Artisanal Mining, Female Labor Supply, and Intimate Partner Violence*

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Abstract

This paper uses micro data from over 30 countries in Sub-Saharan Africa to present nearly continent-wide evidence that the rise in the potential value of artisanal mining leads to a structural transformation from the agricultural to the non-agricultural sectors. Leveraging spatial variation in gold suitability and exogenous temporal variation in global gold prices, we show that employment activities in the mining and retail industries increase more for women than men. An increase in women's intrahousehold bargaining power results in a decrease in violence within the household, ruling out a potential backlash effect.

Keywords: Gold mining, Intimate partner violence, Women's labor supply, Intrahousehold bargaining power, Sub-Saharan Africa

JEL Codes: D12, J12, J16, O13, O55, Q32

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1 Introduction

Intimate partner violence is a serious global concern, with one in three women worldwide having experienced physical or sexual violence, mostly by an intimate partner, in their lifetime (WHO, 2021). It is not only a violation of human rights, but also associated with various long-lasting adverse health consequences, such as physical injury (Campbell et al., 2002), mental health disorders (Ellsberg et al., 2008), suicidal ideation (Oram et al., 2017), drug abuse (Romito et al., 2005), reproductive disorders, and sexually transmitted infections (Jewkes et al., 2010). Studies suggest that providing employment opportunities (Erten and Keskin, 2024; Kotsadam and Villanger, 2025; Bhalotra et al., 2025; Sanin, 2025) and unearned income such as cash transfers and dowry payments (Hidrobo et al., 2016; Haushofer et al., 2019; Calvi and Keskar, 2023) reduce domestic violence through improving women's outside options or increase violence through the backlash effect (Erten and Keskin, 2021). No study yet has examined the role of women's earned income in the risk of domestic violence, except Sanin (2025), who studied the provision of job opportunities to women due to the expansion of coffee mills in Rwanda as an earned income shock. Increase in work incentive due to higher commodity prices, which also directly raises earned income, enhances individuals' willingness to work. It also enables us to provide evidence with external validity, not subject to a specific program in a given country.

This paper presents almost a continent-wide evidence that increasing women's work incentives and earnings potential decreases intimate partner violence in over 30 countries from Sub-Saharan Africa.[1] We also provide evidence that increases in women's activities in mining and retail industries relative to men and the rise in women's intrahousehold bargaining power operate as mechanisms. To establish results, we leverage a combination of spatial variation in gold suitability and exogenous temporal variation in global gold prices, which increase activities and profitability of artisanal gold mining, conditional on industrial gold mining. The mining in Sub-Saharan Africa is an ideal context to provide evidence with external validity on the impact of women's economic conditions on intimate partner violence because Africa's economy depends heavily on the extraction of natural resources (Thomas and Trevino, 2013; Asiamah et al., 2022). The context provides three unique features to investigate the role of work incentives and earning income shock. First, the increase in global gold price incentivizes extraction activities at artisanal and industrial mining sites by increasing opportunity costs. This also directly increases the profitability of industrial mining companies and earnings or earned income of artisanal mining individuals, at least to some degree, even in the presence of intermediaries and imperfect pass-through to the local gold price. Second, gold suitability across regions provides spatial heterogeneity in gold mining activities. Third, we control for industrial gold mining to isolate the impact of artisanal gold mining. In this paper, we first investigate the effects of the shock on different forms of domestic violence, including severe

[1]The region leads the world in terms of intimate partner violence. According to the World Health Organization (WHO), between 2000 and 2018, on average, about one-fifth of women in Sub-Saharan Africa experienced physical or sexual violence by their husbands or partners in the last twelve months, which is the highest worldwide.

and less severe physical violence, sexual violence, with different frequencies. We then explore the potential mechanisms by examining women's intrahousehold bargaining power, gender- and industry-specific economic activities, household wealth, and migration patterns.

Artisanal mining, a small-scale and labor-intensive form of natural resource extraction, is more prevalent than industrial mining in Africa in terms of the number of people employed and the number of mines. While industrial mining is a significant contributor to Africa's economy and exports, artisanal mining provides livelihoods for a much larger number of individuals. Specifically, it 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.[2] Among different natural resources, artisanal gold mining (ASgM) is the main form of artisanal mining in Africa (Girard et al., 2025).

We use nationally representative household surveys to estimate the effects of artisanal gold mining on intimate partner violence and examine the underlying mechanisms. 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 intimate partner violence with individual and household characteristics allow us to control for determinants of domestic violence 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. Using representative data and controlling for granular-level fixed effects enables us to provide population-based evidence with strong external validity, covering almost an entire African continent.

Identifying the causal impact of ASgM on intimate partner violence is challenging since the mining activities are endogenous due to simultaneity bias and omitted variables bias. In terms of simultaneity bias due to reverse causality in the domestic violence regression, ASgM could reduce intimate partner violence 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 gold mining activities. We exploit spatial and temporal variations exogenous to the household's actions to overcome these challenges and isolate the effect of indus-

[2]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 the artisanal mining workforce (ASM Inventory, 2022; Eshun, 2020). Therefore, developments in the labor-intensive artisanal mining industry, which 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 due to the benefit of social and economic independence, leading to different lifestyles and greater empowerment (Werthmann, 2009).

trial gold mining (ISgM) from geographical gold suitability to identify the causal impact of ASgM (Girard et al., 2025). This strategy presents several advantages. First, leveraging granular-level spatial information on gold suitability, we control for fixed effects of widely used PRIO-GRID cells of 0.5×0.5 degrees or about 55×55 kilometers at the equator and time-varying characteristics of individuals and households. Second, we use a temporal variation in ASgM generated from changes in the international gold price that is exogenous to potential revenues from ASgM activities in the local economy. The potential revenue from ASgM directly depends on the world price of gold; however, local artisanal miners cannot affect the world price as they are small-sized price-takers and follow the global market (Sánchez De La Sierra, 2020). We also provide indirect evidence on the price pass-through from the world market to the local economy by estimating heterogeneous effects by internet coverage as a measure of information flow and connectivity. So, our study provides population-based evidence on the determinants of intimate partner violence based on highly plausible assumptions. Third, indirectly identifying the effect of ASgM based on gold suitability conditional on ISgM enables us to capture the impact of registered and unregistered ASgM.

This study contributes to several strands of literature. First, we primarily contribute to the literature studying intimate partner violence. The literature suggests that women's empowerment and improvement in their economic conditions have ambiguous effects on the risk of experiencing intimate partner violence. 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 intimate partner violence (Farmer and Tiefenthaler, 1996; Stevenson and Wolfers, 2006; Anderberg et al., 2016). However, female empowerment can have a backlash effect if husbands want to regain their intrahousehold power, leading to an increase in domestic violence (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 intimate partner violence 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 and women's agency. Not only is this study the pioneer in linking ASgM to 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-domestic violence relationship in general (Guimbeau et al., 2023). Our results suggest that moderately severe physical violence that women sometimes experience in the household decreases 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 potential backlash effect in Sub-Saharan Africa. There is also a separation effect through which the shock could have mediated through to domestic violence. Moreover, we rule out other potential channels, such as changes in demographic composition, household wealth, and alcohol drinking. The ASgM has no significant

effect on broad forms of severe physical violence and sexual violence. However, ASgM increases the incidence of women being forced into unwanted sexual acts other than sex, potentially due to conflicts on fertility decisions.

Second, our work is related to the literature that examines the economic impacts of mining. Existing studies are limited to large-scale and capital-intensive industrial mining at the macro (Frankel, 2012; Sachs and Warner, 2001) and micro (Berman et al., 2017; Benshaul-Tolonen, 2019) level mainly due to the lack of granular-level data on artisanal mining.[3] In the light of recently collected data on artisanal mining and mining suitability, a few recent studies show that artisanal mining improves household welfare through the creation of military actors at mines in Eastern Congo (Sánchez De La Sierra, 2020), increases household consumption in Burkina Faso (Bazillier and Girard, 2020), and supports local economic conditions but leads to deforestation in Africa (Girard et al., 2025). Although female miners constitute a significant share of the artisanal mining workforce, no research has examined the consequences of artisanal mining on violence within the household, which falls disproportionately on women.[4] Leveraging data on industrial gold mines combined with our unique data on gold suitability, this paper disentangles the impacts of artisanal and industrial mining on intimate partner violence. Interestingly and intuitively, industrial and artisanal mining have the opposite effects on physical domestic violence towards women, i.e., industrial (artisanal) mining increases (decreases) domestic violence, primarily driven by less severe physical violence. Similar to artisanal mining, industrial mining has positive effects on some forms of sexual violence, and the impacts are generally more significant. Individuals shift from agricultural to extractive activities when extractive activities become more profitable due to a rise in gold prices. Women's economic activities in the sales or retail industry weakly increase, 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 the artisanal gold mining shock in the short term. However, industrial gold mining does not affect the economic activities, conditional on artisanal gold mining.

Third, we provide new insights into the dynamic effects in the long run. We are unaware of any study that documents how persistent the effect of increasing women's work incentives and earned

[3]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 labor supply (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 industry-specific employment in Sub-Saharan Africa (Girard et al., 2025), gender- and industry-specific employment in Liberia (Gräser, 2024), and violent conflicts in Africa (Rigterink et al., 2025).

[4]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.

income on intimate partner violence is. We examine whether the current shock has a long-lasting impact by utilizing our source of temporal variation, or the international gold price, at different periods in the past. Our analysis shows declines in intimate partner violence, especially moderately severe physical violence, with less frequency, persist over time as women's economic activities in the mining industry sustain over the long run due to the increased profitability of artisanal mining. We also find that the null effect of ASgM on severe physical violence in the short run becomes negative in the long term. Additionally, we provide evidence that the null effect of ASgM on a broad group of sexual domestic violence becomes positive in the long run.

The rest of the paper is structured as follows. Section 2 provides background on ASgM and intimate partner violence in our context and discusses a conceptual framework. Section 3 describes the data and descriptive statistics. Section 4 presents the empirical approach for identifying the causal impacts of the ASgM on labor supply and intimate partner violence. Section 5 presents the results and robustness checks of our main findings, while Section 6 discusses further results on the potential mechanisms. Finally, Section 7 concludes.

2 Background and Conceptual Framework

In this section, we first provide background on ASgM and intimate partner violence in relation to the mining activities in Sub-Saharan Africa. We then discuss theoretical frameworks to conceptually link the natural resource shock with intimate partner violence 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.

2.1 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. (2025) propose a new measure of 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.

2.2 Intimate Partner Violence in Sub-Saharan Africa

Sub-Saharan Africa leads the world in intimate partner violence (Mossie et al., 2023). One in every five women from the region experienced physical and sexual domestic violence over the past twelve months, which is globally the highest estimate, on average, between 2000 and 2018.[5,6] Despite the high average rate, intimate partner violence incidences have declined in the region over time, primarily driven by moderately severe or less severe physical domestic violence. Severe physical and sexual intimate partner violence presented a slight downward trend from 2003 to 2019; however, these forms of violence against women in the household are generally stagnant (Figure 2a). On the other hand, the global price of gold or the gold value increased significantly after 2005, peaked in 2012, and then slightly dropped until 2019 (Figure 2b).[7] The intimate partner violence and the profitability of gold mining thus generally evolve in opposite directions: domestic violence declines while the gold price increases over time. The bivariate correlation between the incidence of any intimate partner violence in the last twelve months and the international gold price is -0.62 (SE: 0.21, p-value: 0.01) in the survey year, -0.71 (SE: 0.19, p-value: 0.00) in a year before the survey year, and -0.76 (SE: 0.17, p-value: 0.00) in two years before the survey year. Section 3 provides more details on international gold prices.

