheet, the figure shows the annual average price of gold (in 2010 US$/troy ounce) at the international market between 1990 and 2019.

Figure 4: Heterogeneous effects of ASgM on IPV by place of residence (broad categories)

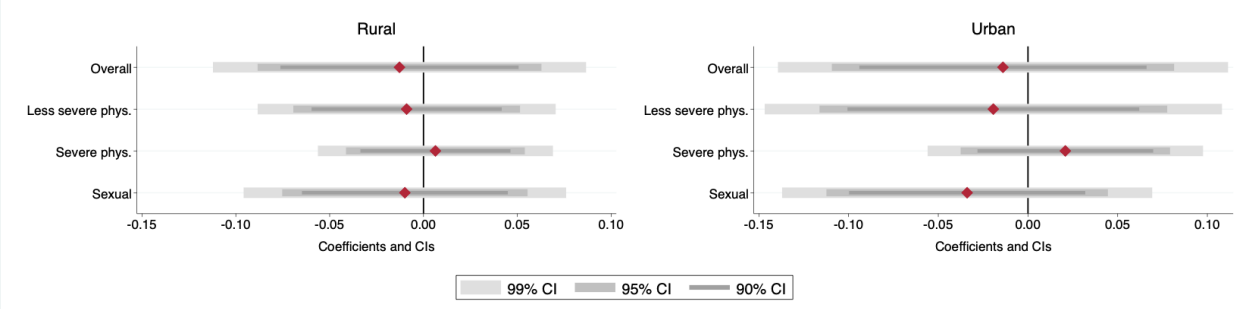
(a) Ever in the last 12 months



(b) Sometimes



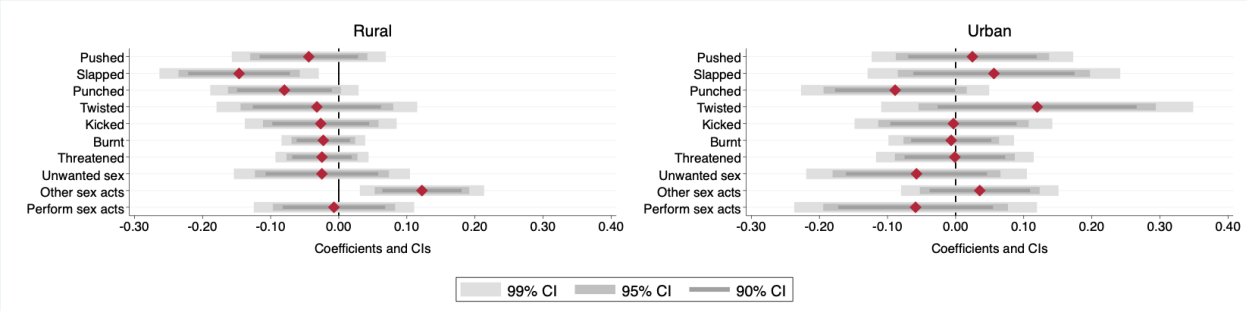
(c) Often



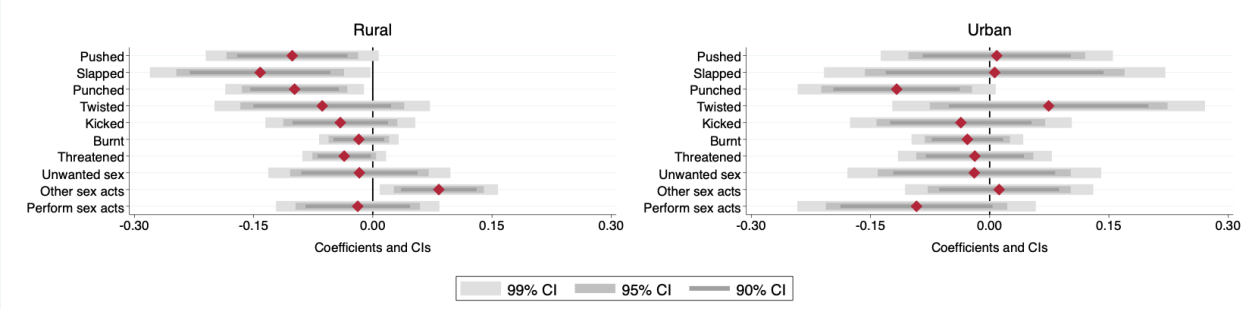
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa, heterogeneous by place of residence (rural and urban). The dependent variables are dummy variables if a woman ever experienced IPV of broad types in the last 12 months (panel (a)), and panels (b) and (c) disaggregate IPV experience into different frequencies. The broad types of IPVs include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual IPVs. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The only household characteristic is household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 5: Heterogeneous effects of ASgM on IPV by place of residence (detailed categories)

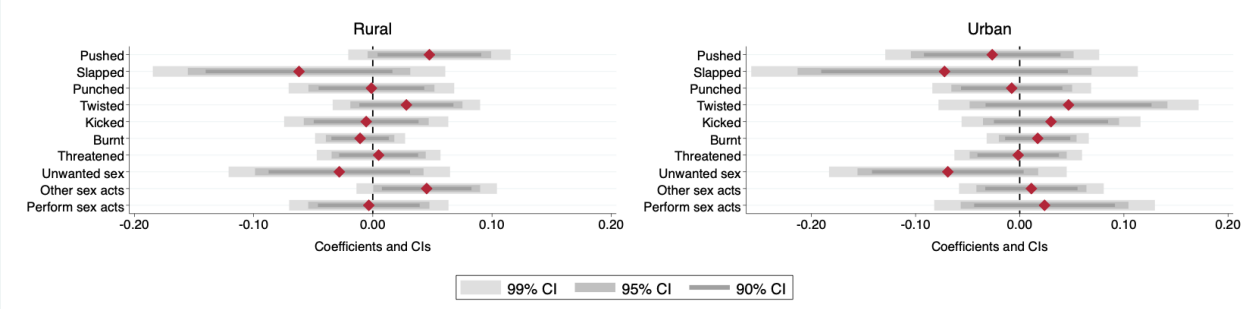
(a) Ever in the last 12 months



(b) Sometimes



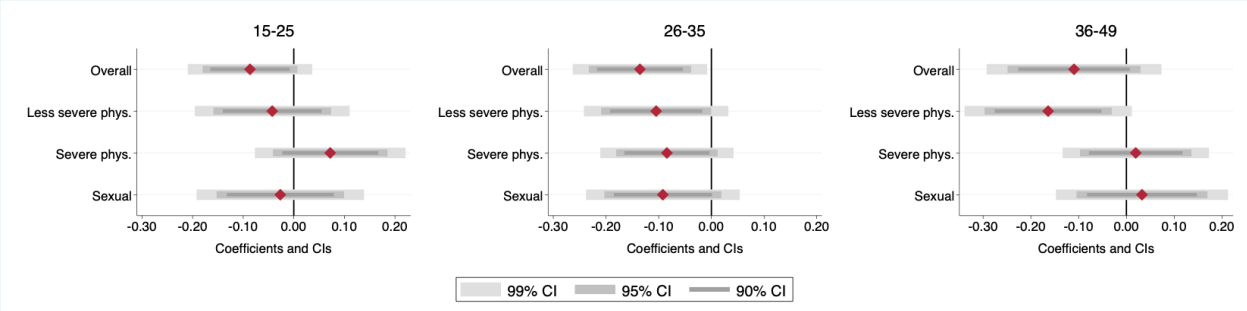
(c) Often



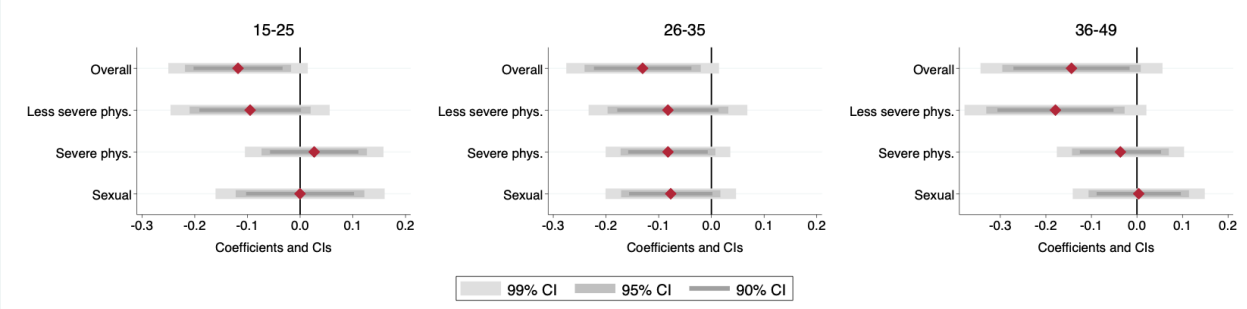
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa, heterogeneous by place of residence (rural and urban). The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (panel (a)), and panels (b) and (c) disaggregate IPV experience into different frequencies. The detailed types of IPVs include dummy variables indicating whether a woman has been (i) pushed, shook, or had something thrown, (ii) slapped, (iii) punched with fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by her husband or partner, respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The only household characteristic is household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 6: Heterogeneous effects of ASgM on IPV by woman's age (broad categories)

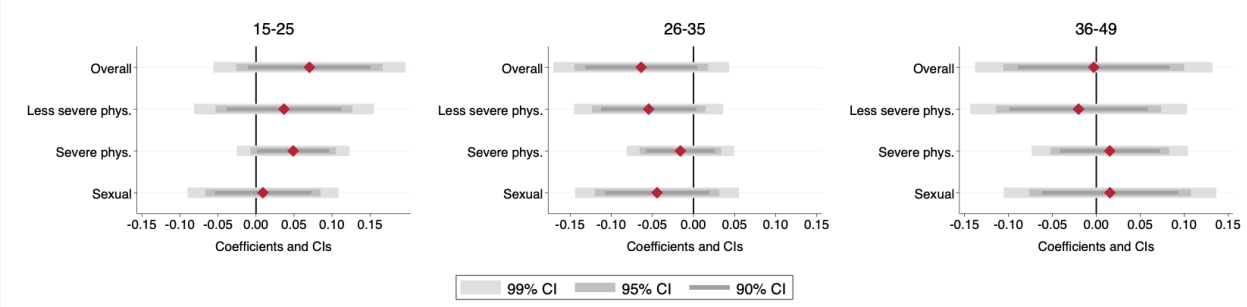
(a) Ever in the last 12 months



(b) Sometimes



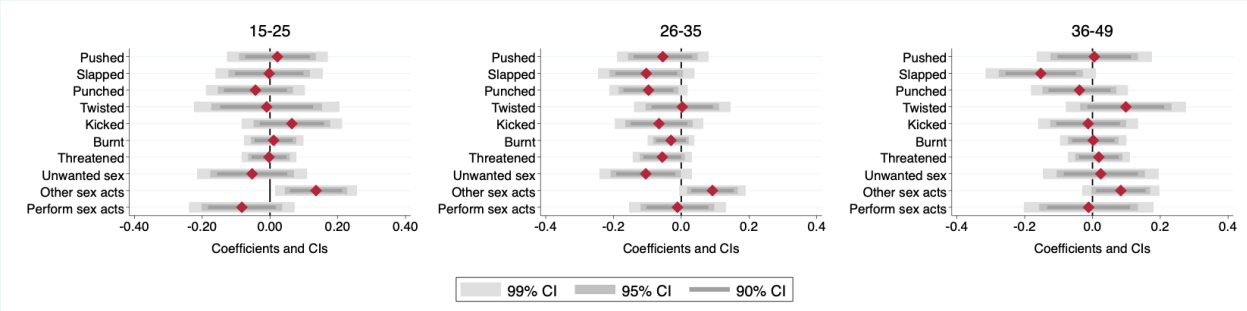
(c) Often



Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa heterogeneous by woman's age. We estimate the regressions using sub-samples consisting of (i) 15-25 years old women, (ii) 26-35 years old women, and (iii) 36-49 years old women. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (panel (a)), and panels (b) and (c) disaggregate IPV experience into different frequencies. The broad types of IPVs include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual IPVs. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

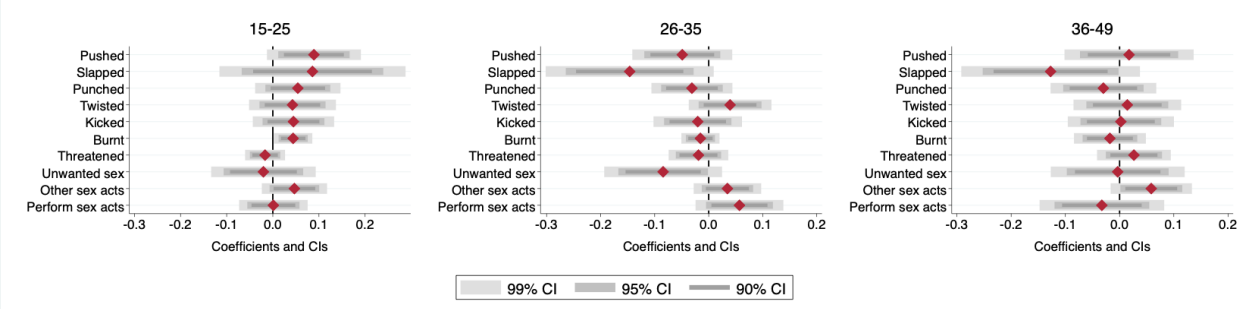
Figure 7: Heterogeneous effects of ASgM on IPV by woman's age (detailed categories)