2.3 Conceptual Framework

Before discussing the theoretical concepts on the relationship between mining and intimate partner violence, 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 expe-

[5] See the WHO's national estimates of intimate partner violence from https://vaw-data.srhr.org/data.

[6] As shown in Figure B.1, intimate partner violence incidences are concentrated in Central Africa, and incidences of mild or less severe physical violence are more prevalent than severe physical and sexual violence within the household.

[7] The surge in international gold prices between 2005 and 2012 is due to several factors, such as a greater demand from major emerging economies such as China and India (Singleton, 2014) and higher investment in commodity indices as a diversification strategy (Tang and Xiong, 2012). The commodity prices sharply increased across the board during the 2005-2008 price boom (Baffes and Haniotis, 2010). As shown in Figure B.2, the value of most minerals and crops sharply increased after 2005 but dropped during the 2008-2009 Great Recession. The gold price increased until 2012, as investors shifted away from speculative assets to more secure assets like gold during the uncertainty (Hergt, 2013).

riencing intimate partner violence. 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.[8] But the indirect 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).[9]

Existing studies and theoretical concepts on intimate partner violence 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 intimate partner violence. 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 domestic (Farmer and Tiefenthaler, 1996; Stevenson and Wolfers, 2006; Aizer, 2010; Hidrobo and Fernald, 2013; Anderberg et al., 2016).[10] 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

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

[9]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).

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

outside options could lead to more violence from her intimate partner, 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 intimate partner violence. However, the association between one's attitude toward domestic violence and her experience of intimate partner violence is still unclear (Benshaul-Tolonen, 2024).

In summary, the effect of changes in employment and income opportunities due to artisanal mining on domestic violence is theoretically ambiguous and depends on which channel dominates. Therefore, in the empirical analysis, we examine several mechanisms that can potentially explain our findings, such as gender-specific sectoral employment, women's intrahousehold bargaining power and attitude to domestic violence, changes in household wealth, and changes in the demographic composition of the mining community.

3 Data

For our empirical analysis, we combine three data sets: Demographic and Health Surveys (DHS) for all countries in Sub-Saharan Africa, information on the suitability of areas for gold mining covering the entire African continent, and gold prices in the global market over time. First, the DHS data provide individual-level repeated cross-section on the primary outcome variable of women's experience of different forms of intimate partner violence with different frequencies and secondary outcomes that we use to examine the potential underlying mechanisms.[11] Second, geological information on gold suitability provides spatial variation in our key explanatory variable, 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.[12]

3.1 Intimate Partner Violence Outcomes

The main outcome we investigate in this paper is the incidence of woman's intimate partner violence from her husband or partner. The existing studies suggest that economically empowering women, e.g., via improving their employment opportunities and earning potentials, could have significant but nuanced impacts on intimate partner violence as discussed in Section 2 (see, for example, Aizer, 2010; Bloch and Rao, 2002; Field et al., 2021; Erten and Keskin, 2021).

[11] In Appendix A.1, we provide details on our secondary outcomes, including gender- and industry-specific labor supply or economic activities, household wealth, attitude toward domestic violence, barriers to health care access, intrahousehold bargaining power, and migration.

[12] Refer to 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.

The DHS data provide information on different forms of intimate partner violence experienced by the respondent or the woman, including severe physical, less severe physical, and sexual violence. We can further disaggregate these three broad forms of domestic violence. 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 did not want to. We also examine these detailed forms.

The DHS surveys also report intimate partner violence at the extensive margin in different periods (whether a woman ever experienced domestic violence in her life, before the past twelve months, and in the last twelve months) and the intensive margin (the frequency of violence over the past twelve months: (i) sometimes and (ii) often). We focus on intimate partner violence experienced in the last twelve months at the extensive and intensive margins. The information on the frequency of domestic violence experienced by a woman in the past year allows us to investigate how ASgM shock impacts extreme and less extreme violent behaviors.

3.2 Gold Mining

We use geographic information on gold suitability throughout Africa obtained from Girard et al. (2025), who identified bedrocks suitable for gold. Like their study, 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.[13] The dummy variable takes a value of one if a cell overlaps with a gold bedrock polygon and zero 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 zero (non-overlapping) and one (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 can also be suitable in those gold-suitable cells, it is crucial to control ISgM to isolate the impact of ASgM from that of ISgM. Hence, the

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

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). Active mining areas and the type of minerals are defined at the PRIO-GRID cells of 0.5×0.5 degrees between 1997 and 2010. Figure B.3 presents the distribution of industrial gold mining across PRIO-GRID cells in Africa. It shows that industrial gold mines are predominantly concentrated in the West and Southern regions of the continent. Additionally, the number of cells hosting industrial gold mines has been steadily increasing as the global gold price has risen over time, as illustrated in Figure 2b. In our regression analysis, however, we employ a time-invariant dummy variable indicating whether a cell ever had industrial gold mines. To introduce temporal variation in industrial gold mining, we interact the measure with the global gold price.

3.3 International Gold Price

We introduce temporal variation in the gold suitability measure defined 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 since 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). We use a one-year lagged gold price index in our baseline analysis. For the robustness checks, we use the log of the lagged gold price and the current price as alternative measures.

3.4 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 intimate partner violence. Individual- and household-level demographics come from the DHS, whereas we obtain cell-level information from external sources. We discuss the cell-level factor of industrial gold mining above in this

section, while Appendix A.2 provides a detailed description of the other environmental covariates we included in our regressions.

3.5 Summary Statistics

Table 1 presents the descriptive statistics on intimate partner violence with different frequencies over the past twelve months. Panel A shows that about one-fourth of the women experienced domestic violence by their spouse or partner. Across various forms of domestic violence, mild or less severe physical violence is the most common, and incidences of sometimes experiencing violence are more prevalent than often experienced. In addition, Panel B further decomposes mild, severe, and sexual violence into detailed forms, 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 2 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.

We present the descriptive summary for individual and household characteristics in Table B.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 reports women's experience of violence from their intimate partners, the women who have experienced violence over the past twelve 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 domestic violence in the last twelve 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 twelve months, particularly in agriculture, while almost all of their husbands/partners are working.

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

4 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., 2025).

4.1 Empirical Specification

To examine the causal impact of ASgM on individual-level employment decisions and intimate partner violence, 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 domestic violence outcomes for woman 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. Similar to the gold suitability measure, we control for an interaction between an indicator variable, set to one if the cells ever hosts an industrial gold mine during our study period, and the lagged gold price in our regressions. Controlling for ISgM measure is crucial for identifying the effect of ASgM, as the gold-suitable areas are suitable for both ASgM and ISgM. Controlling for agricultural potential, defined as the interaction between crop suitability and international crop prices, is also critical. As discussed in Section 2, commodity prices tend to move together, and thus the effect of gold price could be confounded by other price shocks. Therefore, accounting for changes in the prices of minerals and crops is important for identifying the true effect of artisanal gold mining. In Appendix A.2, we describe all cell-level variables in detail. The cell fixed effects, α_c, control for all time-invariant factors at the

[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.

treatment level.

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×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 and domestic violence policies, the legal status of ASgM, and changes in local economic conditions. 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-year 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 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).

4.2 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. In Section 6, we provide indirect evidence that changes in world prices pass through to local prices and affect local mining activities.

The parameter of interest, β_1, in equation (1) captures the effect of ASgM, not that of gold mining, given that we partial out the impact of ISgM in our regressions. 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 (2024), 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. 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., 2025).

Another identification concern relates to the domestic violence reporting bias, which might be correlated with changes in women's employment or earnings. Specifically, women might report domestic violence 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 experiences of domestic violence due to better employment and earning outcomes in response to positive mining shock, we identify a decline in intimate partner violence due to the ASgM shock, which we present in the following Section. Therefore, we find a significant reduction in intimate partner violence even if there is a potential upward bias in the reported domestic violence incidents due to the treatment.

5 Results

In this section, we first discuss the results from estimating the effects of ASgM on intimate partner violence. We also briefly discuss the impact of ISgM. Second, we present the dynamic patterns of ASgM impacts in the medium and long term, which speaks about the persistence of the effects over time. Then, we present results from estimating heterogeneous effects. We finally examine the robustness checks of our main results.

5.1 Average Effects

The impacts of ASgM shock on intimate partner violence experienced by women in the last twelve months are reported in Table 3. Panel A shows that the probability of women experiencing intimate

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

partner violence, especially less severe physical violence, decreases significantly in gold-suitable zones when the gold price increases. The magnitude of the estimated coefficient suggests that a one standard deviation increase in potential profitability from ASgM activities leads to a reduction in domestic violence by 0.033. A similar calculation for the less severe physical violence shows that a one standard deviation increase in ASgM reduces the incidence of such violence by 0.028. However, the impacts of ASgM on severe physical and sexual violence are essentially zero, although the coefficient estimates are negative. Then, we split the domestic violence incidents into two different frequencies: (i) violence sometimes experienced in the last twelve months (Panel B), and (ii) violence often experienced over the past twelve months (Panel C).[17]

Most of the negative effects of ASgM on ever-experienced domestic violence over the past twelve months come from the impacts on the less frequent violence (Panel B). The results shown in Panel C suggest that any of the different forms of domestic violence often experienced in the last twelve 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-domestic violence relationship (for example, Basu et al., 2025) that suggest that regulating alcohol consumption is less effective in reducing the likelihood of often experiencing intimate partner violence.

Although the effects of ISgM are not our central focus, we present notable findings on ISgM effects. The impacts of ISgM are the opposite of those of ASgM and are strongly significant, except for its impact on domestic violence often experienced by women. While the effect of artisanal gold mining on the incidence of often experienced domestic violence is essentially zero, the industrial gold mining reduces incidence of such violence at the 10% significance level (Table 3). In Table B.3, we present the effects of the other two cell-level covariates on broad forms of intimate partner violence. First, crop suitability is weakly associated with an increase in domestic violence, especially sexual violence that occurred sometimes in the last twelve months. However, severe physical violence decreases in crop-suitable regions when crop prices increase. Second, temperature negatively affects intimate partner violence in general. The impacts of temperature on intimate partner violence are not statistically significant; however, it significantly reduces the incidence of severe physical violence (Column (3) of Panel A), particularly those that sometimes occurred in the last twelve months (Column (3) of Panel B). Like other shocks, domestic violence *often* experienced in the past twelve months does not respond to crop suitability and temperature (Panel C).

To examine the impact in more detail, we further dis-aggregate the three broad forms of domestic violence into ten forms of violence, and Table 4 reports the estimation results. We highlight the main findings. First, we find that, among less severe physical violent activities, the likelihood

[17]The domestic violence-reducing impact of artisanal gold mining could be mechanical, i.e., violence 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.

of women being slapped and punched with a fist or hit by something harmful drives the violence-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 over the past twelve months as well (Column (2) of Panel C). Third, although the impact of ASgM shock on broadly defined sexual violence was not significant and negative, 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).

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 broad forms of domestic violence, the effects of industrial gold mining on some of the detailed forms are positive, i.e., opposite to that of artisanal gold mining, and the impacts are more significant for domestic violence experienced sometimes by women. For the three forms 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 *sometimes* being physically forced into unwanted sex (Column (8) of Panel B) and *often* physically forced to perform sexual acts the wife did not want (Column (10) of Panel C).[18]

5.2 Persistence of the Effects

So far, in this section, we show that some forms of domestic violence in gold-suitable regions respond to a one-year lagged increase in international gold prices. But, in this part, we examine whether those effects persist over time by estimating the domestic violence outcomes on the value of international gold price up to 10 years before the survey year, including one year before (one

[18]Table B.4 first shows that the positive relationship between agricultural productivity and sexual violence 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 violence 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 and 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).

year lagged) like in our baseline regressions.[19]

The dynamic effects of ASgM on broad forms of domestic violence are shown in Figure 3, and the results suggest nuanced effects that significantly evolve over time. These results include (i) the negative effect of ASgM on less severe physical violence tends to be sustained in the long run, (ii) the statistically insignificant effect of ASgM on severe physical violence turns negative and statistically significant at the 5% level in the long run, and (iii) statistically insignificant effect of ASgM on sexual violence becomes positive and statistically significant at the 10% level in the long run. The negative impact on intimate partner violence lasts only two years and becomes statistically insignificant starting from the third year after the price shock (Panel (a)). When we consider domestic violence with different frequencies, similar to our results in the previous part, the main findings for domestic violence in the last twelve months are driven by violence experienced sometimes. The only exception is that the negative impact of ASgM on intimate partner violence experienced sometimes tends to persist in the long run (Panel (b)). As presented in Panel (c), the null effects of ASgM on different forms of domestic violence experienced often remain at zero. However, the point estimates tend to turn positive despite the statistical insignificance.

For detailed forms of domestic violence, we focus on five forms of violence 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 4 presents the results. In terms of domestic violence 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 intimate partner violence that happens sometimes, persistency of contemporaneous effects stays relatively longer (Panel (b)). Finally, for domestic violence 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)).[20]

[19] Considering the time required for the world price to pass through to the local price and the possibility of intimate partner violence occurring at the beginning of the past year, the use of more than one year lag for the gold price, especially 2-3 years lag, also provides a robustness check of our results.

[20] As a robustness check, we also control industrial mineral mining, defined by a cell's main mineral for industrial mining activities (if any), interacting with that mineral's international price at the respective period. We also include the interaction between a cell's crop suitability and international crop price. For consistency, we use the same lag for all prices. We present the results in Figures B.4 and B.5 for broad and detailed categories of domestic violence, respectively. See Section A.2 for a description of the industrial mining dataset. The evolution of ASgM effects over the 10 years is very similar to the baseline results.

5.3 Heterogeneous Effects

We quantify heterogeneous effects of ASgM on intimate partner violence to analyze which demographic groups drive the average effects and provide initial evidence on the potential mechanisms, which have been further explored in Section 6.

First, we estimate the heterogeneous impacts in rural and urban areas. Since artisanal mining sites are more likely to be located in rural areas, we expect impacts to be concentrated among rural households. 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. Most of the changes in the prevalence of intimate partner violence (both broad and detailed forms) in response to ASgM shock are concentrated in rural households (Figure 5). For example, decreases in less severe physical violence and thus domestic violence in the last twelve months in response to the mining shock that we found in our baseline estimation are concentrated among rural households. In Figure B.6, we illustrate the heterogeneous impacts on domestic violence with different frequencies. The negative effects of ASgM on violence sometimes occurred in the last twelve months are also significant in the rural sample, while the effects are not statistically significant in the urban sample (Panel (a)). As shown in Panel (b), the prevalence of domestic violence often experienced by women is still not responsive for urban and rural households. The heterogeneous effects on detailed forms of violence are presented in Figure B.7. These results are intuitive and consistent with our expectations.

Second, we perform heterogeneity by women's age, which is likely a significant factor for intra-household bargaining power. The results, shown in Figure 6, suggest that the violence-reducing effects of ASgM are relatively stronger in both magnitude and statistical significance for older women. Figure B.8 illustrates the heterogeneous impacts on domestic violence with different frequencies. The ASgM effects on domestic violence experienced sometimes are relatively stronger for older women (Panel (a)). The domestic violence experienced often does not change (Panel (b)), consistent with the results from heterogeneity analysis by place of residence. Figure B.9 presents the results for detailed forms of intimate partner violence.

Third, we analyze heterogeneity by household wealth since the treatment might have affected the individuals and households differently, for example, low-income individuals could be the first to choose to work on artisanal mining sites when the extractive activity becomes more profitable. Figure 7 presents the results, suggesting that the negative impacts of artisanal gold mining on intimate partner violence, particularly less severe physical violence, are concentrated among households with middle wealth. Figure B.10 illustrates the heterogeneous impacts for intimate partner violence with different frequencies. In Section 6, we estimate the employment effects heterogeneous by household wealth to check if female employment is more pronounced than male employment among middle-wealth households.

Finally, we estimate the heterogeneous effects by the age difference between the woman and her partner, and results are shown in Figure 8. This heterogeneity also allows us to incorporate men's

characteristics in our analysis. We find that the violence-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. The women in the first, second, and third terciles are approximately 18, 7, and 2 years younger than their husbands or partners, on average. The prevalence of violence from an intimate partner is higher as couples' age gets closer: the fraction of women experiencing domestic violence in any form in the last twelve 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 domestic violence incidents have reduced the most for women whose experience of domestic violence is more prevalent. Figure B.11 shows the results for domestic violence with different frequencies.

5.4 Robustness

We conduct a battery of robustness checks of our main results on the concurrent effects of ASgM on intimate partner violence.

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, shown in Table 5, are consistent with the baseline findings. For the detailed forms of domestic violence, statistical significance changes for a few outcomes, but the signs for those coefficients are generally similar to the main results (Table B.5).

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., the gold price. The baseline analysis uses the one-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 Table 6 suggest that the results are remarkably robust.

The effects on the detailed forms of domestic violence also qualitatively remain the same when using these alternative gold prices, as shown in Tables B.6 and B.7.

Baseline Status of the Industrial Gold Mining. In our main analysis, we use a dummy variable indicating whether a cell ever had industrial gold mining. However, considering a potential expansion of industrial gold mines across space as the gold price increases over time, our baseline dummy could be a "bad" control. To check on this potential identification threat, we examine the robustness of the results by fixing the cell's status of industrial gold mining at the baseline or the initial period when the industrial gold mining data were available for each cell. Then we interact this dummy variable with the time-varying global gold price. This interaction serves as a proxy for the intensification of industrial gold mining activities resulting from price changes in cells with industrial gold mines. Table 7 presents the results from this robustness check on the domestic violence

effects. The results are almost quantitatively the same, suggesting that the expansion of industrial gold mining in cells with no industrial gold mining activity in the initial period, due to the gold price increase, does not confound the effects of both artisanal and industrial mining on domestic violence. Only difference from the baseline regression is that the negative baseline effect of ISgM on severe physical violence often experienced by women, which was statistically significant at the 10% level, becomes statistically insignificant.[21]

Industrial Mineral Mining. The next robustness check considers replacing ISgM with industrial mining of multiple minerals (gold and other minerals, including aluminum, coal, copper, diamond, iron, lead, nickel, phosphate, platinum, silver, tantalum, tin, and zinc) 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. Table 8 reports the results. The coefficient estimates on the effect of artisanal gold mining remain qualitatively the same. The impact of ISgM on intimate partner violence 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. As shown in Table B.8, the results for the detailed forms of domestic violence are also robust.

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. (2025), 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 experiencing intimate partner violence, except for domestic violence often experienced by women, particularly less severe physical violence, on which the temperature in gold-suitable areas has positive impacts (Table 9).

The domestic violence-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. Table B.9 provides the full results with the estimated effects on broad forms of domestic violence with different frequencies, and Table B.10 presents the results for detailed forms of domestic violence.

[21] In this analysis, we treat cells with missing information on industrial gold mining in the first period as missing. The results, which are available on request, remain unchanged when we treat them as zero.

Controlling for Husband's Characteristics. In this robustness check, we include the husband's demographic characteristics, including age and education level, in our primary regression of broadly defined domestic violence outcomes. Due to missing values in the husband's characteristics, we did not control these variables in our baseline regressions but used them for robustness. Table 10 presents the results. Although the sample size has been reduced nearly by 20%, the baseline effects of ASgM and ISgM on our primary outcomes are highly robust. The standard errors slightly increase in the regressions of domestic violence sometimes experienced in the last twelve months. However, the effects of ASgM on overall and less severe physical violence are still statistically significant, at least at the 10% level. The magnitudes of the coefficients are relatively stable. The qualitative results from regressions of domestic violence ever experienced (Panel A) and sometimes experienced remain the same.

Excluding Current Marital Status. Our baseline domestic violence regressions control for women's current marital status. However, artisanal mining and the related changes in women's employment could drive marriage market outcomes. Women might delay marriage, making the marital status or age at marriage outcomes "bad" or not valid controls. In the next section, we examine whether the artisanal mining shock affected women's current marital status as a potential mechanism. Here, however, check how much our baseline findings depend on the inclusion of current marital status as a covariate in the domestic violence regressions by dropping the variable as a control. As shown in Table 11, the effects of artisanal mining on intimate partner violence remain unchanged.

6 Mechanisms

In this section, we examine the potential mechanisms through which ASgM could have affected intimate partner violence. We first evaluate the price pass-through or if the source of temporal variation from global gold price generates the variation in local mining activities. Second, we investigate whether ASgM improves various measures of women's intrahousehold bargaining power. Third, we estimate the effects on industry- and gender-specific employment and household wealth to evaluate the underlying reasons for changes in women's intrahousehold bargaining power. We then rule out some other potential channels, including household wealth, compositional changes, and the husband's alcohol drinking. We also provide some evidence on the separation effect or partners stopping living together as a channel for reduced physical violence and on the fertility effect as a potential channel for an increase in some forms of sexual violence.

6.1 Price Pass-Through

Our identification strategy employs international gold price as a proxy for the potential profitability of artisanal gold mining activities. It assumes that artisanal miners or intermediaries are informed about the global price movements and miners earn from international gold prices sufficient to motivate them to work on mining sites in response to price changes. Previous studies have established a strong link between international gold prices and artisanal miners' livelihood. For example, Bazillier and Girard (2020) suggest that informal gold miners in Burkina Faso earn more than 83% of the international gold price during the boom, which is much higher than the country's other popular commodities such as cotton, whose share is only 60% of the world price (van der Merwe et al., 2024). However, one might be concerned if we can empirically test to what extent the local miners benefit from an increase in international gold price and how they get information about the global market.

Despite the lack of data on local gold prices and miners' means of information access, we use the mobile network coverage as a proxy for the degree of information access to evaluate if the global price passes through to the local economy. In doing so, we estimate if the ASgM effect is stronger in cells with a 3G connection. Since individuals living in regions with 3G coverage are likely to access the internet more easily, miners and intermediaries are more likely to get informed about international price updates. We focus on 3G rather than 2G technology as artisanal miners are typically required to register for a license and sell their products to government-licensed agents or state-owned mining companies who oversee the mining sites (Hilson and Hu, 2022; Huntington and Marple-Cantrell, 2022). Those miners are paid a guaranteed share of the world market price under a price-sharing scheme (Banda and Chanda, 2021). Additionally, unlicensed and informal miners, the primary form of artisanal mining, are less likely to access the internet to check global prices. Thus, intermediaries are more likely to check international prices regularly via the internet and invest in digital technologies like 3G with better and faster internet connection. Therefore, we consider the 3G coverage is more appropriate to capture the extent of price pass-through.