(a) Ever in the last 12 months



(b) Sometimes

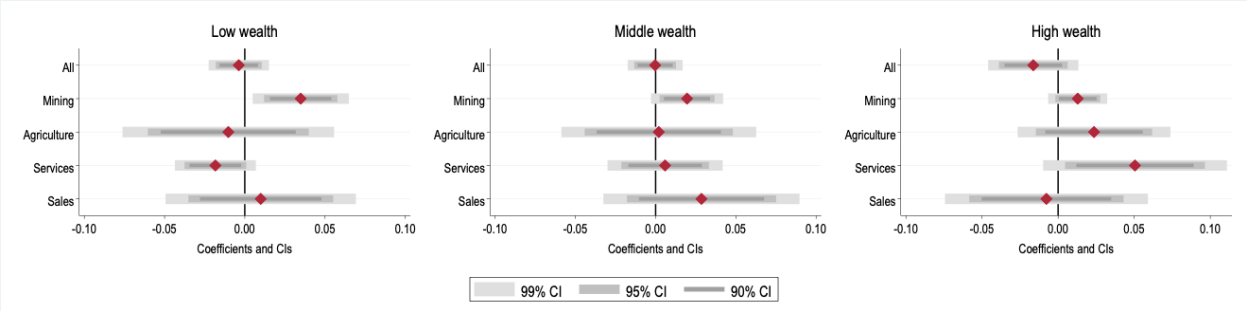
(c) Often



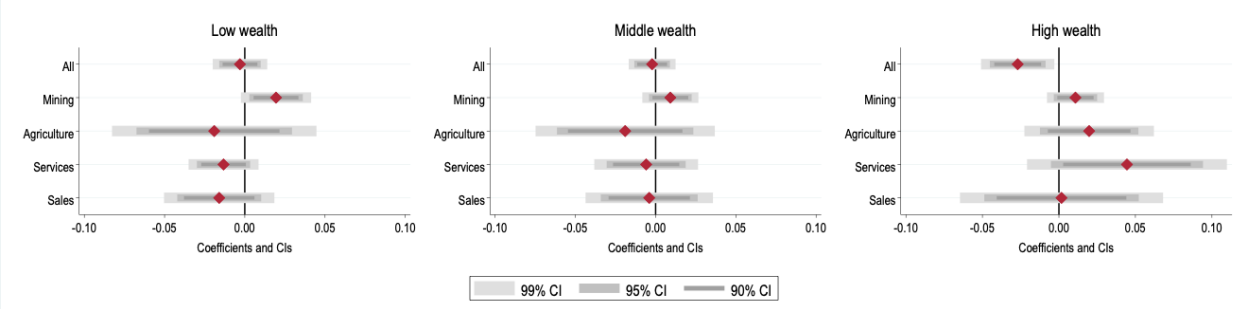
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa heterogeneous by woman's age. We estimate the regressions using sub-samples consisting of (i) 15-25 years old women, (ii) 26-35 years old women, and (iii) 36-49 years old women. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (panel (a)), and panels (b) and (c) disaggregate IPV experience into different frequencies. The detailed types of IPVs include dummy variables indicating whether a woman has been (i) pushed, shook, or had something thrown, (ii) slapped, (iii) punched with fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by her husband or partner, respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 8: Heterogeneous employment effects of ASgM by household wealth

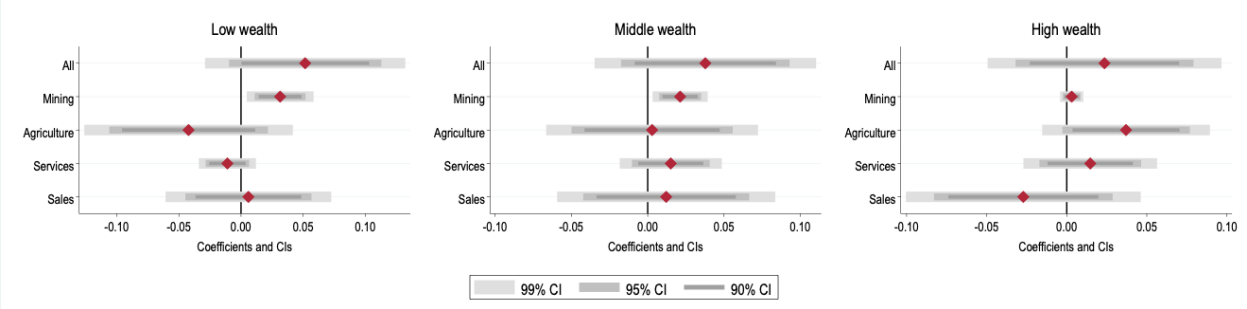
(a) Overall



(b) Male



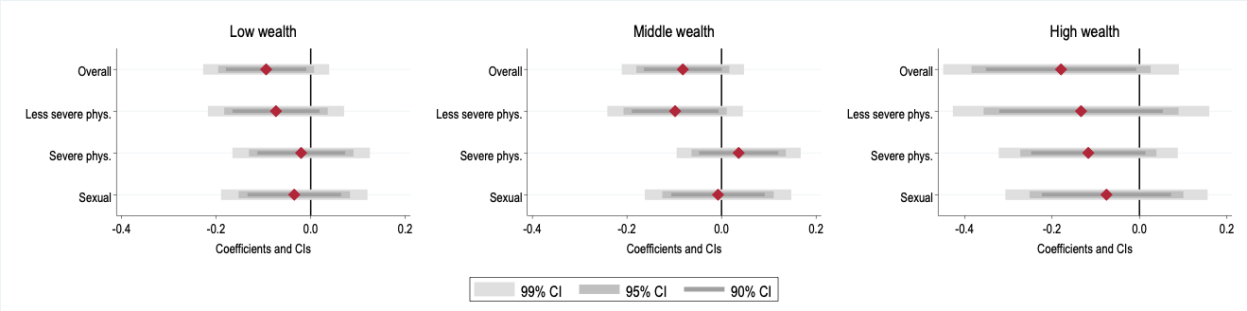
(c) Female



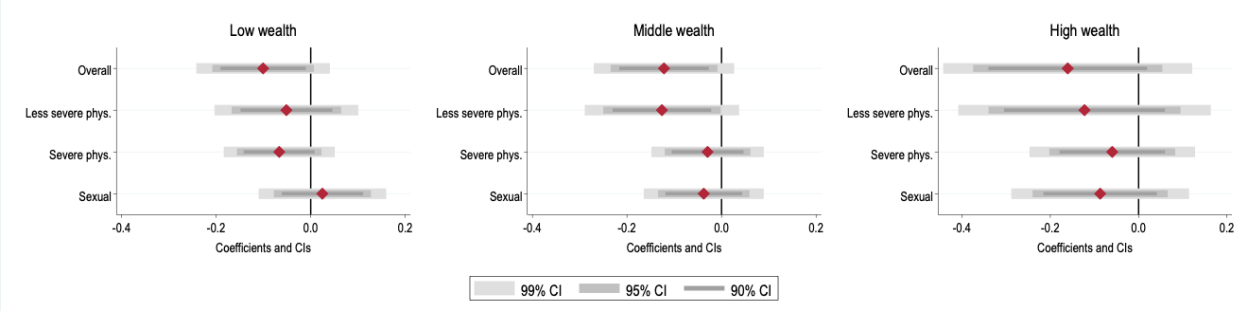
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on employment or labor supply in Sub-Saharan Africa heterogeneous by household wealth. We estimate the regressions using sub-samples consisting of households with (i) low wealth—lowest 40% of households, (ii) middle wealth—middle 40% of households, and (iii) high wealth—top 20% of households. The dependent variables are dummy variables indicating whether an individual is employed in all industries, mining, agriculture, services, and sales in the last 12 months. The aggregate, male, and female employment are considered in panels (a)-(c), respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include the baseline covariates and fixed effects. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 9: Heterogeneous effects of ASgM on IPV by household wealth (broad categories)

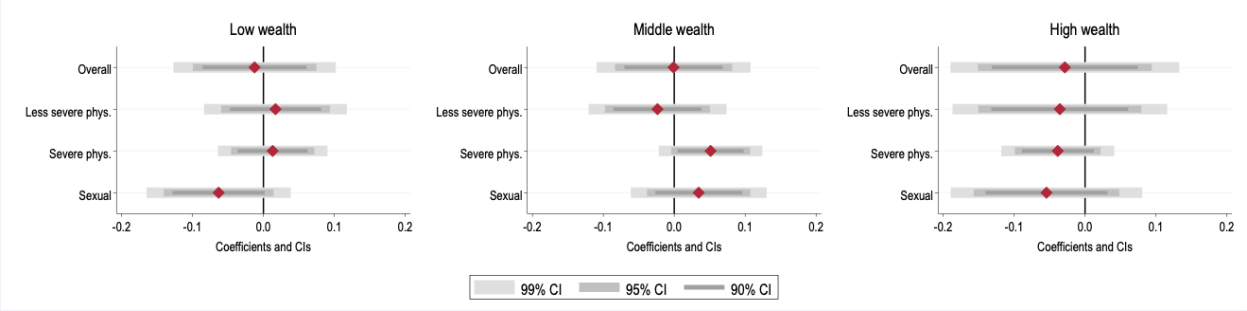
(a) Ever in the last 12 months



(b) Sometimes



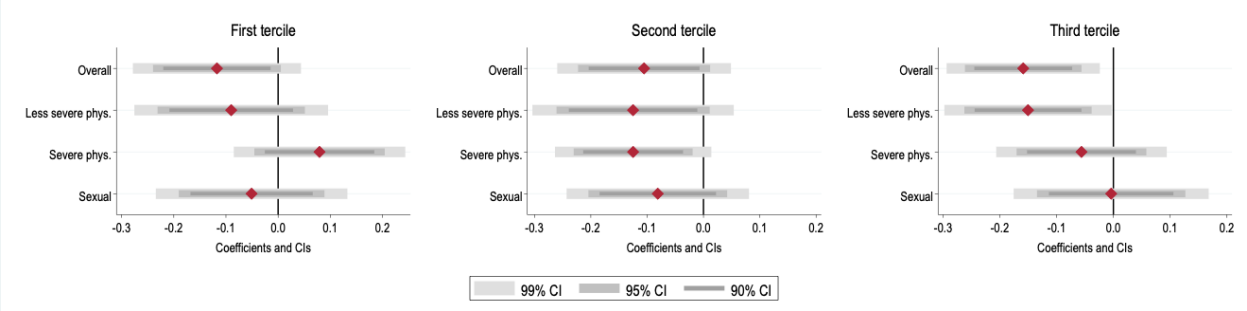
(c) Often



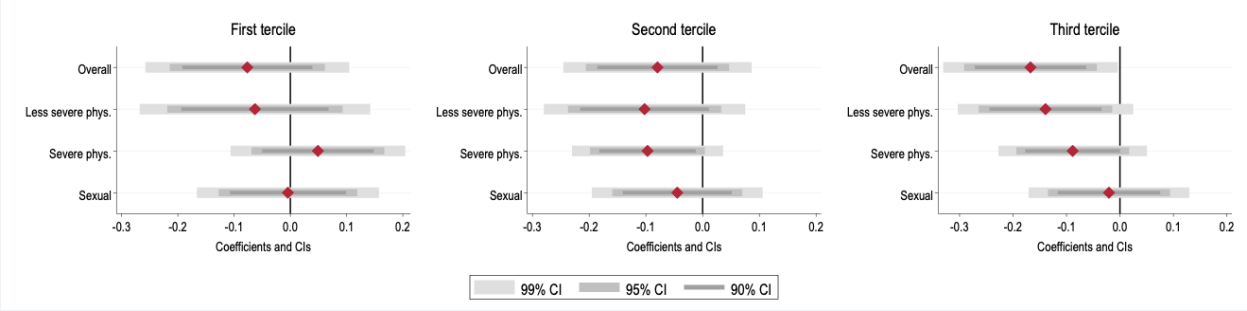
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa heterogeneous by household wealth. We estimate the regressions using sub-samples consisting of households with (i) low wealth—lowest 40% of households, (ii) middle wealth—middle 40% of households, and (iii) high wealth—top 20% of households. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (panel (a)), and panels (b) and (c) disaggregate IPV experience into different frequencies. The broad types of IPVs include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual IPVs. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include the baseline covariates and fixed effects. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 10: Heterogeneous effects of ASgM on IPV by age different between partners (broad categories)

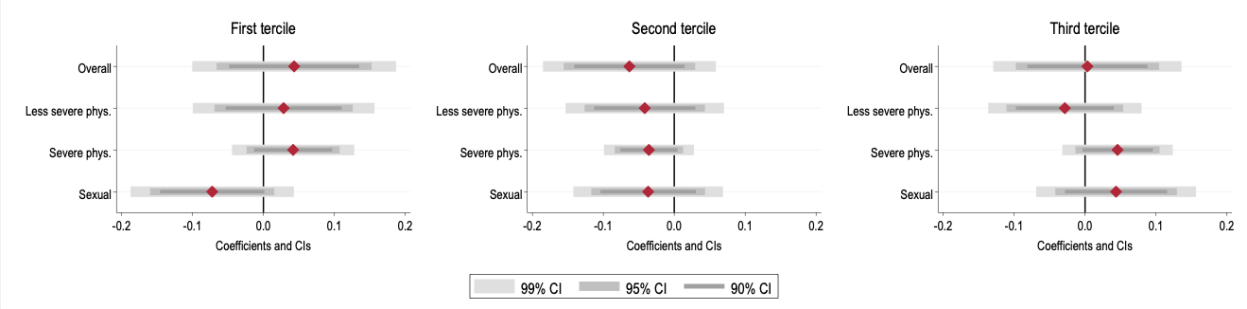
(a) Ever in the last 12 months



(b) Sometimes



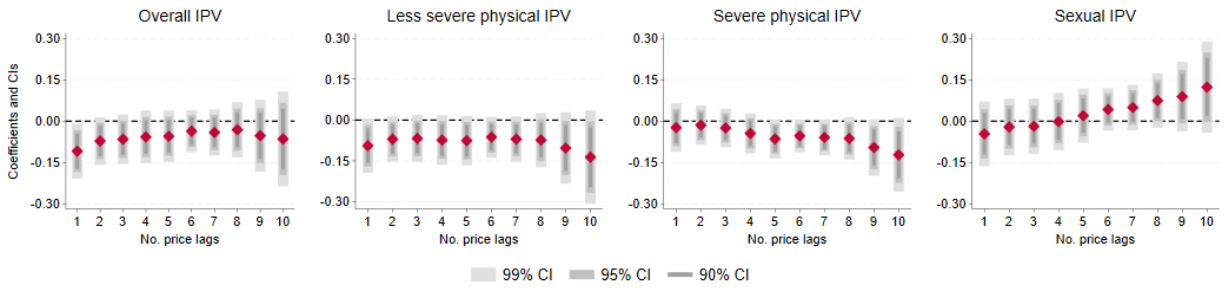
(c) Often



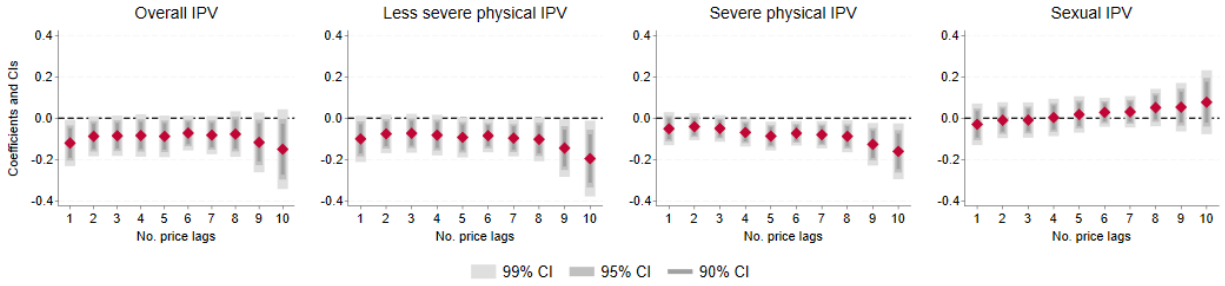
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa heterogeneous by woman's age difference from her partner. We estimate the regressions using sub-samples consisting women whose age difference from her partner is in the (i) first tercile, (ii) second tercile, and (iii) third tercile. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (panel (a)), and panels (b) and (c) disaggregate IPV experience into different frequencies. The broad types of IPVs include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual IPVs. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include the baseline covariates and fixed effects. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 11: Persistence of effects of ASgM on IPV (broad categories)

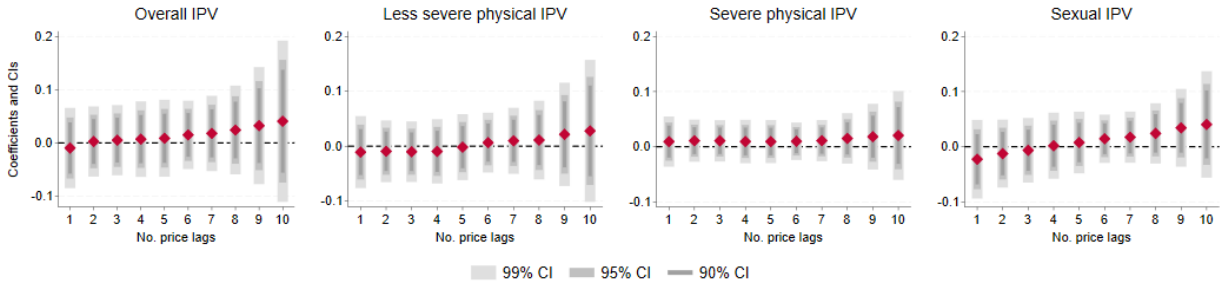
(a) Ever in the last 12 months



(b) Sometimes



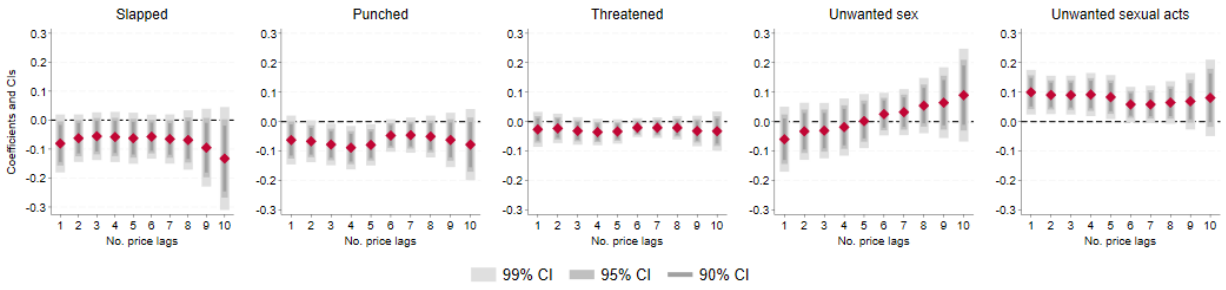
(c) Often



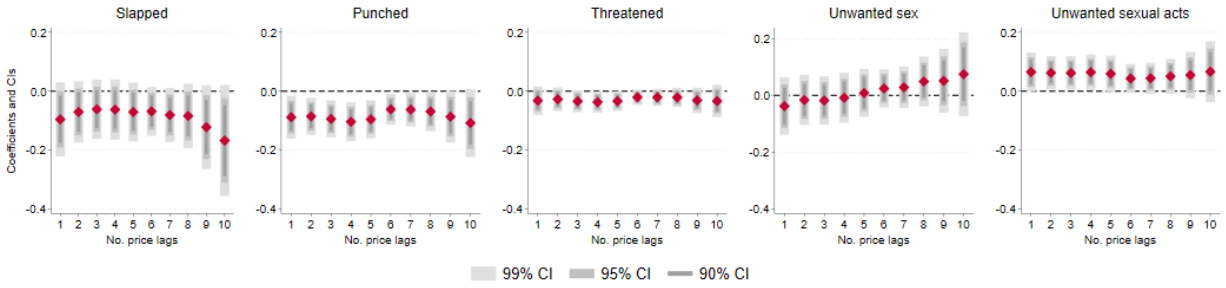
Notes: The figure presents the OLS estimates on the persistence of effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables for broad IPV types ever experienced in the last 12 months (panel (a)) and those with different frequencies (panels (b) and (c)). The broad types of IPVs include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual IPVs. In each sub-panel, each of the point estimates comes from separate regressions where the key explanatory variable is a measure of artisanal gold mining shock at different periods (an interaction between the proportion of the surface of the cell that is gold-suitable and the value of the international gold price with different lags). For example, the first estimate in each sub-panel comes from a regression where we use a 1-year time lag from the survey year, which covers the same period as IPV experiences in the last 12 months, i.e., the number of lags is one. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The only household characteristic is household size. The cell-level covariates include industrial gold mining (industrial gold mines interacted with international gold price at the respective periods), current agricultural potential (crop suitability multiplied by 1-year lagged average crop price in all regressions), and current weather conditions. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Figure 12: Persistence of effects of ASgM on IPV (detailed categories)

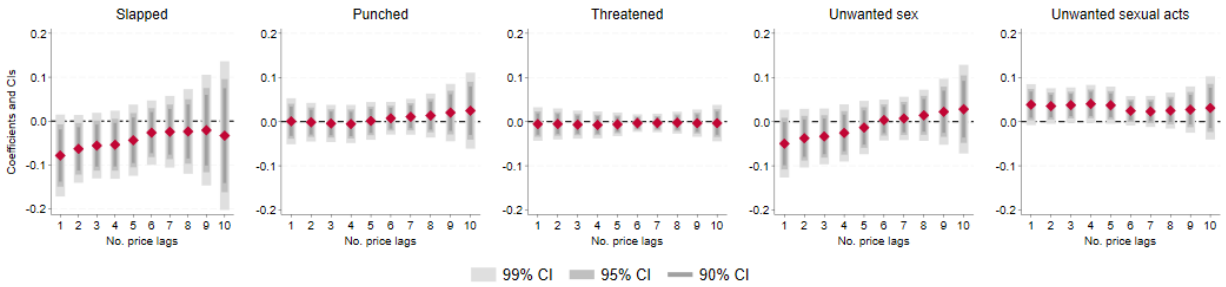
(a) Ever in the last 12 months



(b) Sometimes



(c) Often



Notes: The figure presents the OLS estimates on the persistence of effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables for detailed IPV types ever experienced by the woman in the last 12 months (panel (a)) and those with different frequencies (panels (b) and (c)). The detailed types of IPVs include dummy variables indicating whether a woman has been (i) pushed, shook, or had something thrown, (ii) slapped, (iii) punched with fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/-gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by her husband or partner, respectively. In each sub-panel, each of the point estimates comes from separate regressions where the key explanatory variable is a measure of artisanal gold mining shock at different periods (an interaction between the proportion of the surface of the cell that is gold-suitable and the value of the international gold price with different lags). For example, the first estimate in each sub-panel comes from a regression where we use a 1-year time lag from the survey year, which covers the same period as IPV experiences in the last 12 months, i.e., the number of lags is one. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The only household characteristic is household size. The cell-level covariates include industrial gold mining (industrial gold mines interacted with international gold price at the respective periods), current agricultural potential (crop suitability multiplied by 1-year lagged average crop price in all regressions), and current weather conditions. The unit of observation is the woman. Standard errors are clustered by cells, and 90%, 95%, and 99% confidence intervals are presented.

Tables

Table 1: Pairwise correlation between gold suitability IPV

	Share of the cell suitable for gold
IPV experience, ever	0.036***
	(0.002)
IPV experienced, sometimes	0.037***
	(0.002)
IPV experienced, often	0.008***
	(0.002)
Observations	228,902

Notes: The table presents the correlation coefficients between the woman's experience of intimate partner violence (IPV) by husband or partner with different frequencies and gold suitability share in Sub-Saharan Africa between 1990 and 2019. The standard errors are in parentheses. The unit of observation is a combination of woman, PRIO-Grid cell of 0.5×0.5 degrees, and year. Significance: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

Table 2: Descriptive statistics for DHS variables

	Mean	SD	Min	Max	Observations
	Panel A. Individual characteristics				
Age	31.42	8.706	15	49	855,216
Urban	0.312	0.464	0	1	855,216
Never mover	0.418	0.493	0	1	538,819
Marital status					
Married	0.774	0.418	0	1	842,673
Living with partner	0.112	0.315	0	1	842,673
Widowed	0.038	0.191	0	1	842,673
Divorced	0.032	0.177	0	1	842,673
Separated	0.044	0.204	0	1	842,673
Education					
No school	0.443	0.497	0	1	855,196
Primary	0.342	0.474	0	1	855,196
Secondary	0.186	0.389	0	1	855,196
Higher	0.029	0.167	0	1	855,196
Religion					
None	0.031	0.173	0	1	734,557
Muslim	0.390	0.488	0	1	777,227
Christian	0.558	0.497	0	1	793,175
Others	0.031	0.172	0	1	791,199
	Panel B. Household wealth[a]				
Wealth index	0	1	-3.79	11.42	602,378
Low income	0.416	0.493	0	1	602,378
Middle income	0.388	0.487	0	1	602,378
High income	0.195	0.396	0	1	602,378
	Panel C. Women's employment status				
Employed in the last 12 months	0.725	0.446	0	1	829,962
Currently working	0.662	0.473	0	1	842,158
Agriculture[b]	0.493	0.500	0	1	595,650
Extractive	0.004	0.065	0	1	489,963
Service	0.053	0.225	0	1	596,581
Sales	0.275	0.447	0	1	596,581
	Panel D. Spouse's employment status				
Employed in the last 12 months	0.973	0.162	0	1	771,390
Agriculture[b]	0.483	0.500	0	1	750,400
Extractive	0.022	0.146	0	1	600,448
Service	0.066	0.248	0	1	735,110
Sales	0.113	0.317	0	1	735,110

Notes: The descriptive statistics are estimated from the DHS sample of ever-married women aged between 15-49 years old inclusive. [a] Household wealth summary statistics are calculated at the household level. [b] Conditional on being employed in the last 12 months.

Table 3: Descriptive statistics for IPV experience in the last 12 months

	Ever		Sometimes		Often	
	Mean	SD	Mean	SD	Mean	SD
	Panel A. IPV experience, broad					
Less severe physical IPV	0.201	0.401	0.165	0.371	0.053	0.223
Severe physical IPV	0.082	0.275	0.062	0.241	0.022	0.146
Sexual IPV	0.098	0.298	0.072	0.258	0.030	0.171
Overall (any of these) IPV	0.245	0.430	0.206	0.404	0.071	0.256
	Panel B. IPV experience, detailed					
Pushed	0.093	0.290	0.066	0.249	0.027	0.163
Slapped	0.174	0.379	0.135	0.341	0.046	0.210
Punched with fist	0.071	0.257	0.049	0.216	0.021	0.145
Twisted arm/pulled hair	0.052	0.222	0.036	0.186	0.014	0.119
Kicked/dragged	0.073	0.260	0.053	0.224	0.020	0.139
Strangled or burnt	0.024	0.154	0.017	0.128	0.006	0.080
Threatened or attacked with knife/gun	0.016	0.125	0.010	0.099	0.005	0.072
Physically forced into unwanted sex	0.088	0.283	0.061	0.240	0.027	0.163
Forced into other unwanted sexual acts	0.034	0.182	0.022	0.146	0.011	0.102
Physically forced to perform unwanted sexual acts	0.037	0.190	0.025	0.157	0.011	0.105

Notes: The descriptive statistics are estimated from the DHS sample of ever-married women aged between 15-49 years old inclusive.

Table 4: Descriptive statistics at 0.5×0.5 degrees grid level

	Mean	SD	Min	Max	Observations
Gold suitable dummy	0.588	0.492	0	1	3,948
Gold suitable share	0.259	0.334	0	1	3,948
Crop suitable dummy (Medium)[a]	0.825	0.380	0	1	3,948
Crop suitable dummy (Good)	0.702	0.457	0	1	3,948
Industrial gold mines dummy[b]	0.026	0.158	0	1	9,976
Gold suitable share × Gold price	0.207	0.300	0	1.237	10,170
Crop suitable × Crop price	0.340	0.452	0	1.510	10,841
Industrial gold × Gold price	0.018	0.122	0	1.237	9,602
Temperature	24.50	3.603	9.517	31.13	10,163

Notes: The variables are calculated at 0.5×0.5 degrees PRIO-Grid cells, which overlap with the DHS enumeration area. [a] A cell is suitable for agriculture if it is classified as "Medium" (or "Good") or better for cultivation of at least one crop. [b] $= 1$ if a cell's main mineral of industrial production is gold in year t.