We obtain data on 3G coverage for the entire African continent at 0.5×0.5 cell level from Manacorda and Tesei (2020) and define a dummy, Coverage_{ct}, which equals to one if a cell's 3G coverage is positive for a given year t. To quantify the heterogeneous effects by internet connection, we estimate the following triple interaction model:

$$\begin{aligned} Y_{ict} = \beta_0 &+ \beta_1 \text{Gold Suitability}_c \times \text{Gold Price}_{t-1} \times \text{Coverage}_{c,t-1} + \\ &+ \beta_2 \text{Gold Suitability}_c \times \text{Gold Price}_{t-1} + \beta_3 \text{Gold Suitability}_c \times \text{Coverage}_{c,t-1} + \\ &+ \beta_4 \text{Gold Price}_c \times \text{Coverage}_{c,t-1} + \beta_5 \text{Coverage}_{c,t-1} + \\ &+ \boldsymbol{X}'_{ict}\boldsymbol{\gamma} + \boldsymbol{Z}'_{hct}\boldsymbol{\theta} + \boldsymbol{M}'_{ct}\boldsymbol{\delta} + \alpha_c + \pi_{country,t} + \varepsilon_{ict}, \end{aligned} \tag{2}$$

where the key explanatory variable is the triple interaction between the cell's surface suitable for gold, the lagged value of the international gold price, and the lagged dummy for a cell with 3G

coverage. In this model, we use the lagged value of the internet coverage to be consistent with the lagged price, and all other terms are the same as in equation (1). The 3G coverage data from Manacorda and Tesei (2020) only span between 1998 and 2012. For 2013-2019, we fix the value of Coverage$_{ct}$ to its 2012 value, assuming that a cell has been covered by 3G technology since then if it was covered in 2012. The parameter of interest is β_1, which captures the additional effect of ASgM on intimate partner violence in cells covered by 3G technology.

Table 12 reports the regression results. The effects of ASgM on intimate partner violence are more pronounced in cells with 3G coverage (Column (1)). In particular, the employment and income shock from artisanal mining reduces moderate or less severe physical (Column (2)) and sexual (Column (4)) violence even experienced often over the past twelve months in cells with 3G coverage. These findings support our hypothesis that the availability of 3G infrastructure plays an important role in alleviating information friction and channeling the international gold price to the local price, thereby enhancing the ASgM effects on reducing domestic violence. The economic shock from artisanal gold mining is still ineffective in reducing severely violent behavior, as we fail to find a significant impact on severe physical violence (Column (3)), similar to our baseline results.

6.2 Women's Intrahousehold Bargaining Power

Our finding on a decrease of less severe physical violence 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 bargaining power. The results reported in Table 13 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.[22] An improved women's bargaining power combined with a decline in intimate partner violence 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.

6.3 Female Labor Supply, Structural Transformation, and Earning Potential

We now move to the results on the employment effects of 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 intimate partner violence against them depend on the wife's employment and earnings relative to the husband. Table 14 shows the estimated effects of ASgM on overall (Panel A), male (Panel B), and female (Panel C) employment in the aggregate economy and across

[22] 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 B.11. 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.

different industries, including mining, agriculture, services, and sales or retail.[23] The overall employment effects mirror the results in Girard et al. (2025). 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 14, 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 14, 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 (2024), who show an overall pattern of women entering the sales/retail industry in response to the opening of artisanal mining.

Due to null overall employment impacts, the underlying mechanism for strengthening women's

[23] 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. 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.

intrahousehold bargaining power is less likely to be higher overall employment, at least on the extensive margin. However, our results suggest that changes in sector-specific employment or structural transformation play a role in explaining the response of intrahousehold dynamics to artisanal mining in our context. So, we further explore other potential mechanisms. Several mechanisms could have increased a woman's bargaining power within the household, such as an increase in her earnings relative to her husband or partner. 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.[24] 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.

The lack of data on individual-level income restricts this paper from directly checking if the wife's earnings increased more than her husband's. 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. (2025); 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 (Table 15). We check the robustness of the household wealth effect of artisanal gold mining using the cell's baseline status of industrial gold mines instead of the cell's status of ever hosting ISgM (Columns (1) and (2) of Table 16). The effect of ASgM on household wealth is almost quantitatively the same, while the significant effect of ISgM disappears, which is consistent with Girard et al. (2025). This intuitively indicates that artisanal mining is more inclusive than industrial mining. When we fix the ISgM status at the baseline period, the effect of ASgM could be biased, as the gold suitability might capture the effect of the expansion of ISgM in cells that did not have an industrial gold mine at the baseline period due to an increase in gold prices. To investigate this, we drop the ISgM measure altogether and find that the coefficient estimate on the gold suitability in the household wealth regression is remarkably unchanged (Column (3) of Table 16). This suggests that the choice of ISgM measure does not contaminate the effect of ASgM, and gold suitability largely represents the artisanal gold mining.

We cannot disentangle the contribution of the wife and husband to the household wealth growth. However, we consider 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)

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

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 14, could also indicate an improvement in aggregate demand through higher income.

As discussed in the previous section, we estimate the employment effects heterogeneous by household wealth. Figure 9 shows the results. 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)). 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 intimate partner violence.

6.4 Household Wealth

We further check whether a reduction in intimate partner violence is mediated through a change in household wealth because Haushofer et al. (2019) show that changes in household income affect the intimate partner violence in the context of a cash transfer program in Kenya. Thus, we run the baseline regression on domestic violence outcomes with household wealth index as an additional covariate, and we report the results in Table 17. Higher household wealth is associated with a lower incidence of domestic violence. 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 intimate partner violence. Table B.12 provides the full results with the estimated impacts on broad forms of domestic violence with different frequencies. The findings are the same for detailed forms of domestic violence (Table B.13).

6.5 Composition Changes, Separation, and Migration

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 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 18 reports the results. We found no significant impact of ASgM on all character-

istics except that, after the gold price increase, women living in gold-suitable areas are more likely to be separated from a consensual union (Column (5)). 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 18, 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 19). We find no significant increase in migrants, regardless of when they arrived in the community. This result suggests that the composition of the communities is strongly stable in response to the shock. Given no major changes in the population composition, the first channel described above is less plausible. Therefore, the intimate partner violence could have been reduced via a "separation" effect due to less interaction between partners as they are not living together.

6.6 Alcohol Drinking

Studies on the link between alcohol consumption and domestic violence suggest that husband's or partner's alcohol drinking is a significant determinant of violent behavior and intimate partner violence in developed (Card and Dahl, 2011; Ivandić et al., 2024) and developing (Luca et al., 2015, 2019; Basu et al., 2025) countries. Since the employment and income from artisanal mining by husbands or male partners can increase their alcohol consumption through income effect[25] and high rates of binge drinking (Cawley and Ruhm, 2011) or reduce alcohol consumption via problem drinking effect (Mullahy and Sindelar, 1996). The DHS data collect information on whether a woman and her husband or partner drink alcohol. Leveraging this information, we first estimate the effect of artisanal gold mining on husband's alcohol drinking to examine if its impact on intimate partner violence is mediated through changes in men's alcohol consumption. Panel A of Table 20 reports the results under four separate specifications wherein more controls are added successively. Our baseline and preferred specification in Column (4) suggests that the effect of artisanal gold mining on a husband or partner's alcohol consumption is essentially zero. This result provides evidence that ASgM does not reduce intimate partner violence via altering the husband's alcohol drinking and the associated behavioral changes.

Although the data on women's alcohol drinking status is available for limited countries and DHS rounds, we estimate the effect of artisanal gold mining on women's drinking behavior and find that ASgM reduces women's alcohol consumption. The impact is statistically significant at the

[25] See Fogarty (2010) for a comprehensive literature review on studies estimating the income elasticity of demand for alcoholic drinks.

10% level (Panel B of Table 20). This finding supports our results on the positive effect of ASgM on female employment, which is more significant than the male employment effect. Women reduce alcohol drinking as they supply their labor to broader industries in response to the positive economic shock. However, industrial gold mining strongly increases women's alcohol consumption, and the effect is larger both in magnitude and statistical significance. It potentially indicates the non-gender-inclusive feature of industrial mining.

6.7 Fertility Decision

So far, we have focused on explaining how ASgM might have reduced physical violence and thus overall domestic violence. However, the baseline effects on detailed forms of intimate partner violence suggest that ASgM increases a specific form of sexual violence, i.e., women being forced into unwanted sexual acts other than sex. Women's better labor market opportunities and earning potentials might make a wife postpone fertility (Baizán, 2007; Bloom et al., 2009; Aaronson et al., 2021; Doepke et al., 2023), while the husband wants a child. So we estimate the impact on fertility decisions proxied by the number of children, and results are shown in Table 21. The effects of ASgM on different fertility measures are statistically insignificant; however, the signs of the coefficients are negative.

Although the impact is not statistically significant or imprecisely estimated, the result provides suggestive evidence on the negative effect of female labor force participation and fertility, which could explain an increase in the wife's experience of unwanted sexual acts by her husband or partner. The insignificant impact of ASgM on fertility, however, is consistent with the insignificant effect on overall female employment. It is also possible that the husband wanted sexual acts other than sex when the wife refused to have sex preventing them from having children.

7 Conclusion

This paper presents the first evidence that increasing women's work incentives and earned income decrease intimate partner violence. Using data representative data from over 30 countries in Sub-Saharan Africa, we provide nearly continent-wide population-based evidence with strong external validity. For identification, we leverage the spatial and temporal variations in artisanal gold mining using geological data on gold suitability at the most granular or cell level, geospatial location of industrial gold mines, and exogenous changes in global gold price.

In the short term, less severe physical violence with less frequency decrease, which drives the overall impact on domestic violence. Women's intrahousehold bargaining power improved due to the shock, indicating that the bargaining power channel dominates the potential backlash effect. The overall labor supply does not change for men and women in response to increased profitability

of extractive activities; however, women's economic activities increased with higher magnitude in more industries, including mining and sales or retail, than men.[26] 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 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 domestic violence, particularly less severe physical violence, tend to sustain over time. However, severe physical domestic violence 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 intimate partner violence. Industrial gold mining, which is less inclusive and highly dependent on heavy machines operated by men, increases violence against 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 forms of domestic violence, 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 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 intimate partner violence 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

[26]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.

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.

References

Aaronson, Daniel, Rajeev Dehejia, Andrew Jordan, Cristian Pop-Eleches, Cyrus Samii, and Karl Schulze. 2021. "The Effect of Fertility on Mothers' Labor Supply over the Last Two Centuries." *The Economic Journal*, 131(633): 1–32.

Aizer, Anna. 2010. "The Gender Wage Gap and Domestic Violence." *American Economic Review*, 100(4): 1847–1859.

Anderberg, Dan, Helmut Rainer, Jonathan Wadsworth, and Tanya Wilson. 2016. "Unemployment and Domestic Violence: Theory and Evidence." *The Economic Journal*, 126(597): 1947–1979.

Angrist, Joshua D., and Jörn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Aragón, Fernando M., and Juan Pablo Rud. 2013. "Natural Resources and Local Communities: Evidence from a Peruvian Gold Mine." *American Economic Journal: Economic Policy*, 5(2): 1–25.

Arezki, Rabah, Elena Dumitrescu, Andreas Freytag, and Marc Quintyn. 2014. "Commodity Prices and Exchange Rate Volatility: Lessons from South Africa's Capital Account Liberalization." *Emerging Markets Review*, 19: 96–105.

Asiamah, Oliver, Samuel Kwaku Agyei, Ahmed Bossman, Ellen Animah Agyei, Joseph Asucam, and Michael Arku-Asare. 2022. "Natural Resource Dependence and Institutional Quality: Evidence from Sub-Saharan Africa." *Resources Policy*, 79: 102967.

ASM Inventory. 2022. "World Maps of Artisanal and Small-scale Mining."

Baffes, John, and Tassos Haniotis. 2010. "Placing the 2006/08 Commodity Price Boom into Perspective." *World Bank Policy Research Working Paper No. 5371*.