Table 5: Effects of artisanal and industrial gold mining on intimate partner violence (broad categories)

	Dependent variable: A dummy variable for intimate partner violence (IPV)			
	(1) Overall IPV	(2) Less severe physical IPV	(3) Severe physical IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
Gold suitable × Gold price	-0.109***	-0.094**	-0.023	-0.046
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial gold mines × Gold price	0.135***	0.171***	0.034	0.097
	(0.045)	(0.054)	(0.049)	(0.064)
Observations	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes			
Gold suitable × Gold price	-0.120***	-0.100**	-0.051	-0.030
	(0.043)	(0.043)	(0.031)	(0.039)
Industrial gold mines × Gold price	0.178***	0.191***	0.077	0.086*
	(0.056)	(0.060)	(0.056)	(0.050)
Observations	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often			
Gold suitable × Gold price	-0.010	-0.011	0.009	-0.023
	(0.029)	(0.025)	(0.018)	(0.028)
Industrial gold mines × Gold price	-0.066	-0.079	-0.052	0.016
	(0.052)	(0.049)	(0.035)	(0.041)
Observations	69840	67703	69250	67516
R^2	0.20	0.21	0.09	0.11

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(4), respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). The effects of industrial gold mining are also presented, and the measure of industrial gold mining is our baseline measure (an interaction of a dummy indicating whether a cell has industrial gold mines with the lagged value of the international gold price). All regressions include individual and household characteristics, other cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include agricultural potential and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 6: Effects of artisanal and industrial gold mining on intimate partner violence (detailed categories)

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable × Gold price	-0.006	-0.081**	-0.063*	0.022	-0.012	-0.010	-0.026	-0.060	0.100***	-0.036
	(0.034)	(0.039)	(0.032)	(0.052)	(0.033)	(0.020)	(0.023)	(0.043)	(0.029)	(0.041)
Industrial gold mines × Gold price	0.018	0.148***	0.043	0.201**	0.088	-0.004	-0.010	0.134**	0.034	0.188***
	(0.051)	(0.050)	(0.039)	(0.097)	(0.058)	(0.045)	(0.038)	(0.063)	(0.048)	(0.062)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
R^2	0.10	0.15	0.09	0.08	0.13	0.12	0.07	0.12	0.10	0.09
	Panel B. Sometimes									
Gold suitable × Gold price	-0.046	-0.096**	-0.088***	-0.007	-0.031	-0.016	-0.032*	-0.038	0.065**	-0.053
	(0.033)	(0.049)	(0.028)	(0.047)	(0.030)	(0.016)	(0.019)	(0.039)	(0.026)	(0.035)
Industrial gold mines × Gold price	0.030	0.154***	0.005	0.191*	0.171***	-0.000	0.020	0.132**	0.014	0.093
	(0.044)	(0.059)	(0.034)	(0.098)	(0.066)	(0.042)	(0.031)	(0.055)	(0.034)	(0.067)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
R^2	0.10	0.16	0.09	0.07	0.15	0.13	0.05	0.12	0.09	0.08
	Panel C. Often									
Gold suitable × Gold price	0.018	-0.078**	0.001	0.029	0.004	0.001	-0.005	-0.050*	0.038**	0.005
	(0.021)	(0.036)	(0.020)	(0.022)	(0.020)	(0.010)	(0.015)	(0.030)	(0.018)	(0.022)
Industrial gold mines × Gold price	-0.030	-0.076	0.004	0.073	-0.082	-0.020	-0.038	0.039	0.034	0.107***
	(0.034)	(0.076)	(0.029)	(0.053)	(0.055)	(0.023)	(0.026)	(0.041)	(0.037)	(0.038)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578
R^2	0.15	0.23	0.13	0.09	0.10	0.06	0.08	0.12	0.08	0.10

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). The effects of industrial gold mining are also presented, and the measure of industrial gold mining is our baseline measure (an interaction of a dummy indicating whether a cell has industrial gold mines with the lagged value of the international gold price). All regressions include individual and household characteristics, other cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. Other cell-level covariates include agricultural potential and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 7: Effects of artisanal gold mining on women's intrahousehold decision-making

	(1) Aggregate index 1	(2) Aggregate index 2	(3) Own money	(4) Own health	(5) Large purchase	(6) Daily purchase	(7) Visit	(8) Cook	(9) Husband money
Gold suitable × Gold price	0.059***	0.071***	0.018	0.063***	0.054**	0.093**	0.097***	0.039	-0.011
	(0.016)	(0.020)	(0.018)	(0.023)	(0.022)	(0.036)	(0.027)	(0.043)	(0.038)
Observations	601189	598713	280025	594362	598571	233360	598556	134210	467840
R^2	0.35	0.34	0.12	0.28	0.27	0.30	0.24	0.19	0.28

Notes: The table presents the effects of artisanal gold mining on women's intrahousehold decision-making power using OLS regressions. The outcomes are dummy variables, indicating if the woman has the final say, individually or jointly with her husband/partner/someone else, on (i) spending her own money, (ii) her health care, (iii) making large purchases, (iv) making daily purchases, (v) making family visits, (vi) deciding what to cook daily, and (vii) spending her husband's money. The aggregate index 1 is calculated by taking a simple average of all the dummies, and aggregate index 2 is a simple average of the three most commonly asked questions in the DHS: (ii), (iii), and (v). The key explanatory variable is the interaction between gold suitability share and 1-year lagged gold price index. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the individual. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 8: Effects of artisanal gold mining on women's attitude toward domestic violence and barriers to health care access

	Panel A. Attitude toward domestic violence						Panel B. Barriers to health care access			
	(1) Aggregate index	(2) Go out	(3) Neglect	(4) Argue	(5) Refuse sex	(6) Burn food	(7) Aggregate index	(8) Permission	(9) Money	(10) Distance
Gold suitable × Gold price	0.001	0.011	0.009	0.002	-0.008	-0.010	-0.010	-0.019	-0.016	0.005
	(0.019)	(0.024)	(0.024)	(0.025)	(0.021)	(0.018)	(0.019)	(0.018)	(0.024)	(0.027)
Industrial gold × Gold price	-0.001	0.003	-0.015	0.016	0.002	-0.008	-0.064*	-0.098***	-0.038	-0.056
	(0.022)	(0.027)	(0.032)	(0.029)	(0.026)	(0.028)	(0.037)	(0.035)	(0.053)	(0.044)
Observations	597179	593799	594434	593123	591133	593662	598011	597803	597852	597834
R^2	0.28	0.22	0.20	0.22	0.24	0.16	0.22	0.16	0.17	0.19

Notes: The table presents the effects of artisanal gold mining on women's attitudes toward domestic violence (panel A) and their barriers to healthcare access (panel B). The outcomes for women's attitudes are dummy variables indicating whether the woman agrees that it is justified for the husband to beat his wife if she (i) goes out without telling her husband, (ii) neglects the children, (iii) argues with her husband, (iv) refuses to have sex, and (v) burns the food. The aggregate index is calculated by taking a simple average of the dummies. Outcomes for barriers to health care access are dummy variables equal to one if a woman thinks (i) getting permission, (ii) getting money, or (iii) distance to the health facility is a barrier to health care access. The key explanatory variable is the interaction between gold suitability share and 1-year lagged gold price index. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the individual. Standard errors clustered by cells are in parentheses. Significance: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

Table 9: Employment effects of artisanal gold mining

	Dependent variable: A dummy variable for employment				
	(1) All	(2) Mining	(3) Agriculture	(4) Services	(5) Sales
	Panel A. Overall				
Gold suitable × Gold price	-0.005	0.024***	-0.027	-0.024**	0.033*
	(0.005)	(0.008)	(0.017)	(0.011)	(0.018)
Industrial gold mines × Gold price	0.007	0.011	-0.034	-0.011	0.022
	(0.010)	(0.014)	(0.028)	(0.015)	(0.024)
Observations	690232	540713	669866	663098	663098
R^2	0.09	0.09	0.42	0.12	0.19
	Panel B. Male				
Gold suitable × Gold price	-0.007	0.012**	-0.034**	-0.017*	0.004
	(0.004)	(0.005)	(0.015)	(0.010)	(0.010)
Industrial gold mines × Gold price	0.016	0.004	-0.040	0.005	0.016
	(0.012)	(0.009)	(0.028)	(0.013)	(0.014)
Observations	658986	516913	640177	624925	624925
R^2	0.08	0.08	0.36	0.08	0.09
	Panel C. Female				
Gold suitable × Gold price	-0.015	0.023***	-0.034*	-0.016	0.037*
	(0.020)	(0.006)	(0.021)	(0.011)	(0.022)
Industrial gold mines × Gold price	0.008	0.011	-0.032	-0.021	0.013
	(0.040)	(0.013)	(0.042)	(0.018)	(0.035)
Observations	690121	398605	482918	483692	483692
R^2	0.20	0.09	0.44	0.14	0.28

Notes: The table presents the effects of artisanal gold mining on employment or labor supply in Sub-Saharan Africa using OLS regressions. The dependent variables are dummy variables indicating whether an individual is employed in different industries. The aggregate, male, and female employment are considered in Panels A-C, respectively. Employment outcomes in Columns (1)-(5) are activities in all industries, mining, agriculture, services, and sales, respectively, in the last 12 months. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the individual. Standard errors clustered by cells are in parentheses. Significance: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

Table 10: Effects of artisanal gold mining on household wealth, various specifications

	Dependent variable: Household wealth index, standardized				
	(1)	(2)	(3)	(4)	(5)
Gold suitable × Gold price (lag 1)	0.090**				0.088**
	(0.043)				(0.043)
Gold suitable × Log price		0.069**			
		(0.030)			
Gold suitable × Current price			0.094*		
			(0.048)		
Gold suitable dummy × Gold price				0.066**	
				(0.031)	
Crop suitable × Crop price	-0.019	-0.018	-0.013	-0.021	-0.019
	(0.039)	(0.039)	(0.040)	(0.038)	(0.039)
Industrial gold mining × Gold price	0.166***	0.163***	0.141***	0.161***	
	(0.056)	(0.056)	(0.055)	(0.057)	
Industrial mineral mining × Mineral price					0.158***
					(0.048)
Temperature	-0.171***	-0.172***	-0.181***	-0.171***	-0.169***
	(0.037)	(0.037)	(0.039)	(0.037)	(0.037)
Observations	552088	552088	651510	552088	554109
R^2	0.65	0.65	0.62	0.65	0.65

Notes: The table presents the effects of artisanal gold mining on household wealth in Sub-Saharan Africa using OLS regressions. The dependent variable is the standardized household wealth index. The key explanatory variable is an alternative specification of an interaction of a cell's gold suitability with the international gold price. Column (1) is a baseline specification, an interaction of gold suitability share with a 1-year lagged gold price index. Column (2) uses log gold price. Column (3) uses contemporaneous price. Column (4) uses a gold suitability dummy. Column (5) controls industrial mineral mining. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual characteristics include the woman's and her spouse/partner's age, education level, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold or mineral mining, agricultural potential, and weather conditions. The unit of observation is the household. Standard errors clustered by cells are in parentheses. Significance: $*p < 0.10$, $**p < 0.05$, and $***p < 0.01$.

Table 11: Effects of artisanal and industrial gold mining on intimate partner violence, controlling for household wealth (broad categories)

	Dependent variable: A dummy variable for intimate partner violence (IPV)			
	(1) Overall IPV	(2) Less severe physical IPV	(3) Severe physical IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
Gold suitable × Gold price	-0.106***	-0.091**	-0.022	-0.044
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial gold mines × Gold price	0.134***	0.170***	0.034	0.096
	(0.045)	(0.053)	(0.049)	(0.064)
Household wealth	-0.027***	-0.031***	-0.016***	-0.018***
	(0.003)	(0.003)	(0.003)	(0.003)
Observations	69990	69987	69979	69972
R^2	0.18	0.17	0.13	0.13
	Panel B. Sometimes			
Gold suitable × Gold price	-0.118***	-0.098**	-0.050	-0.029
	(0.044)	(0.043)	(0.031)	(0.039)
Industrial gold mines × Gold price	0.178***	0.190***	0.077	0.086*
	(0.056)	(0.060)	(0.056)	(0.050)
Household wealth	-0.020***	-0.025***	-0.010***	-0.008***
	(0.003)	(0.003)	(0.003)	(0.003)
Observations	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often			
Gold suitable × Gold price	-0.008	-0.009	0.010	-0.021
	(0.029)	(0.025)	(0.018)	(0.027)
Industrial gold mines × Gold price	-0.067	-0.079	-0.052	0.015
	(0.052)	(0.049)	(0.035)	(0.040)
Household wealth	-0.022***	-0.016***	-0.010***	-0.015***
	(0.003)	(0.002)	(0.002)	(0.002)
Observations	69840	67703	69250	67516
R^2	0.20	0.21	0.09	0.11

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(4), respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). The effects of industrial gold mining are also presented, and the measure of industrial gold mining is our baseline measure (an interaction of a dummy indicating whether a cell has industrial gold mines with the lagged value of the international gold price). All regressions include individual and household characteristics, other cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include the place of residence or rural/urban dummy, household size, and wealth index. The cell-level covariates include agricultural potential and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: $^*p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 12: Effects of artisanal and industrial gold mining on intimate partner violence, controlling for household wealth (detailed categories)

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable × Gold price	-0.004	-0.078**	-0.061*	0.022	-0.011	-0.010	-0.025	-0.058	0.101***	-0.037
	(0.034)	(0.039)	(0.032)	(0.051)	(0.033)	(0.020)	(0.023)	(0.043)	(0.029)	(0.041)
Industrial gold mines × Gold price	0.018	0.147***	0.042	0.205**	0.089	-0.004	-0.010	0.133**	0.034	0.193***
	(0.051)	(0.050)	(0.039)	(0.097)	(0.058)	(0.045)	(0.038)	(0.063)	(0.048)	(0.064)
Household wealth	-0.019***	-0.027***	-0.020***	-0.007***	-0.016***	-0.004**	-0.008***	-0.015***	-0.009***	-0.012***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
R^2	0.10	0.15	0.09	0.08	0.13	0.12	0.07	0.12	0.10	0.09
	Panel B. Sometimes									
Gold suitable × Gold price	-0.046	-0.094*	-0.087***	-0.006	-0.030	-0.016	-0.031*	-0.037	0.066**	-0.053
	(0.033)	(0.049)	(0.029)	(0.047)	(0.031)	(0.016)	(0.019)	(0.039)	(0.025)	(0.035)
Industrial gold mines × Gold price	0.030	0.154***	0.004	0.192**	0.171***	-0.000	0.020	0.132**	0.014	0.096
	(0.044)	(0.059)	(0.034)	(0.098)	(0.065)	(0.042)	(0.031)	(0.055)	(0.034)	(0.068)
Household wealth	-0.012***	-0.024***	-0.015***	-0.003	-0.010***	-0.001	-0.005***	-0.006**	-0.004**	-0.007***
	(0.003)	(0.004)	(0.003)	(0.002)	(0.003)	(0.001)	(0.001)	(0.003)	(0.002)	(0.002)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
R^2	0.10	0.17	0.09	0.07	0.15	0.13	0.06	0.12	0.09	0.08
	Panel C. Often									
Gold suitable × Gold price	0.019	-0.075**	0.002	0.030	0.006	0.001	-0.005	-0.048	0.039**	0.004
	(0.021)	(0.036)	(0.020)	(0.022)	(0.020)	(0.010)	(0.015)	(0.030)	(0.018)	(0.022)
Industrial gold mines × Gold price	-0.031	-0.078	0.004	0.076	-0.082	-0.020	-0.038	0.038	0.034	0.109***
	(0.034)	(0.075)	(0.030)	(0.053)	(0.055)	(0.023)	(0.026)	(0.041)	(0.036)	(0.038)
Household wealth	-0.014***	-0.020***	-0.010***	-0.006***	-0.011***	-0.004***	-0.003***	-0.015***	-0.007***	-0.006***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578
R^2	0.15	0.23	0.13	0.09	0.10	0.06	0.08	0.12	0.09	0.10

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). The effects of industrial gold mining are also presented, and the measure of industrial gold mining is our baseline measure (an interaction of a dummy indicating whether a cell has industrial gold mines with the lagged value of the international gold price). All regressions include individual and household characteristics, other cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include the place of residence or rural/urban dummy, household size, and wealth index. Other cell-level covariates include agricultural potential and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 13: Effects of artisanal gold mining on individual and household characteristics

	Dependent variable: Observable characteristics					
	(1) Never married	(2) Married	(3) Living together	(4) Widowed	(5) Divorced	(6) Separated
Gold suitable × Gold price	0.003	0.012	-0.024**	0.004	-0.002	0.008**
	(0.008)	(0.013)	(0.012)	(0.003)	(0.002)	(0.004)
Observations	944670	944670	944670	944670	944670	944670
R^2	0.38	0.29	0.16	0.06	0.03	0.03
	(7) Age	(8) Non-mover	(9) Household size			
Gold suitable × Gold price	-0.180	-0.028	-0.005			
	(0.181)	(0.031)	(0.019)			
Observations	957053	564907	957053			
R^2	0.10	0.16	0.23			

Notes: The table presents the effects of artisanal gold mining on observable characteristics of the full DHS sample using OLS regressions. Non-movers (Column (8)) are those who never move out of their residence. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include education level and religion. The household characteristics include place of residence or rural/urban dummy. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 14: Effects of artisanal gold mining on individual migration status

	(1) 0 year	(2) 1 year	(3) 2 years	(4) 3 years	(5) 4 years
	Panel A. All women				
Gold suitable × Gold price	0.013**	0.011	0.011	0.010	0.008
	(0.006)	(0.009)	(0.012)	(0.015)	(0.017)
Observations	944687	944687	944687	944687	944687
R^2	0.06	0.10	0.13	0.17	0.19
	Panel B. Ever-married women				
Gold suitable × Gold price	0.011*	0.008	0.007	0.004	0.001
	(0.006)	(0.009)	(0.011)	(0.014)	(0.016)
Observations	702016	702016	702016	702016	702016
R^2	0.07	0.10	0.14	0.18	0.20

Notes: The table presents the effects of artisanal gold mining on individual migration status using OLS regressions. Each Column represents the maximum period the woman is residing in her location. For example, Column (2) contains individuals living in their locality for at most one year. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include education level and religion. The household characteristics include place of residence or rural/urban dummy. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 15: Robustness checks: Effects of artisanal gold mining on intimate partner violence (broad categories) using gold suitability dummy

	Dependent variable: A dummy variable for intimate partner violence (IPV)			
	(1) Overall IPV	(2) Less severe IPV	(3) Severe IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
Gold suitable dummy × Gold price	-0.114***	-0.097***	0.017	-0.040
	(0.028)	(0.031)	(0.025)	(0.030)
Observations	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes			
Gold suitable dummy × Gold price	-0.094***	-0.097***	0.009	-0.022
	(0.032)	(0.034)	(0.023)	(0.024)
Observations	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often			
Gold suitable dummy × Gold price	-0.028	-0.021	0.006	-0.033
	(0.022)	(0.019)	(0.013)	(0.022)
Observations	69840	67703	69250	67516
R^2	0.20	0.21	0.09	0.11

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(2), (3)-(4), (5)-(6), (7)-(8), respectively. The key explanatory variable is an interaction of the gold suitability dummy with the 1-year lagged gold price index. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 16: Robustness checks: Effects of artisanal gold mining on intimate partner violence (detailed categories) using gold suitability dummy

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable dummy × Gold price	0.004	-0.106***	-0.006	0.076*	0.003	0.021*	0.001	-0.036	0.039*	-0.011
	(0.025)	(0.031)	(0.023)	(0.044)	(0.025)	(0.013)	(0.014)	(0.029)	(0.020)	(0.029)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
R^2	0.10	0.15	0.09	0.08	0.13	0.12	0.07	0.12	0.10	0.09
	Panel B. Sometimes									
Gold suitable dummy × Gold price	-0.022	-0.124***	-0.025	0.033	-0.007	0.011	-0.007	-0.018	0.029*	-0.024
	(0.024)	(0.038)	(0.019)	(0.039)	(0.024)	(0.011)	(0.011)	(0.024)	(0.017)	(0.025)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
R^2	0.10	0.16	0.09	0.07	0.15	0.13	0.05	0.12	0.09	0.08
	Panel C. Often									
Gold suitable dummy × Gold price	0.010	-0.087***	0.006	0.041**	-0.002	0.009	0.004	-0.040*	0.004	-0.002
	(0.016)	(0.028)	(0.016)	(0.019)	(0.016)	(0.008)	(0.010)	(0.023)	(0.013)	(0.014)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578
R^2	0.15	0.23	0.13	0.09	0.10	0.06	0.08	0.12	0.08	0.10

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is an interaction of the gold suitability dummy with the 1-year lagged gold price index. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 17: Robustness checks: Effects of artisanal gold mining on intimate partner violence (broad categories) using alternative gold prices

	Dependent variable: A dummy variable for intimate partner violence (IPV)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Overall IPV		Less severe IPV		Severe IPV		Sexual IPV	
	Panel A. Ever in the last 12 months							
Gold suitable × Log price	-0.072**		-0.067**		-0.015		-0.026	
	(0.028)		(0.028)		(0.026)		(0.035)	
Gold suitable × Current price		-0.111**		-0.117**		-0.006		-0.024
		(0.048)		(0.049)		(0.045)		(0.059)
Observations	69990	69990	69987	69987	69979	69979	69972	69972
R^2	0.18	0.18	0.17	0.17	0.12	0.12	0.13	0.13
	Panel B. Sometimes							
Gold suitable × Log price	-0.079**		-0.070**		-0.038		-0.010	
	(0.032)		(0.032)		(0.023)		(0.029)	
Gold suitable × Current price		-0.099*		-0.101*		-0.042		0.001
		(0.054)		(0.055)		(0.041)		(0.049)
Observations	69813	69813	68275	68275	69478	69478	68665	68665
R^2	0.21	0.21	0.17	0.17	0.14	0.14	0.12	0.12
	Panel C. Often							
Gold suitable × Log price	-0.008		-0.013		0.009		-0.018	
	(0.022)		(0.019)		(0.014)		(0.024)	
Gold suitable × Current price		-0.026		-0.033		0.017		-0.024
		(0.039)		(0.033)		(0.025)		(0.041)
Observations	69840	69840	67703	67703	69250	69250	67516	67516
R^2	0.20	0.20	0.21	0.21	0.09	0.09	0.11	0.11

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(2), (3)-(4), (5)-(6), (7)-(8), respectively. The key explanatory variable is an interaction of the proportion of the cell's surface suitable for gold with the log of 1-year lagged gold price (odd-numbered columns) or current price index at the survey year (even-numbered columns). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table 18: Robustness checks: Effects of artisanal gold mining on intimate partner violence (detailed categories) using log gold prices

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable × Log price	-0.005	-0.057**	-0.049*	0.016	-0.011	-0.006	-0.020	-0.040	0.079***	-0.029
	(0.026)	(0.028)	(0.026)	(0.043)	(0.026)	(0.014)	(0.017)	(0.033)	(0.022)	(0.034)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
R^2	0.10	0.15	0.09	0.08	0.13	0.12	0.07	0.12	0.10	0.09
	Panel B. Sometimes									
Gold suitable × Log price	-0.034	-0.065*	-0.069***	-0.006	-0.025	-0.011	-0.024*	-0.019	0.051***	-0.043
	(0.025)	(0.037)	(0.022)	(0.039)	(0.024)	(0.012)	(0.013)	(0.029)	(0.019)	(0.029)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
R^2	0.10	0.16	0.09	0.07	0.15	0.13	0.05	0.12	0.09	0.08
	Panel C. Often									
Gold suitable × Log price	0.010	-0.064**	-0.003	0.023	0.004	0.001	-0.004	-0.038	0.032**	0.004
	(0.017)	(0.026)	(0.017)	(0.018)	(0.017)	(0.008)	(0.012)	(0.026)	(0.014)	(0.018)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578
R^2	0.15	0.23	0.13	0.09	0.10	0.06	0.08	0.12	0.08	0.10

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is an interaction of the proportion of the cell's surface suitable for gold with the log of 1-year lagged gold price. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 19: Robustness checks: Effects of artisanal gold mining on intimate partner violence (detailed categories) using contemporaneous gold prices

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable × Current price	-0.001	-0.088*	-0.065	0.060	-0.002	0.002	-0.030	-0.053	0.147***	-0.023
	(0.045)	(0.049)	(0.044)	(0.075)	(0.046)	(0.026)	(0.029)	(0.056)	(0.039)	(0.057)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
R^2	0.10	0.15	0.09	0.08	0.13	0.12	0.07	0.12	0.10	0.09
	Panel B. Sometimes									
Gold suitable × Current price	-0.044	-0.091	-0.095**	0.038	-0.026	-0.012	-0.038*	-0.016	0.098***	-0.044
	(0.044)	(0.063)	(0.038)	(0.069)	(0.043)	(0.021)	(0.022)	(0.049)	(0.034)	(0.051)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
R^2	0.10	0.16	0.09	0.07	0.15	0.13	0.05	0.12	0.09	0.08
	Panel C. Often									
Gold suitable × Current price	0.012	-0.118**	-0.007	0.031	0.005	0.007	-0.004	-0.058	0.057**	0.009
	(0.030)	(0.046)	(0.030)	(0.031)	(0.029)	(0.014)	(0.022)	(0.044)	(0.026)	(0.031)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578
R^2	0.15	0.23	0.13	0.09	0.10	0.06	0.08	0.12	0.08	0.10

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is an interaction of the proportion of the cell's surface suitable for gold with the current price index at the survey year. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 20: Robustness checks: Effects of artisanal gold mining on intimate partner violence (broad categories) controlling for industrial mineral mining

	Dependent variable: A dummy variable for intimate partner violence (IPV)			
	(1) Overall IPV	(2) Less severe IPV	(3) Severe IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
Gold suitable × Gold price	-0.109***	-0.095**	-0.027	-0.045
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial mining × Mineral price	0.133***	0.167***	0.090	0.079
	(0.051)	(0.057)	(0.056)	(0.061)
Observations	70276	70273	70265	70258
R^2	0.18	0.17	0.13	0.13
	Panel B. Sometimes			
Gold suitable × Gold price	-0.119***	-0.100**	-0.054*	-0.028
	(0.043)	(0.043)	(0.031)	(0.039)
Industrial mining × Mineral price	0.161***	0.177***	0.121**	0.066
	(0.060)	(0.063)	(0.055)	(0.049)
Observations	70099	68552	69762	68950
R^2	0.21	0.17	0.14	0.12
	Panel C. Often			
Gold suitable × Gold price	-0.010	-0.012	0.010	-0.023
	(0.029)	(0.025)	(0.018)	(0.028)
Industrial mining × Mineral price	-0.056	-0.049	-0.034	0.015
	(0.049)	(0.048)	(0.033)	(0.037)
Observations	70121	67973	69528	67791
R^2	0.20	0.21	0.09	0.11

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(2), (3)-(4), (5)-(6), (7)-(8), respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial mineral mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 21: Robustness checks: Effects of artisanal gold mining on intimate partner violence (detailed categories) controlling for industrial mineral mining

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable × Gold price	-0.004	-0.081**	-0.064**	0.024	-0.014	-0.010	-0.025	-0.057	0.097***	-0.037
	(0.034)	(0.039)	(0.032)	(0.051)	(0.032)	(0.020)	(0.023)	(0.043)	(0.029)	(0.041)
Industrial mining × Mineral price	0.053	0.148***	0.068	0.145	0.131*	0.024	0.012	0.099	0.081*	0.169***
	(0.056)	(0.055)	(0.041)	(0.091)	(0.073)	(0.043)	(0.037)	(0.062)	(0.044)	(0.065)
Observations	70237	70245	70206	63768	68498	70228	64756	70233	66371	53775
R^2	0.10	0.15	0.09	0.08	0.13	0.12	0.07	0.12	0.10	0.09
	Panel B. Sometimes									
Gold suitable × Gold price	-0.043	-0.096**	-0.088***	-0.004	-0.032	-0.016	-0.031	-0.034	0.064**	-0.052
	(0.033)	(0.049)	(0.028)	(0.046)	(0.030)	(0.016)	(0.019)	(0.039)	(0.025)	(0.035)
Industrial mining × Mineral price	0.033	0.151**	0.030	0.157**	0.181***	0.012	0.029	0.100*	0.046	0.095
	(0.049)	(0.063)	(0.036)	(0.080)	(0.064)	(0.038)	(0.029)	(0.054)	(0.034)	(0.059)
Observations	64899	61941	66148	61082	64765	68906	63766	64838	64281	52098
	Panel C. Often									
Gold suitable × Gold price	0.018	-0.077**	0.001	0.031	0.005	0.001	-0.006	-0.050*	0.037**	0.005
	(0.021)	(0.036)	(0.020)	(0.022)	(0.020)	(0.010)	(0.015)	(0.030)	(0.018)	(0.022)
Industrial mining × Mineral price	0.016	-0.043	0.008	0.009	-0.046	-0.003	-0.022	0.024	0.059*	0.077**
	(0.038)	(0.074)	(0.029)	(0.044)	(0.054)	(0.023)	(0.025)	(0.039)	(0.032)	(0.039)
Observations	56766	43270	60573	56773	57908	66708	62858	57523	61972	49804