Baizán, Pau. 2007. "The Impact of Labour Market Status on Second and Higher-Order Births." In *Family Formation and Family Dilemmas in Contemporary Europe*. ed. by Gosta Esping-Andersen, Fundación BBVA Bilbao, pp. 93–127.

Banda, Webby, and Emmanuel K. Chanda. 2021. "A Proposed Cooperatives Strategy for Artisanal and Small-Scale Gold Mining Sector in Zambia." *Resources Policy*, 70: 101909.

Banerjee, Sudeshna Ghosh, Zayra Romo, Gary McMahon, Perrine Toledano, Peter Robinson, and Inés Pérez Arroyo. 2015. *The Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa*. World Bank.

Basu, Arnab K., Tsenguunjav Byambasuren, and Nancy H. Chau. 2025. "Alcohol Consumption and Intimate Partner Violence: Long-Term Effects of a Temporary Alcohol Ban." *Working Paper*.

Basu, Kaushik. 2006. "Gender and Say: A Model of Household Behaviour with Endogenously Determined Balance of Power." *The Economic Journal*, 116(511): 558–580.

Baum, Sarah, and Anja Benshaul-Tolonen. 2021. "Extractive Industries and Gender Equality." *Review of Environmental Economics and Policy*, 15(2): 195–215.

Bazillier, Remi, and Victoire Girard. 2020. "The Gold Digger and the Machine. Evidence on

the Distributive Effect of the Artisanal and Industrial Gold Rushes in Burkina Faso." *Journal of Development Economics*, 143: 102411.

Benshaul-Tolonen, Anja. 2019. "Local Industrial Shocks and Infant Mortality." *The Economic Journal*, 129(620): 1561–1592.

Benshaul-Tolonen, Anja. 2024. "Industrial Gold Mining and Female Empowerment." *Economic Development and Cultural Change*, 72(3): 1213–1266.

Berman, Nicolas, Mathieu Couttenier, Dominic Rohner, and Mathias Thoenig. 2017. "This Mine is Mine! How Minerals Fuel Conflicts in Africa." *American Economic Review*, 107(6): 1564–1610.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan. 2004. "How Much Should We Trust Differences-in-Differences Estimates?" *The Quarterly Journal of Economics*, 119(1): 249–275.

Bhalotra, Sonia, Diogo G. C. Britto, Paolo Pinotti, and Breno Sampaio. 2025. "Job Displacement, Unemployment Benefits and Domestic Violence." *Review of Economic Studies*, 92(6): 3649–3681.

Bhalotra, Sonia, Uma Kambhampati, Samantha Rawlings, and Zahra Siddique. 2021. "Intimate Partner Violence: The Influence of Job Opportunities for Men and Women." *The World Bank Economic Review*, 35(2): 461–479.

Bloch, Francis, and Vijayendra Rao. 2002. "Terror as a Bargaining Instrument: A Case Study of Dowry Violence in Rural India." *American Economic Review*, 92(4): 1029–1043.

Bloom, David E., David Canning, Günther Fink, and Jocelyn E. Finlay. 2009. "Fertility, Female Labor Force Participation, and the Demographic Dividend." *Journal of Economic Growth*, 14: 79–101.

Bobonis, Gustavo J., Melissa González-Brenes, and Roberto Castro. 2013. "Public Transfers and Domestic Violence: The Roles of Private Information and Spousal Control." *American Economic Journal: Economic Policy*, 5(1): 179–205.

Calvi, Rossella, and Ajinkya Keskar. 2023. "'Til Dowry Do Us Part: Bargaining and Violence in Indian Families." *Review of Economics and Statistics*, 1–45.

Campbell, Jacquelyn, Alison Snow Jones, Jacqueline Dienemann, Joan Kub, Janet Schollenberger, Patricia O'Campo, Andrea Carlson Gielen, and Clifford Wynne. 2002. "Intimate Partner Violence and Physical Health Consequences." *Archives of Internal Medicine*, 162(10): 1157–1163.

Card, David, and Gordon B. Dahl. 2011. "Family Violence and Football: The Effect of Unexpected Emotional Cues on Violent Behavior." *The Quarterly Journal of Economics*, 126(1): 103–143.

Cawley, John, and Christopher J. Ruhm. 2011. "The Economics of Risky Health Behaviors." In *Handbook of Health Economics, Vol. 2*. eds. by Thomas G. Mcguire Mark V. Pauly, and Pedro P. Barros, North Holland, New York, pp. 95–199.

Corden, W. Max, and J. Peter Neary. 1982. "Booming Sector and De-Industrialisation in a Small Open Economy." *The Economic Journal*, 92(368): 825–848.

Doepke, Matthias, Anne Hannusch, Fabian Kindermann, and Michèle Tertilt. 2023. "The Economics of Fertility: A New Era." In *Handbook of the Economics of the Family, Vol. 1*. eds. by Shelly Lundberg, and Alessandra Voena, Amsterdam, Netherlands, pp. 151–254.

Ellix, Hannah, Karilyn Farmer, Luk Kowalik, R. Little, T. Moonsamy, M. Mussacaleca, P. Ruban, and G. Zapata. 2021. "Why Women Are Leaving the Mining Industry and What Mining Companies Can Do About It." *McKinsey & Company*.

Ellsberg, Mary, Henrica A. Jansen, Lori Heise, Charlotte H. Watts, and C. Garcia-Moreno. 2008. "Intimate Partner Violence and Women's Physical and Mental Health in the WHO Multicountry Study on Women's Health and Domestic Violence: An Observational Study." *The Lancet*, 371(9619): 1165–1172.

Erten, Bilge, and Pinar Keskin. 2018. "For Better or for Worse?: Education and the Prevalence of Domestic Violence in Turkey." *American Economic Journal: Applied Economics*, 10(1): 64–105.

Erten, Bilge, and Pinar Keskin. 2021. "Female Employment and Intimate Partner Violence: Evidence from Syrian Refugee Inflows to Turkey." *Journal of Development Economics*, 150: 102607.

Erten, Bilge, and Pinar Keskin. 2024. "Trade-offs? The Impact of WTO Accession on Intimate Partner Violence in Cambodia." *Review of Economics and Statistics*, 106(2): 322–333.

Eshun, Maame Esi. 2020. "Women, Artisanal Mining and Peacebuilding in Africa." In *Women and Peacebuilding in Africa*. ed. by Anna Chitando, London: Routledge, pp. 158–172.

Fafchamps, Marcel, Michael Koelle, and Forhad Shilpi. 2017. "Gold Mining and Proto-Urbanization: Recent Evidence from Ghana." *Journal of Economic Geography*, 17(5): 975–1008.

Farmer, Amy, and Jill Tiefenthaler. 1996. "Domestic Violence: The Value of Services as Signals." *American Economic Review*, 86(2): 274–279.

Field, Erica, Rohini Pande, Natalia Rigol, Simone Schaner, and Charity Troyer Moore. 2021. "On Her Own Account: How Strengthening Women's Financial Control Impacts Labor Supply and Gender Norms." *American Economic Review*, 111(7): 2342–2375.

Fogarty, James. 2010. "The Demand for Beer, Wine and Spirits: A Survey of the Literature." *Journal of Economic Surveys*, 24(3): 428–478.

Fourati, Maleke, Victoire Girard, and Jeremy Laurent-Lucchetti. 2022. "Sexual Violence as a Weapon of War." *Working Paper*.

Frankel, Jeffrey A. 2012. "The Natural Resource Curse: A Survey of Diagnoses and Some Prescriptions." In *Commodity Price Volatility and Inclusive Growth in Low-Income Countries*. eds. by Marc G. Quintyn Rabah Arezki, Catherine A. Pattillo, and Min Zhu, Washington, DC: International Monetary Fund, pp. 7–34.

Girard, Victoire, Teresa Molina-Millán, and Guillaume Vic. 2025. "Artisanal Mining in Africa: Green for Gold?" *The Economic Journal*, 135(672): 2578–2597.

Gräser, Melanie. 2024. "Industrial versus Artisanal Mining: The Effects on Local Employment in Liberia." *Journal of Rural Studies*, 111: 103389.

Guimbeau, Amanda, Xinde James Ji, Nidhiya Menon, and Yana van der Meulen Rodgers. 2023. "Mining and Women's Agency: Evidence on Acceptance of Domestic Violence and Shared Decision-Making in India." *World Development*, 162: 106135.

Haushofer, Johannes, Charlotte Ringdal, Jeremy P. Shapiro, and Xiao Yu Wang. 2019. "Income Changes and Intimate Partner Violence: Evidence from Unconditional Cash Transfers in Kenya." *NBER Working Paper No. 25627*.

Heath, Rachel, and Emma Riley. 2024. "Digital Financial Services and Women's Empowerment: Experimental Evidence from Tanzania." *Working Paper*.

Hergt, Brian. 2013. "Gold Prices during and after the Great Recession." *Beyond the Numbers: Prices and Spending*, 2(4): 1–8.

Hidrobo, Melissa, and Lia Fernald. 2013. "Cash Transfers and Domestic Violence." *Journal of Health Economics*, 32(1): 304–319.

Hidrobo, Melissa, Amber Peterman, and Lori Heise. 2016. "The Effect of Cash, Vouchers, and Food Transfers on Intimate Partner Violence: Evidence from a Randomized Experiment in Northern Ecuador." *American Economic Journal: Applied Economics*, 8(3): 284–303.

Hilson, Gavin. 2016. "Farming, Small-scale Mining and Rural Livelihoods in Sub-Saharan Africa: A Critical Overview." *The Extractive Industries and Society*, 3(2): 547–563.

Hilson, Gavin, and Yanfei Hu. 2022. "Changing Priorities, Shifting Narratives: Remapping Rural Livelihoods in Africa's Artisanal and Small-Scale Mining Sector." *Journal of Rural Studies*, 92: 93–108.

Hinton, Jennifer, Marcello M. Veiga, and Christian Beinhoff. 2003. "Women and Artisanal Mining: Gender Roles and the Road Ahead." In *The Socio-Economic Impacts of Artisanal and Small-Scale Mining in Developing Countries*. ed. by G. Hilson, Netherlands: A.A. Balkema, Swets Publishers, pp. 149–188.

Huntington, Heather, and Kate Marple-Cantrell. 2022. "The Importance of Artisanal and Small-Scale Mining for Rural Economies: Livelihood Diversification, Dependence, and Heterogeneity in Rural Guinea." *Journal of Rural Studies*, 94: 177–191.

Ivandić, Ria, Tom Kirchmaier, Yasaman Saeidi, and Neus Torres Blas. 2024. "Football, Alcohol, and Domestic Abuse." *Journal of Public Economics*, 230: 105031.

Jewkes, Rachel K., Kristin Dunkle, Mzikazi Nduna, and Nwabisa Shai. 2010. "Intimate Partner Violence, Relationship Power Inequity, and Incidence of HIV Infection in Young Women in South Africa: A Cohort Study." *The Lancet*, 376(9734): 41–48.

Kotsadam, Andreas, Gudrun Østby, and Siri Aas Rustad. 2017. "Structural Change and Wife Abuse: A Disaggregated Study of Mineral Mining and Domestic Violence in Sub-Saharan Africa, 1999–2013." *Political Geography*, 56: 53–65.

Kotsadam, Andreas, and Anja Tolonen. 2016. "African Mining, Gender, and Local Employment." *World Development*, 83: 325–339.

Kotsadam, Andreas, and Espen Villanger. 2025. "Jobs and Intimate Partner Violence: Evidence from a Field Experiment in Ethiopia." *Journal of Human Resources*, 60(2): 469–495.