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial mineral mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 22: Effects of artisanal gold mining on intimate partner violence (broad categories) controlling for temperature-induced push factor

	Dependent variable: A dummy variable for IPV			
	(1) Overall IPV	(2) Less severe IPV	(3) Severe IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
Temperature	-0.021	-0.069	-0.048	0.031
	(0.037)	(0.042)	(0.033)	(0.041)
Gold suitable × Temperature	-0.023	0.050	-0.041	-0.028
	(0.043)	(0.048)	(0.040)	(0.045)
Gold suitable × Gold price	-0.112***	-0.086**	-0.030	-0.050
	(0.040)	(0.041)	(0.035)	(0.045)
Observations	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes			
Temperature	-0.016	-0.048	-0.040	0.020
	(0.042)	(0.044)	(0.028)	(0.036)
Gold suitable × Temperature	-0.070	-0.019	-0.035	-0.060
	(0.048)	(0.050)	(0.036)	(0.039)
Gold suitable × Gold price	-0.131***	-0.103**	-0.056*	-0.039
	(0.044)	(0.045)	(0.032)	(0.039)
Observations	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often			
Temperature	-0.036	-0.038	-0.025	0.008
	(0.028)	(0.024)	(0.016)	(0.023)
Gold suitable × Temperature	0.082**	0.089***	0.008	0.035
	(0.036)	(0.030)	(0.022)	(0.030)
Gold suitable × Gold price	0.003	0.003	0.011	-0.017
	(0.029)	(0.026)	(0.017)	(0.027)
Observations	69840	67703	69250	67516
R^2	0.20	0.21	0.09	0.11

Notes: The table presents the OLS estimates on the heterogeneous temperature effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(2), (3)-(4), (5)-(6), (7)-(8), respectively. The key explanatory variable is an interaction of the gold suitability share with the log of the 1-year lagged gold price index and the interaction between gold suitability share and average annual temperature. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 23: Effects of artisanal gold mining on intimate partner violence (detailed categories) controlling for temperature-induced push factor

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Temperature	-0.026	-0.037	-0.084***	0.037	-0.051	-0.019	-0.007	0.003	0.012	0.070**
	(0.033)	(0.042)	(0.030)	(0.030)	(0.031)	(0.016)	(0.016)	(0.038)	(0.028)	(0.034)
Gold suitable × Temperature	0.068	-0.002	0.128***	-0.009	-0.008	-0.000	0.007	-0.002	-0.008	-0.025
	(0.049)	(0.045)	(0.035)	(0.044)	(0.043)	(0.022)	(0.023)	(0.044)	(0.032)	(0.045)
Gold suitable × Gold price	0.005	-0.081**	-0.043	0.022	-0.013	-0.010	-0.026	-0.060	0.099***	-0.045
	(0.035)	(0.041)	(0.032)	(0.051)	(0.033)	(0.019)	(0.023)	(0.042)	(0.030)	(0.047)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
	Panel B. Sometimes									
Temperature	-0.027	-0.017	-0.056**	0.034	-0.035	-0.020	-0.004	-0.010	-0.014	0.062**
	(0.033)	(0.044)	(0.027)	(0.027)	(0.027)	(0.013)	(0.014)	(0.035)	(0.025)	(0.031)
Gold suitable × Temperature	0.056	-0.045	0.098***	-0.029	-0.030	-0.003	0.000	-0.047	0.013	-0.041
	(0.043)	(0.050)	(0.031)	(0.041)	(0.038)	(0.019)	(0.019)	(0.039)	(0.027)	(0.039)
Gold suitable × Gold price	-0.039	-0.101**	-0.075***	-0.007	-0.033	-0.017	-0.032*	-0.044	0.067***	-0.067*
	(0.034)	(0.050)	(0.029)	(0.047)	(0.031)	(0.016)	(0.019)	(0.039)	(0.026)	(0.040)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
	Panel C. Often									
Temperature	-0.008	-0.085**	-0.043**	-0.002	-0.030*	-0.006	-0.003	-0.002	0.008	0.005
	(0.020)	(0.034)	(0.018)	(0.015)	(0.018)	(0.009)	(0.008)	(0.026)	(0.014)	(0.015)
Gold suitable × Temperature	0.035	0.089**	0.059***	0.012	0.015	0.007	0.006	0.051	-0.010	0.019
	(0.029)	(0.042)	(0.023)	(0.022)	(0.027)	(0.012)	(0.016)	(0.033)	(0.020)	(0.027)
Gold suitable × Gold price	0.024	-0.058	0.010	0.029	0.006	0.002	-0.005	-0.042	0.037**	0.012
	(0.021)	(0.038)	(0.019)	(0.022)	(0.020)	(0.010)	(0.014)	(0.028)	(0.018)	(0.025)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. The key explanatory variable is our baseline measure of artisanal gold mining (an interaction of the proportion of the cell's surface suitable for gold with the lagged value of the international gold price). All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial mineral mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table 24: Robustness checks: Effects of artisanal gold mining on intimate partner violence (broad categories) using alternative ASgM data

	Dependent variable: A dummy variable for IPV			
	(1) Overall IPV	(2) Less severe IPV	(3) Severe IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
ASgM suitable dummy (RGLS) × Gold price	-0.084**	-0.049	0.024	-0.067*
	(0.033)	(0.033)	(0.029)	(0.039)
Observations	46959	46957	46949	46946
R^2	0.18	0.17	0.12	0.14
	Panel B. Sometimes			
ASgM suitable dummy (RGLS) × Gold price	-0.069*	-0.045	0.019	-0.042
	(0.040)	(0.038)	(0.027)	(0.030)
Observations	46836	45724	46597	46024
R^2	0.22	0.18	0.14	0.13
	Panel C. Often			
ASgM suitable dummy (RGLS) × Gold price	-0.022	-0.014	0.006	-0.048*
	(0.025)	(0.023)	(0.017)	(0.028)
Observations	46851	45402	46454	45331
R^2	0.22	0.23	0.10	0.12

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa using an alternative data for artisanal gold mining (ASgM) suitability. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1), (2), (3), and (4), respectively. The key explanatory variable is an interaction of the ASgM suitability dummy with the 1-year lagged gold price index, whereas the data for gold suitability is taken from Rigterink et al. (2025), or RGLS. All regressions include individual and household characteristics, cell-level covariates, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The cell-level covariates include industrial gold mining, agricultural potential, and weather conditions. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Supplementary Materials
(For Online Publication Only)

Artisanal Mining, Female Empowerment, and Intimate Partner Violence

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This supplementary material presents further details on the data by describing additional outcomes and demographic and environmental controls (Appendix A) and provides additional figures and tables with more results (Appendix B).

A Data Appendix

In Section 4, we defined our primary outcome variables for different types of intimate partner violence (IPV) with different frequencies. This appendix describes our secondary outcomes and demographic and environmental or cell-level characteristics included in our regressions.

A.1 Secondary Outcomes

In this section, we provide details about our secondary outcomes, including various measures of women's intrahousehold bargaining power, individual's gender- and industry-specific employment, household wealth, women's attitudes to intimate partner violence, women's access to health care, and migration.

Intrahousehold decision-making process: The DHS asks women to evaluate their involvement in the household decision-making process throughout several domains, specifically whether she has the final say on (a) spending her own money, (b) her health care, (c) making large purchases, (d) making daily purchases, (e) making family visits, (f) deciding what to cook daily, and (g) spending her husband's money (variable 739 and 743a-743f). We construct a dummy equal to one if she makes a decision by herself or jointly with her husband/partner/someone else. We then calculate an aggregate index for this dimension as a simple average of these dummies. As the questions are not consistently asked throughout the country-year rounds, following Benshaul-Tolonen (2024), we compute another aggregate index using the three most commonly asked domains in the DHS: deciding her own health care, making large purchases, and making family visits.

Labor supply: The focus is employment outcomes among ever-married and 15 and 49-year-old women. We also look at labor supply by husbands or partners to examine the employment impact of artisanal mining heterogeneous by gender. Quantifying relative changes in employment and earning potential between wives and husbands in response to the ASgM shock is crucial in understanding the impact of ASgM on intimate partner violence (IPV) against women because IPV depends on changes in the wife's employment opportunity relative to her husband or partner. The DHS data set is suitable for this purpose as the data provide information on the status of current employment or employment in the last 12 months for the woman and her husband or partner. The data report the woman's and her husband's activity status in different sectors, such as agriculture, extractive or mining, services, and sales or retail. Although we denote an individual's extractive activities as employment in mining, an individual might not be involved in an employment relation with an employer but just self-employed and directly earn from the sales of gold extracted.

First, we extract the woman's current employment status[29] from variable 714 and her employ-

[29]While we acknowledge that a boom in local mining activities could induce one to work harder and work for longer hours (i.e., intensive margin), due to the data availability in the DHS, our employment measure can only capture a snapshot of labor allocation across the sector (i.e., extensive margin).

ment status in the past 12 months from variable 731 and define a dummy variable that takes a value of one if the woman is currently employed or employed in the past year, 0 otherwise. For men, we use variable 705, which reports the industry of the husband's current or most recent employment in the past 12 months, to define a dummy variable similar to a variable constructed for women above. We then combine these two variables for men and women to define a dummy variable of overall employment, indicating whether the wife or husband is currently employed or has been employed in the past 12 months. Second, we use a grouped or aggregate classification of industries in which the woman and her husband or partner work (currently or worked in the past 12 months) captured in variables 717 and 705 to create three dummy variables indicating whether the individual works in the agriculture, services or trade sector. Information on the industry in which the respondent and her husband or partner work enable us to examine the structural change, i.e., whether there is any shift of employment across sectors in response to ASgM shock. In this classification, we consider that the non-agriculture industry captures mining and its associated industries. According to the Dutch disease hypothesis, the rapid development in the mining industry leads to the transition of resources such as labor from non-mining to mining, i.e., from agriculture to non-agriculture. Third, we use a detailed classification of industries in which the woman and her husband or partner work (currently and worked in the last year) captured in variables 716 and 704. Using detailed industry classifications, we manually define two dummy variables indicating whether the respondent and her husband or partner work in the extractive sector. It is worth noting that the detailed industries that we used to define the extractive industry are not entirely consistent across DHS rounds and countries.[30] However, indicators of male and female employment in the extractive sector enable us to look deeper than the non-agriculture sector. However, a change in aggregate demand due to the ASgM shock can positively affect the labor supply in non-mining industries, especially in the services and trade sectors.

Household wealth: To examine how artisanal gold mining (ASgM) induced by changes in international gold prices affects the living standards of households, we estimate the impact of the ASgM on household wealth. The DHS provides information on the household wealth index (variable 191), which is generated based on asset information from the Household Questionnaire, where each household asset is given a factor score calculated from the principal component analysis. To make it comparable across countries, we standardize the wealth index by country and year. In addition, the DHS provides information on the household wealth index (variable 190) grouped into three categories rather than household income: low wealth or low income (the lowest 40% of households), middle wealth or middle income (the middle 40% of households), and high wealth or high income (the top 20% of households).

In addition to the IPV experience outcomes in the baseline result, we explore another aspect

[30]For example, we consider the following different occupations in different DHS rounds and countries as extractive activity or industry: "miner" in Benin's 1996 round, several occupations like "mining engineer" and "other senior geology and mining staff not elsewhere classified" in Benin's 2011-2012 round, and "grouped in labors in mining, construction, manufacturing, and transport" in Ghana's 1998-1999 round.

of female empowerment through two dimensions closely related to actual IPV incidents: women's attitude toward domestic violence and their intrahousehold decision-making power. There is a well-established literature that posits an improvement in female bargaining power following an increase in women's outside labor market opportunities, which might contribute to a reduction in domestic violence toward women.[31] The descriptive statistics for these variables are in Appendix Table B.4.

Attitude to IPV: We use five questions regarding a woman's attitude toward domestic violence (variable 744a-744e). Specifically, she is asked to evaluate whether it is justified for a husband to beat his wife if she (a) goes out without telling her husband, (b) neglects the children, (c) argues with her husband, (d) refuses to have sex, and (e) burns the food. The variables are dummy which equals one if she thinks it is justified, and zero otherwise. We then calculate the simple average of these dummies to get the aggregate index for women's attitudes to domestic violence.

Access to health care: We use three variables to measure a woman's barrier to healthcare access. These are dummies equal to one if a woman thinks (a) getting permission, (b) getting money, or (c) distance to the health facility is a barrier to her access to health care. We also calculate an aggregate index for this dimension as a simple average of the three dummies.

Migration: We use variable 104 to determine one's migration status. This question asks a woman how long she has been living in her current residence. We classify a woman to be *non-mover* if she never moves out of her residence and *mover* otherwise. For movers, using variable v104, we can know whether she just recently migrated.

A.2 Details on Demographic and Environmental Controls

This section first describes the individual- and household-level demographic characteristics from the DHS surveys included in our regressions. Then, we discuss some cell-level factors likely to affect our outcomes in Sub-Saharan Africa.

Individual characteristics: We control for four individual-level demographics in our regressions, including women's age, education, marital status, and religion. First, we include the woman's age (variable 012), which is expected to determine her employment and IPV experience. For labor supply, an individual's age is likely to serve as a proxy for health conditions, physical strength, and availability to work in artisanal gold mines and in different industries. For IPV outcomes, age can indicate a woman's vulnerability and her dependence on her husband or partner. For example, older wives might have more bargaining power within the household, and younger couples can also be responsive to different shocks or tend to argue more. Second, we control for women's education, captured by variable 106, in our employment and IPV regressions. The literature suggests that a woman's employment, for example, in the extractive sector, and her likelihood of experiencing IPV

[31] For some studies on the link between female labor market opportunities and their intrahousehold bargaining power, see Benshaul-Tolonen (2024), Anderson and Eswaran (2009), Majlesi (2016), Heath (2014), and Guimbeau et al. (2023).

(Erten and Keskin, 2018) depend on her education level. We classify women's education into three groups: no education, secondary education, and higher education. Third, we include marital status (variable 501) in our regressions because (i) the DHS data collects information on IPV by either the husband or partner and (ii) the sample consists of ever-married women whose current marital status could be different from marital status sometime in the past 12 months when the woman experienced IPV. Married women are expected to supply less labor than single women as they tend to be more responsible for household tasks like chores, cooking, and childcare in developing countries, such as Sub-Saharan Africa. We control for a variable indicating whether a woman is currently married, living with a partner, widowed, divorced, or separated. Fourth, religion (variable 130) could also affect for employment, especially for women, and IPV by husband or partner. Given that DHS surveys have different sets of religions across countries and even across survey rounds for the same country, we classify them into four general categories: (i) no religion, (ii) Muslim, (iii) Christian, and (iv) other religions.

Household characteristics: We control for two household-level demographics in our regressions, including place of residence and household size. First, we include a dummy for the place of residence or an urban/rural dummy captured in variable v025. Since gold mining is more prevalent in rural areas, most actions or impacts are expected to concentrate in rural regions. We also include household size (variable 136)[32] as the second household-level demographic controls. For employment, household size can have two opposing impacts on labor supply by either wife or husband. If there are more family members, they are likely to supply more labor to provide food for them, for example. But, if multiple people in the household work, then, for example, the wife does not need to work and spends more time on domestic household tasks like childcare and cooking instead of labor supply to the market, e.g., at ASgM sites. For IPV, household size might have a counterfeiting impact: more household members provide additional security for wives but create another source of pressure on husbands or conflicts between partners.

There are two additional cell-level environmental factors that we controlled in our regressions, including (i) agricultural suitability and (ii) weather conditions in addition to industrial gold mining, which we described in the main text of the paper.

Agriculture or crop suitability: To rule out other major activities happening in a given cell that might have a significant impact on employment, income, and thus IPV, we control for agricultural activities measured by the cell's agricultural suitability (Nunn, 2011; McGuirk, 2020; Girard et al., 2023). Following Nunn (2011), we use crop suitability instead of the actual yield of crops to be consistent with the gold suitability measure and because suitability is more exogenous to local activities. We first find a cell's most suitable crop and interact with that crop's international price to be consistent with how we specify the gold suitability in our baseline. The crop suitability data comes from FAO's Global Agro-Ecological Zones (GAEZ), and crop price information is derived

[32]Household size refers to the total number of household members living together, and it might be different from family members as they might include members from the extended family.

from the World Bank Pink Sheet.[33]

We obtain the GAEZ suitability index under rain-fed and high-intensity input conditions for 51 crops with a 1981-2000 reference period. Since the data is recorded at 5 arc-minute levels, we aggregate up by taking the weighted average of the index of those 5 arc-minute cells within a 0.5×0.5 degrees cell with the weights being the area of the 5 arc-minute cells to come up with the suitability index for each crop at 0.5×0.5 degrees grid cell. We define a cell as suitable for agriculture if it is classified as "Good" (or "Medium") for at least one crop (i.e., crop suitability dummy equals to 1).[34] For those cells, we find its main suitable crop by taking a crop with the highest suitability index, and we then interact its crop suitability dummy by that corresponding crop's international price. If there are more than two crops, we will take a simple average of their price index base 1 in 2010. Appendix Figure B.2 shows the regions suitable for agricultural cultivation in Africa and the main suitable crop for each 0.5×0.5 degrees grid cell. Of 10,662 cells, 4,441 cells (41.65%) are classified as at least "Good", and 4,143 cells (93.29%) have a unique main suitable crop.

Weather conditions: We include time-varying weather conditions at the cell level to account for major environmental factors likely to be associated with local activities and employment opportunities like mining and agriculture. The weather condition is proxied by the average temperature of the year as the temperature data is more reliable than precipitation data (Dell et al., 2014; Girard et al., 2023). Information on temperature is obtained from the Climatic Research Unit of the University of East Anglia (CRU).

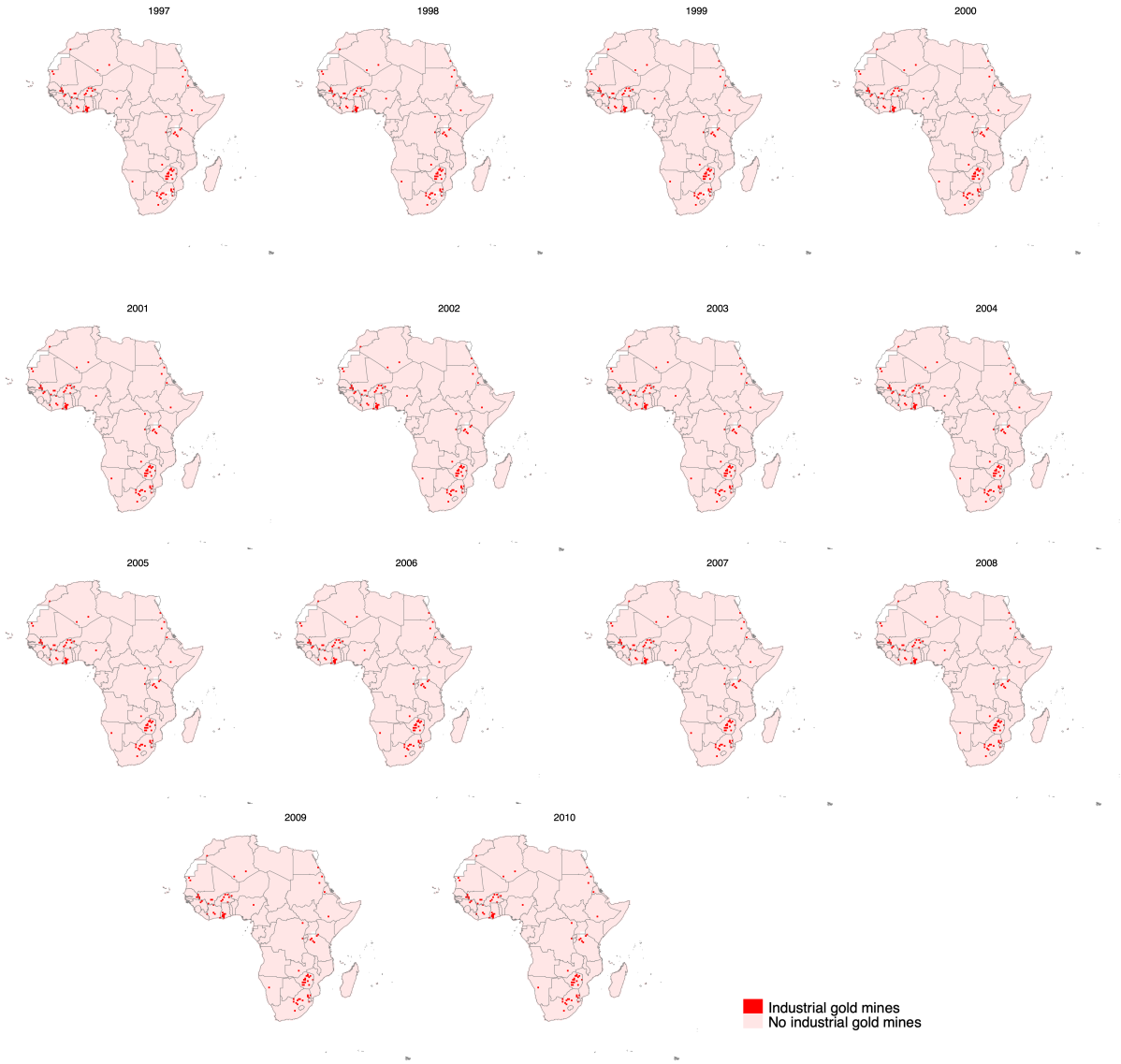
[33]To see how FAO-GAEZ computes the suitability index, please refer to this website: https://gaez.fao.org/pages/theme-details-theme-4

[34]Following GAEZ's classification method, a cell is classified as "Good" ("Medium") for the cultivation of a crop if its suitability index is at least 5500 (4000).

B Additional Figures and Tables

B.1 Additional Figures

Figure B.1: Spatial distribution of industrial gold mines across PRIO-Grid cells, 1997-2010

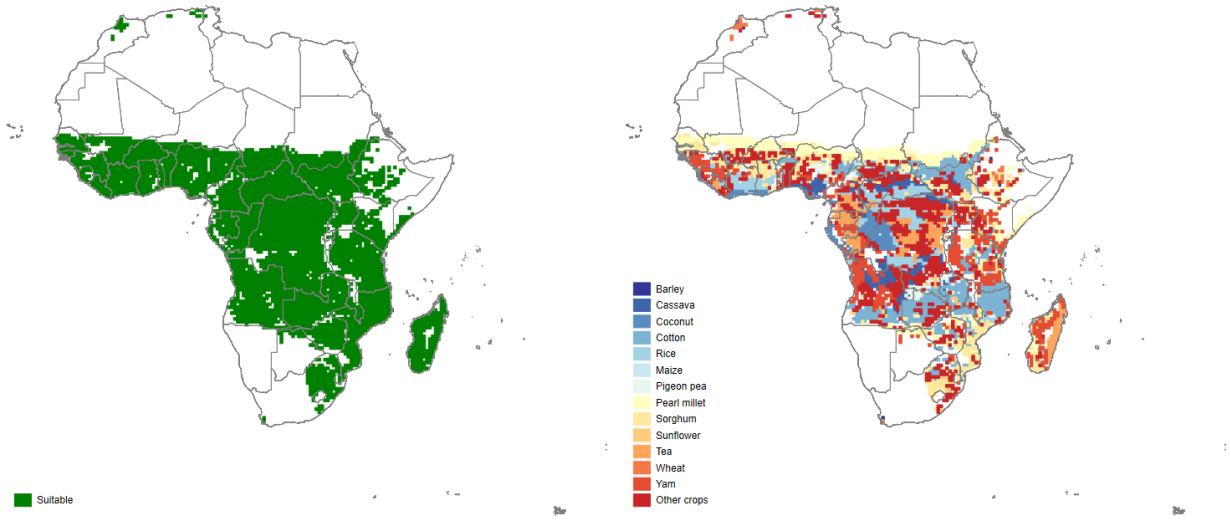


Notes: The figure plots the distribution of industrial gold mines in Africa across PRIO-Grid cells of 0.5×0.5 degrees latitude and longitude (around 55×55 kilometers at the equator) from 1997 to 2010.

Figure B.2: Spatial distribution of crop suitability in Africa

(a) Agriculture suitability

(b) Most suitable crop

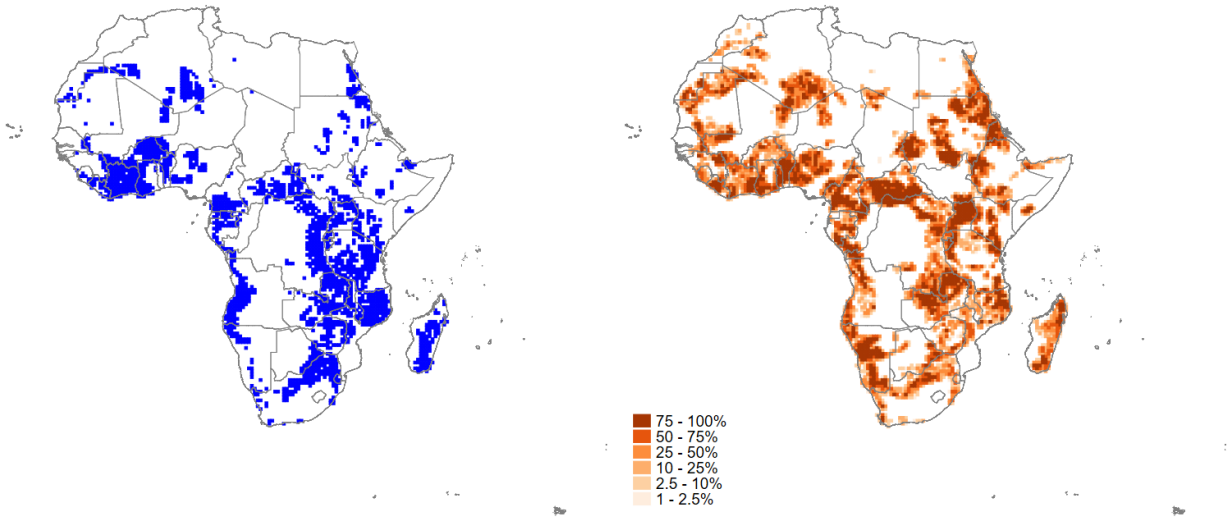


Notes: The figure shows the distribution of the region that is suitable for agricultural cultivation in Africa under rain-fed and high input intensity conditions (panel (a)) and the main suitable crop for each 0.5×0.5 degrees cell (panel (b)). A cell is suitable for agriculture if classified as "Good" or above, i.e., if its suitability index is at least 5500.

Figure B.3: Comparison of spatial distribution of ASgM suitability across different datasets

(a) Rigterink, Ghani, Lozano, and Shapiro

(b) Girard, Molina-Millán, and Vic



Notes: The figure shows the distribution of the region that is suitable for artisanal gold mining in the 0.5×0.5 degrees cell using data from Rigterink et al. (2025) in panel (a) and Girard et al. (2023) in panel (b).