Luca, Dara Lee, Emily Owens, and Gunjan Sharma. 2015. "Can Alcohol Prohibition Reduce Violence against Women?" *American Economic Review: Papers and Proceedings*, 105(5): 625–629.

Luca, Dara Lee, Emily Owens, and Gunjan Sharma. 2019. "The Effectiveness and Effects of Alcohol Regulation: Evidence from India." *IZA Journal of Development and Migration*, 9(4).

Manacorda, Marco, and Andrea Tesei. 2020. "Liberation Technology: Mobile Phones and Political Mobilization in Africa." *Econometrica*, 88(2): 533–567.

Moretti, Enrico. 2010. "Local Multipliers." *American Economic Review*, 100(2): 373–377.

Mossie, Tilahun B., Haile Mekonnen Fenta, Meseret Tadesse, and Animut Tadele. 2023. "Mapping the Disparities in Intimate Partner Violence Prevalence and Determinants across Sub-Saharan Africa." *Frontiers in Public Health*, 11: 1188718.

Mullahy, John, and Jody Sindelar. 1996. "Employment, Unemployment, and Problem Drinking." *Journal of Health Economics*, 15(4): 409–434.

van der Merwe, Antoinette, Fritz Brugger, and Isabel Günther. 2024. "Rising Gold Prices but Lower Incomes for Gold Miners: Evidence on Market Imperfections from Burkina Faso during COVID-19." *Journal of African Economies*, 33(1): 92–108.

van der Ploeg, Frederick. 2011. "Natural Resources: Curse or Blessing?" *Journal of Economic Literature*, 49(2): 366–420.

Oram, Sian, Hind Khalifeh, and Louise M. Howard. 2017. "Violence Against Women and Mental Health." *The Lancet Psychiatry*, 4(2): 159–170.

Park, David Sungho, Shilpa Aggarwal, Dahyeon Jeong, Naresh Kumar, Jonathan Robinson, and Alan Spearot. 2024. "Private but Misunderstood? Evidence on Measuring Intimate Partner Violence via Self-Interviewing in Rural Liberia and Malawi." *The World Bank Economic Review*, p. lhae040.

Rigterink, Anouk S., Tarek Ghani, Juan S. Lozano, and Jacob N. Shapiro. 2025. "Mining Competition and Violent Conflict in Africa: Pitting Against Each Other." *The Journal of Politics*, 87(1): 99–114.

Romito, Patrizia, Janet Molzan Turan, and Margherita De Marchi. 2005. "The Impact of Current and Past Interpersonal Violence on Women's Mental Health." *Social Science & Medicine*, 60(8): 1717–1727.

Rustad, Siri Aas, Gudrun Østby, and Ragnhild Nordås. 2016. "Artisanal mining, conflict, and sexual violence in Eastern DRC." *The Extractive Industries and Society*, 3(2): 475–484.

Sachs, Jeffrey D., and Andrew M. Warner. 2001. "The Curse of Natural Resources." *European Economic Review*, 45(4-6): 827–838.

Sánchez De La Sierra, Raúl. 2020. "On the Origins of the State: Stationary Bandits and Taxation in Eastern Congo." *Journal of Political Economy*, 128: 32–74.

Sanin, Deniz. 2025. "Women's Employment, Husbands' Economic Self-Interest and Domestic Violence." *Working Paper*.

Santos, Rafael J. 2018. "Blessing and Curse. The Gold Boom and Local Development in Colom-

bia." *World Development*, 106: 337–355.

Siddique, Zahra. 2022. "Media-Reported Violence and Female Labor Supply." *Economic Development and Cultural Change*, 70(4): 1337–1365.

Signé, Landry, and Chelsea Johnson. 2021. "Africa's Mining Potential: Trends, Opportunities, Challenges and Strategies." *Working Paper*.

Singleton, Kenneth J. 2014. "Investor Flows and the 2008 Boom/Bust in Oil Prices." *Management Science*, 60(2): 300–318.

Stevenson, Betsey, and Justin Wolfers. 2006. "Bargaining in the Shadow of the Law: Divorce Laws and Family Distress." *Quarterly Journal of Economics*, 121(1): 267–288.

Tang, Ke, and Wei Xiong. 2012. "Index Investment and the Financialization of Commodities." *Financial Analysts Journal*, 68(6): 54–74.

Thomas, Alun, and Juan P. Trevino. 2013. "Resource Dependence and Fiscal Effort in Sub-Saharan Africa." *IMF Working Paper WP/13/188*.

Tollefsen, Andreas Forø, Håvard Strand, and Halvard Buhaug. 2012. "PRIO-GRID: A Unified Spatial Data Structure." *Journal of Peace Research*, 49(2): 363–374.

Werthmann, Katja. 2009. "Working in a Boom-Town: Female Perspectives on Gold-Mining in Burkina Faso." *Resources Policy*, 34(1-2): 18–23.

WHO. 2021. "Devastatingly Pervasive: 1 in 3 Women Globally Experience Violence."

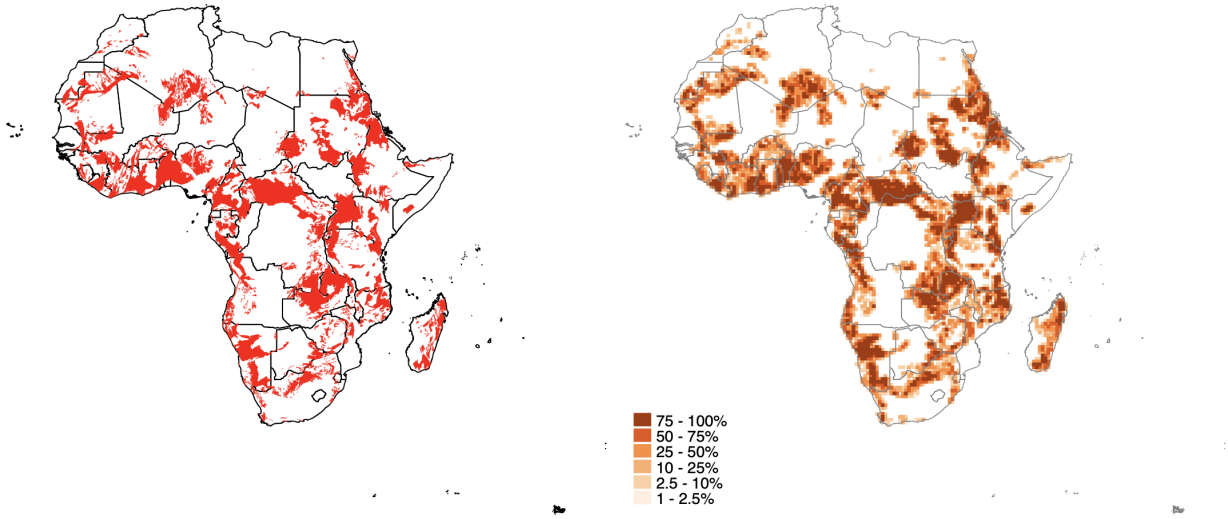
World Bank. 2020. "2020 State of the Artisanal and Small Scale Mining Sector." Washington, DC: World Bank.

Figures

Figure 1: Artisanal Gold Mining in Africa

(a) Gold suitable bedrocks

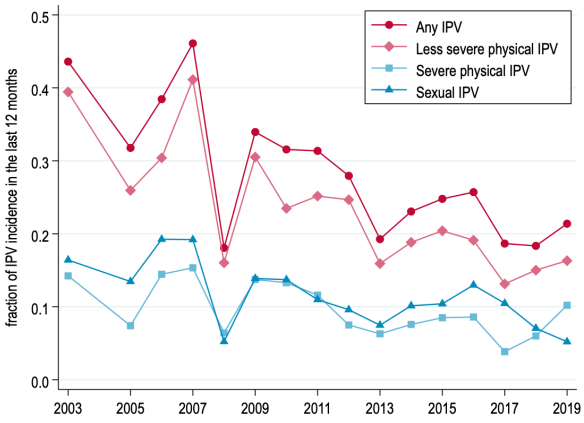
(b) Share of the cell area suitable for gold



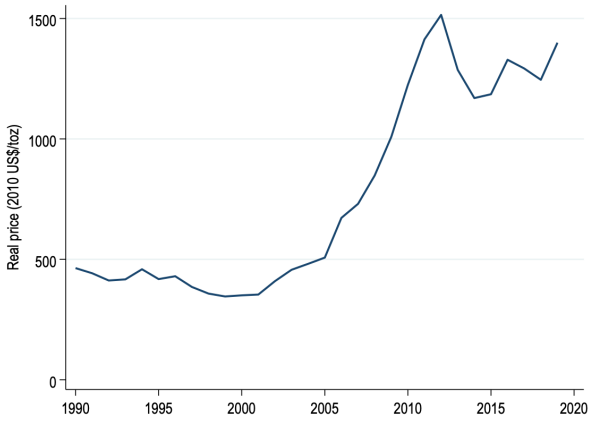
Notes: Panel (a) depicts the geological bedrocks suitable for artisanal gold mining. Panel (b) shows the percentage of areas suitable for artisanal gold mining in the PRIO-GRID cells of 0.5×0.5 degrees or 55×55 kilometers at the Equator.