B.2 Additional Tables

Table B.1: Data availability on outcome variables by country and DHS rounds

Country	DHS Rounds	IPV	Intrahousehold Decision Making	Sector of Activity	Extractive Activities	Household Wealth
Angola	2015-16	Y	Y	Y	Y	Y
Benin	1996	N	N	Y	Y	N
	2001	N	Y	Y	N	N
	2011-12	N	Y	Y	Y	Y
	2017-18	Y	Y	Y	Y	Y
Burkina Faso	1992-93	N	N	Y	N	N
	1998-99	N	N	Y	N	N
	2003	N	Y	Y	N	Y
	2010	Y	Y	N	N	Y
Burundi	2010-11	N	Y	Y	Y	Y
	2016-17	Y	Y	Y	Y	Y
Cameroon	1991	N	N	Y	N	N
	2004	Y	Y	Y	N	Y
	2011	Y	Y	Y	N	Y
	2018	Y	Y	Y	N	Y
Chad	2014-15	Y	Y	Y	Y	Y
Congo DR	2007	Y	Y	Y	N	Y
	2013-14	Y	Y	Y	N	Y
Cote d'Ivoire	1994	N	N	Y	N	N
	1998-99	N	N	Y	N	N
	2011-12	Y	Y	Y	Y	Y
Eswatini	2006-07	N	Y	Y	Y	Y
Ethiopia	1992	N	N	Y	Y	N
	1997	N	Y	Y	Y	N
	2003	N	Y	Y	Y	Y
	2008	Y	Y	Y	Y	Y
Gabon	2012	Y	Y	Y	N	Y
Ghana	1993-94	N	N	Y	N	N
	1998-99	N	N	Y	Y	N
	2003	N	Y	Y	Y	Y
	2008	Y	Y	Y	Y	Y
	2014	N	Y	Y	Y	Y
Guinea	1999	N	N	Y	N	N
	2005	N	Y	Y	Y	Y
	2012	N	Y	Y	Y	Y
	2018	N	Y	Y	Y	Y
Kenya	2003	Y	Y	Y	Y	Y
	2008-09	Y	Y	Y	Y	Y
	2014	Y	Y	Y	Y	Y
Lesotho	2004-05	N	Y	Y	Y	Y
	2009-10	N	Y	Y	Y	Y
	2014	N	Y	Y	Y	Y
Liberia	2006-07	Y	Y	Y	Y	Y
	2013	N	Y	Y	Y	Y
Madagascar	1997	N	N	Y	N	N
	2008-09	N	Y	Y	Y	Y
Malawi	2000	N	Y	Y	Y	N
	2004-05	Y	Y	Y	Y	Y
	2010	Y	Y	Y	Y	Y
	2015-16	Y	Y	Y	Y	Y

Table B.1: (Continued)

Country	DHS Rounds	IPV	Intrahousehold Decision Making	Sector of Activity	Extractive Activities	Household Wealth
Mali	1995-96	N	N	Y	N	N
	2001	N	Y	Y	N	N
	2006	Y	Y	Y	Y	Y
	2012-13	Y	Y	Y	N	Y
	2018	Y	Y	Y	N	Y
Mozambique	2011	Y	Y	Y	Y	Y
Namibia	2000	N	N	Y	Y	N
	2006-07	N	Y	Y	Y	Y
	2013	Y	Y	Y	Y	Y
Nigeria	1990	N	N	Y	N	N
	2003	N	Y	Y	Y	Y
	2008	Y	Y	Y	Y	Y
	2013	Y	Y	Y	Y	Y
	2018	Y	Y	Y	N	Y
Rwanda	2005	Y	Y	Y	Y	Y
	2010-11	Y	Y	Y	Y	Y
	2014-15	Y	Y	Y	Y	Y
Senegal	1992-93	N	N	Y	N	N
	1997	N	N	Y	N	N
	2005	N	Y	Y	N	Y
	2010-11	N	Y	Y	N	Y
	2012-13	N	Y	Y	N	Y
	2014	N	Y	Y	N	Y
	2015	N	Y	Y	N	Y
	2016	N	Y	Y	N	Y
	2017	Y	Y	Y	N	Y
	2018	Y	Y	Y	N	Y
Sierra Leone	2008	N	Y	Y	N	Y
	2013	Y	Y	Y	Y	Y
South Africa	2016	Y	Y	Y	N	Y
Tanzania	1999	N	N	N	N	N
	2003-04	N	N	Y	Y	Y
	2007-08	N	N	N	Y	Y
	2009-10	Y	Y	Y	Y	Y
	2011-12	N	N	N	Y	Y
	2015-16	Y	Y	Y	Y	Y
Togo	1998	N	N	Y	N	N
	2013-14	Y	Y	Y	N	Y
Uganda	2000-01	N	Y	Y	N	Y
	2006	Y	Y	Y	Y	Y
	2011	Y	Y	Y	N	Y
	2016	Y	Y	Y	N	Y
Zambia	2007	Y	Y	Y	Y	Y
	2013-14	Y	Y	Y	Y	Y
	2018	Y	Y	Y	Y	Y
Zimbabwe	1999	N	Y	Y	N	N
	2005-06	Y	Y	Y	N	Y
	2010-11	Y	Y	Y	N	Y
	2015	Y	Y	Y	N	Y

Notes: The table presents the DHS data availability on intimate partner violence (IPV), intrahousehold decision making, sector of activity by individuals, extractive or mining activities by individuals, and household wealth across counties in Sub-Saharan Africa. Here Yes (Y) and No (N) indicate whether the variable is available in the DHS round of the country.

Table B.2: Effects of cell-level covariates on intimate partner violence (broad categories)

	Dependent variable: A dummy variable for intimate partner violence (IPV)			
	(1) Overall IPV	(2) Less severe physical IPV	(3) Severe physical IPV	(4) Sexual IPV
	Panel A. Ever in the last 12 months			
Gold suitable × Gold price	-0.109***	-0.094**	-0.023	-0.046
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial gold mines × Gold price	0.135***	0.171***	0.034	0.097
	(0.045)	(0.054)	(0.049)	(0.064)
Crop suitable × Crop price	0.075**	0.024	-0.036	0.033
	(0.037)	(0.040)	(0.029)	(0.037)
Temperature	-0.028	-0.052	-0.061**	0.021
	(0.034)	(0.039)	(0.030)	(0.038)
Observations	69990	69987	69979	69972
	Panel B. Sometimes			
Gold suitable × Gold price	-0.120***	-0.100**	-0.051	-0.030
	(0.043)	(0.043)	(0.031)	(0.039)
Industrial gold mines × Gold price	0.178***	0.191***	0.077	0.086*
	(0.056)	(0.060)	(0.056)	(0.050)
Crop suitable × Crop price	0.047	-0.004	-0.042*	0.054*
	(0.036)	(0.039)	(0.024)	(0.029)
Temperature	-0.039	-0.054	-0.051*	-0.000
	(0.038)	(0.041)	(0.027)	(0.034)
Observations	69813	68275	69478	68665
	Panel C. Often			
Gold suitable × Gold price	-0.010	-0.011	0.009	-0.023
	(0.029)	(0.025)	(0.018)	(0.028)
Industrial gold mines × Gold price	-0.066	-0.079	-0.052	0.016
	(0.052)	(0.049)	(0.035)	(0.041)
Crop suitable × Crop price	0.037	0.024	0.011	-0.005
	(0.026)	(0.023)	(0.017)	(0.027)
Temperature	-0.008	-0.009	-0.023	0.020
	(0.027)	(0.023)	(0.015)	(0.022)
Observations	69840	67703	69250	67516

Notes: The table presents the OLS estimates on the effects of cell-level covariates on overall and different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. Experiences of overall, less severe physical, severe physical, and sexual IPVs are considered in Columns (1)-(4), respectively. All regressions include individual and household characteristics, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.

Table B.3: Effects of cell-level covariates on intimate partner violence (detailed categories)

	Dependent variable: A dummy variable for intimate partner violence (IPV)									
	Less severe physical IPV				Severe physical IPV			Sexual IPV		
	(1) Pushed, shook, or had something thrown	(2) Slapped	(3) Punch with fist or hit by something harmful	(4) Had arm twisted or hair pulled	(5) Kicked or dragged	(6) Strangled or burnt	(7) Threatened with knife/gun or other weapons	(8) Physically forced into unwanted sex	(9) Forced into other unwanted sexual acts	(10) Physically forced to perform sexual acts respondent did not want
	Panel A. Ever in the last 12 months									
Gold suitable × Gold price	-0.006	-0.081**	-0.063*	0.022	-0.012	-0.010	-0.026	-0.060	0.100***	-0.036
	(0.034)	(0.039)	(0.032)	(0.052)	(0.033)	(0.020)	(0.023)	(0.043)	(0.029)	(0.041)
Industrial gold mines × Gold price	0.018	0.148***	0.043	0.201**	0.088	-0.004	-0.010	0.134**	0.034	0.188***
	(0.051)	(0.050)	(0.039)	(0.097)	(0.058)	(0.045)	(0.038)	(0.063)	(0.048)	(0.062)
Crop suitable × Crop price	0.028	-0.004	0.029	-0.049*	-0.054*	0.022	0.012	0.007	-0.031	0.054**
	(0.029)	(0.040)	(0.031)	(0.026)	(0.030)	(0.016)	(0.015)	(0.037)	(0.026)	(0.027)
Temperature	-0.004	-0.038	-0.041	0.034	-0.053*	-0.019	-0.005	0.002	0.010	0.062**
	(0.031)	(0.038)	(0.029)	(0.028)	(0.028)	(0.015)	(0.014)	(0.036)	(0.027)	(0.030)
Observations	69952	69959	69921	63488	68212	69943	64505	69947	66091	53538
	Panel B. Sometimes									
Gold suitable × Gold price	-0.046	-0.096**	-0.088***	-0.007	-0.031	-0.016	-0.032*	-0.038	0.065**	-0.053
	(0.033)	(0.049)	(0.028)	(0.047)	(0.030)	(0.016)	(0.019)	(0.039)	(0.026)	(0.035)
Industrial gold mines × Gold price	0.030	0.154***	0.005	0.191*	0.171***	-0.000	0.020	0.132**	0.014	0.093
	(0.044)	(0.059)	(0.034)	(0.098)	(0.066)	(0.042)	(0.031)	(0.055)	(0.034)	(0.067)
Crop suitable × Crop price	0.006	-0.027	0.017	-0.042*	-0.052**	0.008	0.001	0.030	-0.015	0.040*
	(0.027)	(0.042)	(0.024)	(0.023)	(0.024)	(0.014)	(0.013)	(0.030)	(0.021)	(0.023)
Temperature	-0.009	-0.032	-0.023	0.025	-0.045*	-0.020*	-0.004	-0.025	-0.010	0.050*
	(0.030)	(0.041)	(0.025)	(0.025)	(0.025)	(0.012)	(0.013)	(0.033)	(0.023)	(0.027)
Observations	64635	61680	65880	60819	64500	68626	63516	64561	64004	51865
	Panel C. Often									
Gold suitable × Gold price	0.018	-0.078**	0.001	0.029	0.004	0.001	-0.005	-0.050*	0.038**	0.005
	(0.021)	(0.036)	(0.020)	(0.022)	(0.020)	(0.010)	(0.015)	(0.030)	(0.018)	(0.022)
Industrial gold mines × Gold price	-0.030	-0.076	0.004	0.073	-0.082	-0.020	-0.038	0.039	0.034	0.107***
	(0.034)	(0.076)	(0.029)	(0.053)	(0.055)	(0.023)	(0.026)	(0.041)	(0.037)	(0.038)
Crop suitable × Crop price	0.029	0.004	0.011	-0.014	-0.003	0.019**	0.015	-0.005	-0.012	0.022
	(0.018)	(0.034)	(0.020)	(0.016)	(0.017)	(0.010)	(0.009)	(0.029)	(0.016)	(0.014)
Temperature	0.004	-0.054*	-0.024	0.002	-0.025	-0.004	-0.001	0.016	0.005	0.010
	(0.019)	(0.031)	(0.017)	(0.014)	(0.017)	(0.008)	(0.007)	(0.024)	(0.014)	(0.014)
Observations	56547	43102	60325	56533	57675	66445	62618	57266	61709	49578

Notes: The table presents the OLS estimates on the effects of cell-level covariates on different types of intimate partner violence (IPV) by husband or partner in Sub-Saharan Africa. The dependent variables are dummy variables if a woman ever experienced IPV of detailed categories in the last 12 months (Panel A). In Panels B and C, IPV experiences are disaggregated into different frequencies. In Columns (1)-(10), the IPV outcome indicates whether a woman has been (i) pushed, shaken, or had something thrown, (ii) slapped, (iii) punched with a fist or hit by something harmful, (iv) had arm twisted or hair pulled, (v) kicked or dragged, (vi) strangled or burnt, (vii) threatened with knife/gun or other weapons, (viii) physically forced into unwanted sex, (ix) forced into other unwanted sexual acts, and (x) physically forced to perform sexual acts she did not want by husband or partner, respectively. All regressions include individual and household characteristics, cell fixed effects (FEs), and country-by-year FEs. The individual or woman characteristics include age, education level, current marital status, and religion. The household characteristics include place of residence or rural/urban dummy and household size. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: $^{*}p < 0.10$, $^{**}p < 0.05$, and $^{***}p < 0.01$.

Table B.4: Descriptive statistics for women's attitude to domestic violence, barriers to health care access, and intrahousehold decision-making power

	Mean	SD	Min	Max	Observations
	Panel A. Attitude to wife beating				
Beating is justified if a woman . . .					
Goes out without telling a husband	0.37	0.48	0	1	717,027
Neglects the children	0.39	0.49	0	1	717,886
Argues with a husband	0.35	0.48	1	0	716,247
Refuses to have sex	0.31	0.46	0	1	713,694
Burns the food	0.20	0.40	0	1	717,044
Aggregate index	0.32	0.38	0	1	721,260
	Panel B. Barriers to health care access				
If . . . is a big barrier to health care access					
Getting permission	0.15	0.36	0	1	636,045
Getting money	0.55	0.50	0	1	636,094
Distance to health facility	0.41	0.49	1	0	636,090
Aggregate index	0.37	0.34	0	1	636,282
	Panel C. Intrahousehold decision-making				
If she has final say on . . .					
Spending her money	0.88	0.33	0	1	317,515
Her health care	0.51	0.50	1	0	638,705
Large purchase	0.48	0.50	0	1	643,027
Daily purchase	0.58	0.49	0	1	255,239
Family visits	0.59	0.49	0	1	643,004
What to cook	0.71	0.45	0	1	151,528
Spending husband's money	0.43	0.50	0	1	487,972
Aggregate index	0.56	0.38	0	1	662,737

Notes: The descriptive statistics are estimated from the DHS sample of ever-married women aged between 15-49 years old inclusive.

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