Figure 2: Trends of Domestic Violence and Global Gold Price

(a) Domestic Violence, 2003-2019

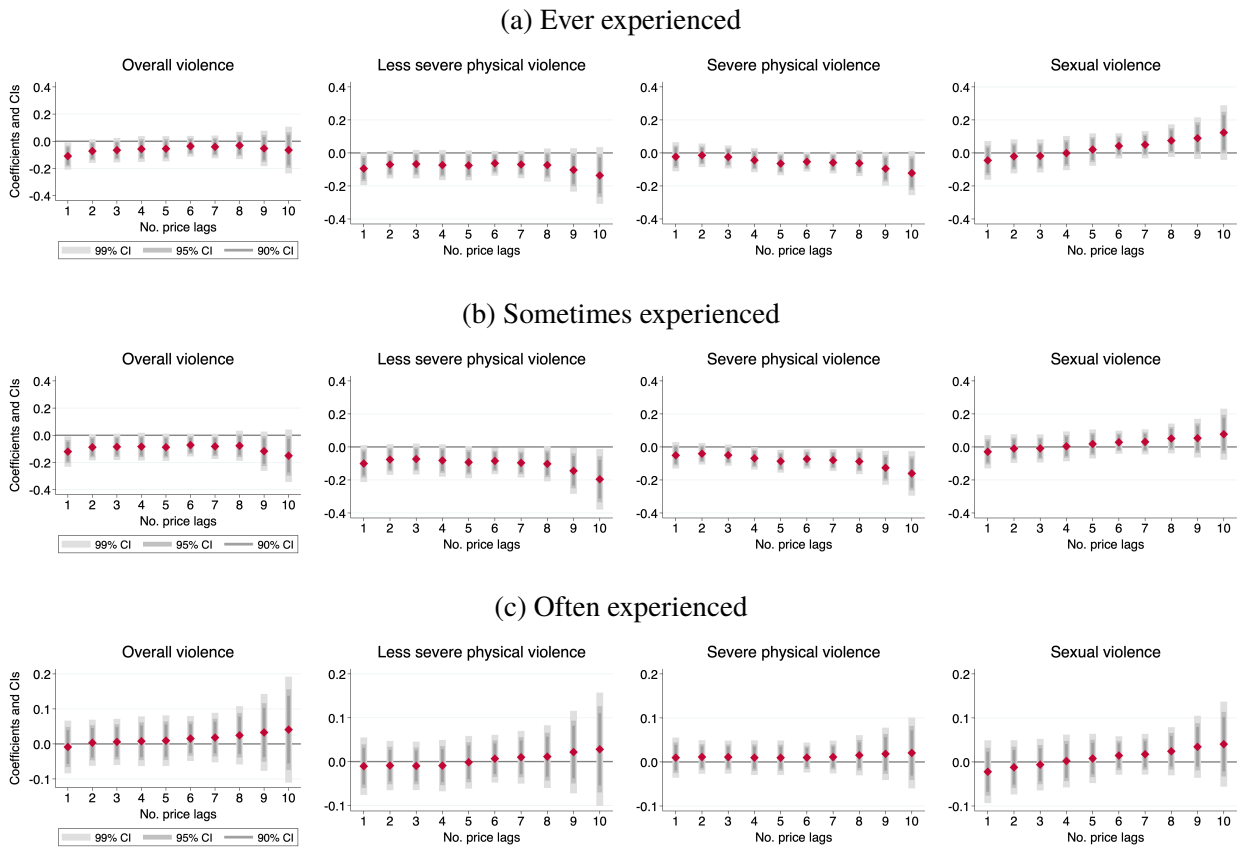


(b) Global gold price, 1990-2019



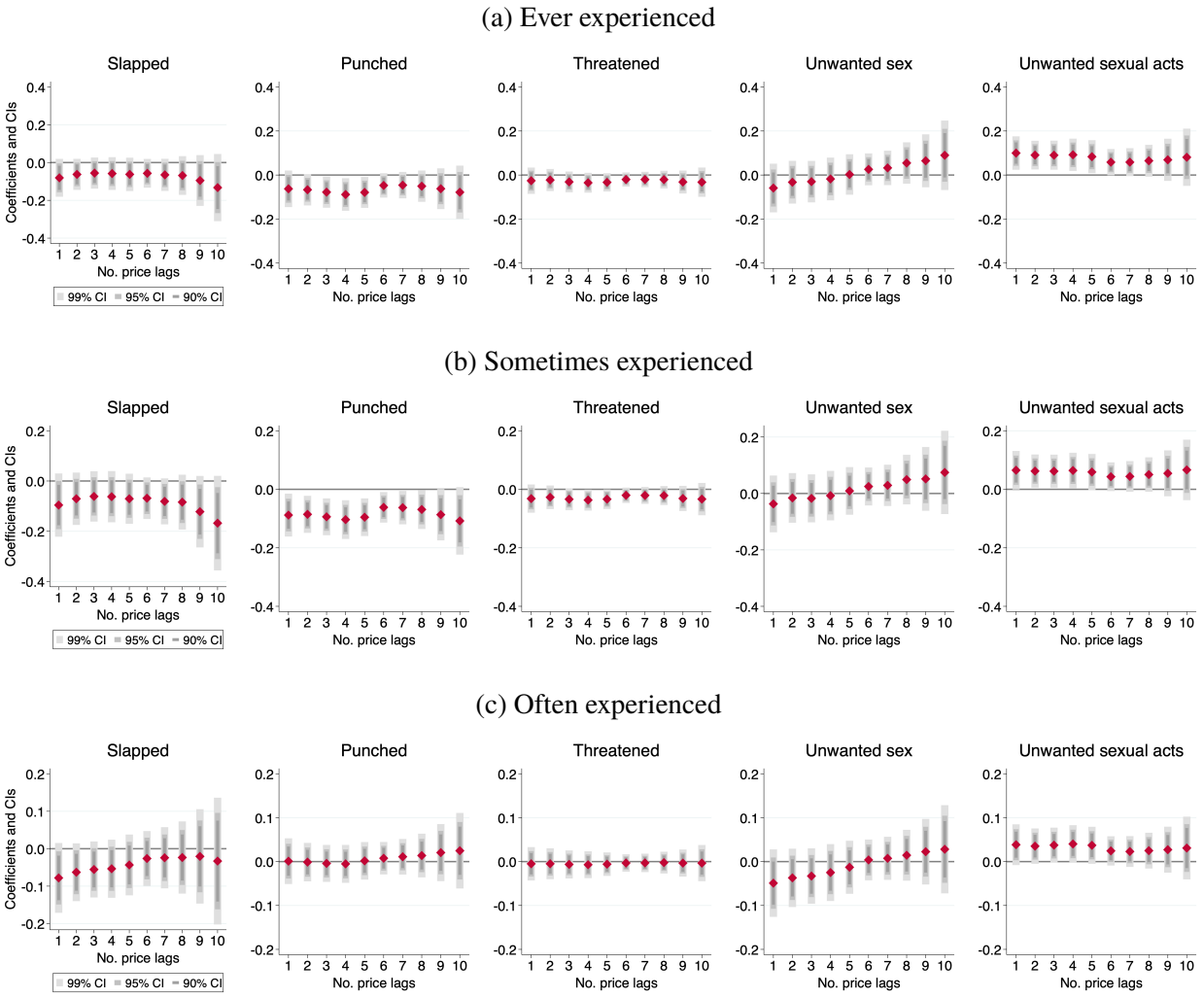
Notes: Panel (a) plots the trend of intimate partner violence in Sub-Saharan Africa using the DHS data from 2003-2019. The domestic violence data was unavailable in 2004 for all countries in our sample. The sample weight is applied to calculate the average incidence of intimate partner violence. Panel (b) shows the annual average price of gold (in 2010 US$/troy ounce) in the international market between 1990 and 2019 using data from the World Bank's Pink Sheet.

Figure 3: Persistence of ASgM Effects on Broad Forms of Domestic Violence



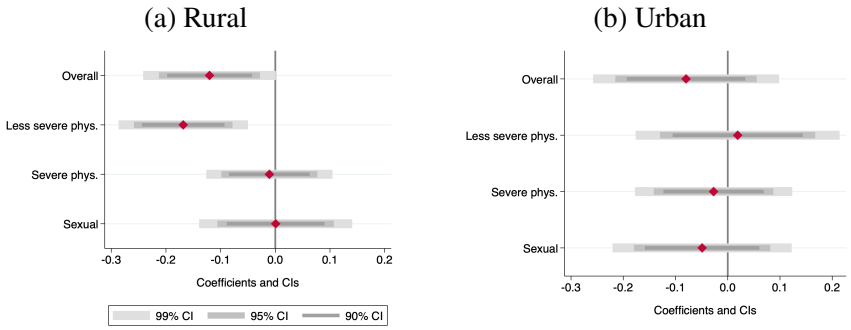
Notes: The figure presents the OLS estimates on the persistence of effects of artisanal gold mining on overall and different forms of intimate partner violence. The dependent variables are dummy variables for broad forms of domestic violence ever (Panel (a)), sometimes (Panel (b)), and often (Panel (c)) experienced in the last twelve months. The broad forms of domestic violence include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual violence. 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 one-year time lag from the survey year, which covers the same period as domestic violence experiences in the last twelve months, i.e., the number of lags is one. 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 4: Persistence of ASgM Effects on Detailed Forms of Domestic Violence



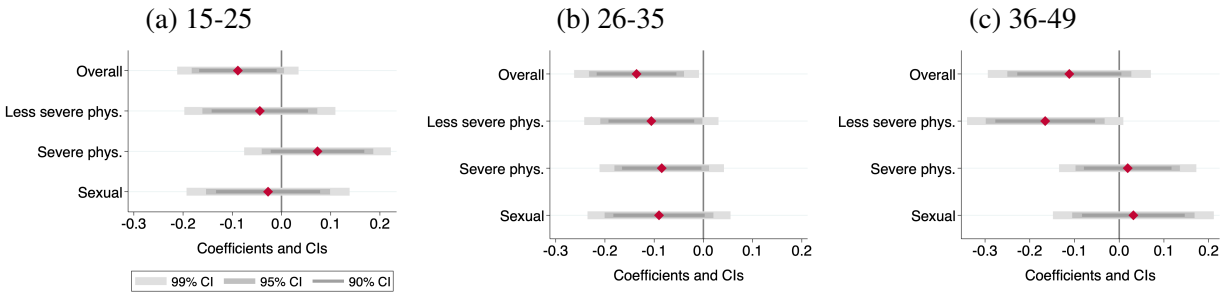
Notes: The figure presents the OLS estimates on the persistence of effects of artisanal gold mining on overall and different forms of intimate partner violence. The dependent variables are dummy variables for detailed forms of domestic violence ever (Panel (a)), sometimes (Panel (b)), and often (Panel (c)) experienced by the woman in the last twelve months. The detailed forms of domestic violence 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 one-year time lag from the survey year, which covers the same period as domestic violence experiences in the last twelve months, i.e., the number of lags is one. 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 5: Heterogeneous Effects of ASgM on Broad Forms of Domestic Violence by Residence



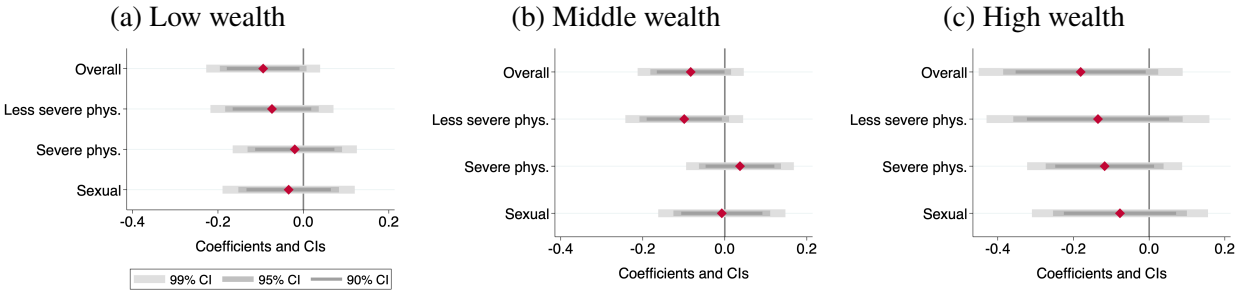
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different forms of intimate partner violence in rural (Panel (a)) and urban (Panel (b)) areas. The dependent variables are dummy variables if a woman ever experienced broad forms of domestic violence in the last twelve months. The broad forms of domestic violence include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual violence. 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 Broad Forms of Domestic Violence by Woman's Age



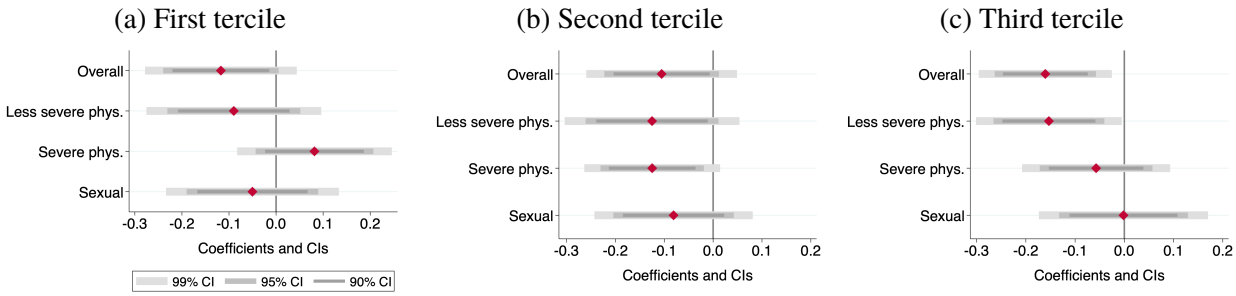
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different forms of intimate partner violence heterogeneous by woman's age groups. We estimate the regressions using sub-samples consisting of (i) 15-25 years old women, (ii) 26-35 years old women, and (iii) 36-49 years old women. The dependent variables are dummy variables if a woman ever experienced broad forms of domestic violence in the last twelve months. The broad forms of domestic violence include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual violence. 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 urban/rural status 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 Broad Forms of Domestic Violence by Household Wealth



Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different forms of intimate partner violence 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 broad forms of domestic violence in the last twelve months. The broad forms of domestic violence include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual violence. 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.

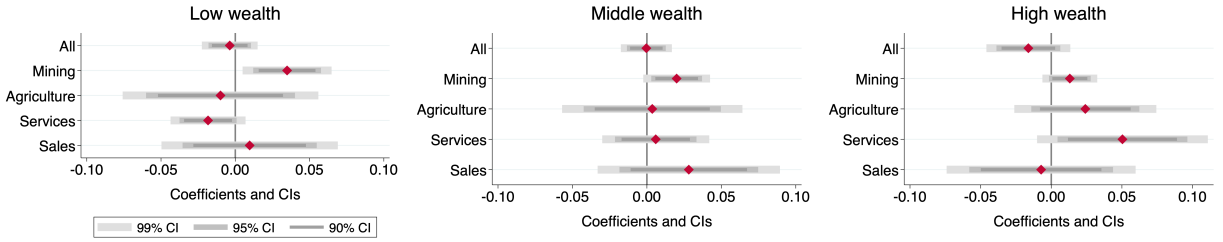
Figure 8: Heterogeneous Effects of ASgM on Broad Forms of Domestic Violence by Age Difference between Partners



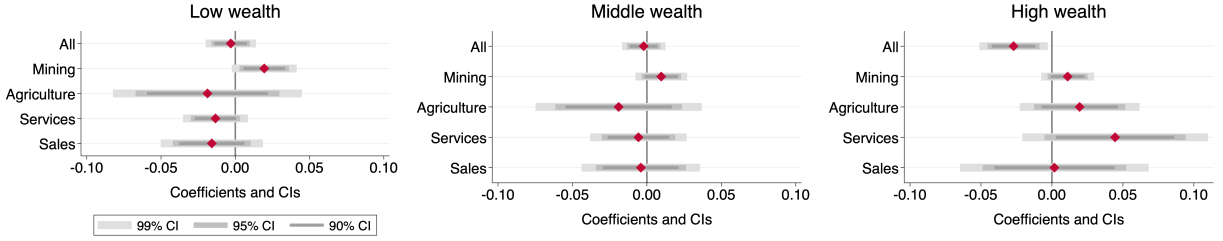
Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on overall and different forms of intimate partner violence heterogeneous by woman's age difference from her partner. We estimate the regressions using sub-samples consisting women whose age difference from her partner is in the (i) first tercile, (ii) second tercile, and (iii) third tercile. The dependent variables are dummy variables if a woman ever experienced broad forms of domestic violence in the last twelve months. The broad forms of domestic violence include dummy variables indicating whether a woman has been experiencing less severe physical, severe physical, and sexual violence. 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 Employment Effects of ASgM by Household Wealth

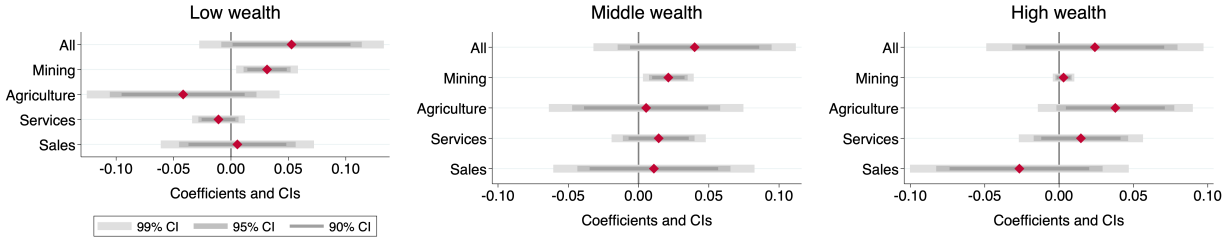
(a) Overall



(b) Male



(c) Female



Notes: The figure presents the OLS estimates on the effects of artisanal gold mining on employment or labor supply 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 twelve 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.

Tables

Table 1: Descriptive Statistics of Domestic Violence Outcomes

	Ever		Sometimes		Often	
	Mean	SD	Mean	SD	Mean	SD
	Panel A. Broad forms of domestic violence					
Less severe physical violence	0.201	0.401	0.165	0.371	0.053	0.223
Severe physical violence	0.082	0.275	0.062	0.241	0.022	0.146
Sexual violence	0.098	0.298	0.072	0.258	0.030	0.171
Overall (any of these) violence	0.245	0.430	0.206	0.404	0.071	0.256
	Panel B. Detailed forms of domestic violence					
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 table presents the descriptive statistics of domestic violence experienced over the past twelve months using the DHS sample of ever-married women aged between 15-49 years (inclusive).

Table 2: Descriptive Statistics of Mining, Agricultural, and Environmental Factors

	Mean	SD	Min	Max	N
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 $\times$ Gold price	0.207	0.300	0	1.237	10,170
Crop suitable $\times$ Crop price	0.340	0.452	0	1.510	10,841
Industrial gold $\times$ 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$\times$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 3: Effects of Artisanal and Industrial Gold Mining on Broad Forms of Domestic Violence

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
Gold suitable × Gold price	-0.109***	-0.095**	-0.023	-0.045
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial gold mines × Gold price	0.131***	0.173***	0.018	0.050
	(0.049)	(0.059)	(0.051)	(0.062)
N	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes experienced			
Gold suitable × Gold price	-0.120***	-0.100**	-0.051	-0.029
	(0.043)	(0.043)	(0.031)	(0.039)
Industrial gold mines × Gold price	0.159***	0.174***	0.061	0.054
	(0.058)	(0.064)	(0.059)	(0.050)
N	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often experienced			
Gold suitable × Gold price	-0.009	-0.011	0.010	-0.022
	(0.029)	(0.025)	(0.018)	(0.028)
Industrial gold mines × Gold price	-0.089*	-0.076	-0.064*	-0.006
	(0.052)	(0.053)	(0.036)	(0.042)
N	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 forms of intimate partner violence. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence 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 urban/rural status 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 4: Effects of Artisanal and Industrial Gold Mining on Detailed Forms of Domestic Violence

	Dependent variable: A dummy variable for domestic violence									
	Less severe physical violence				Severe physical violence			Sexual violence		
	(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 experienced									
Gold suitable × Gold price	-0.006	-0.081**	-0.063*	0.021	-0.013	-0.010	-0.026	-0.059	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	0.015	0.142***	0.037	0.202*	0.093	-0.020	-0.033	0.081	0.028	0.144***
	(0.055)	(0.055)	(0.043)	(0.109)	(0.073)	(0.046)	(0.033)	(0.059)	(0.053)	(0.053)
N	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 experienced									
Gold suitable × Gold price	-0.046	-0.096**	-0.088***	-0.007	-0.031	-0.016	-0.032*	-0.037	0.065**	-0.052
	(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	0.015	0.134**	-0.006	0.204*	0.187**	-0.017	0.008	0.083*	0.010	0.048
	(0.046)	(0.061)	(0.036)	(0.112)	(0.082)	(0.043)	(0.031)	(0.045)	(0.038)	(0.041)
N	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 experienced									
Gold suitable × Gold price	0.018	-0.078**	0.001	0.029	0.005	0.001	-0.005	-0.049*	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	-0.034	-0.085	-0.005	0.080	-0.120**	-0.029	-0.051*	0.007	0.029	0.102**
	(0.036)	(0.079)	(0.031)	(0.059)	(0.056)	(0.024)	(0.027)	(0.036)	(0.040)	(0.044)
N	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 forms of intimate partner violence. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced detailed forms of domestic violence in the last twelve months. In Columns (1)-(10), the domestic violence 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 the baseline demographic and environmental controls and fixed effects. 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 5: Effects on Broad Forms of Domestic Violence using Gold Suitability Dummy

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
Gold suitable dummy × Gold price	-0.113***	-0.096***	0.018	-0.037
	(0.028)	(0.030)	(0.025)	(0.030)
N	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes experienced			
Gold suitable dummy × Gold price	-0.092***	-0.094***	0.010	-0.020
	(0.032)	(0.034)	(0.023)	(0.024)
N	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often experienced			
Gold suitable dummy × Gold price	-0.027	-0.021	0.006	-0.032
	(0.021)	(0.019)	(0.013)	(0.022)
N	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 forms of intimate partner violence. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence are considered in Columns (1)-(4), respectively. The key explanatory variable is an interaction of the gold suitability dummy with the one-year lagged gold price index. All regressions include the baseline demographic and environmental controls and fixed effects. 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 on Broad Forms of Domestic Violence using Alternative Gold Prices

	Dependent variable: A dummy variable for domestic violence							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Overall violence		Less severe physical violence		Severe physical violence		Sexual violence	
	Panel A. Ever experienced							
Gold suitable × Log price	-0.072**		-0.067**		-0.015		-0.025	
	(0.028)		(0.029)		(0.026)		(0.035)	
Gold suitable × Current price		-0.111**		-0.118**		-0.006		-0.022
		(0.048)		(0.049)		(0.045)		(0.059)
N	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 experienced							
Gold suitable × Log price	-0.079**		-0.070**		-0.037		-0.010	
	(0.032)		(0.032)		(0.023)		(0.029)	
Gold suitable × Current price		-0.099*		-0.101*		-0.041		0.002
		(0.054)		(0.055)		(0.042)		(0.049)
N	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 experienced							
Gold suitable × Log price	-0.007		-0.013		0.010		-0.017	
	(0.022)		(0.019)		(0.014)		(0.024)	
Gold suitable × Current price		-0.025		-0.033		0.018		-0.023
		(0.039)		(0.033)		(0.025)		(0.041)
N	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 forms of intimate partner violence. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence 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 one-year lagged gold price (odd-numbered columns) or current price index at the survey year (even-numbered columns). All regressions include the baseline demographic and environmental controls and fixed effects. 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 on Broad Forms of Domestic Violence using Baseline Status of Industrial Gold Mining

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
Gold suitable × Gold price	-0.108***	-0.094**	-0.024	-0.044
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial gold mines × Gold price	0.127**	0.173***	0.045	0.037
	(0.051)	(0.060)	(0.053)	(0.066)
N	69954	69951	69943	69936
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes experienced			
Gold suitable × Gold price	-0.120***	-0.100**	-0.051	-0.029
	(0.043)	(0.043)	(0.031)	(0.039)
Industrial gold mines × Gold price	0.163***	0.179***	0.084	0.042
	(0.060)	(0.065)	(0.062)	(0.053)
N	69777	68242	69442	68631
R^2	0.21	0.17	0.14	0.12
	Panel C. Often experienced			
Gold suitable × Gold price	-0.009	-0.011	0.009	-0.022
	(0.029)	(0.025)	(0.018)	(0.028)
Industrial gold mines × Gold price	-0.098*	-0.080	-0.058	-0.007
	(0.052)	(0.054)	(0.038)	(0.044)
N	69804	67671	69214	67482
R^2	0.20	0.21	0.09	0.11

Notes: The table presents the OLS estimates on the effects of artisanal and industrial gold mining on overall and different forms of intimate partner violence. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence are considered in Columns (1)-(4), respectively. The key explanatory variable is our baseline continuous measure of gold suitability interacted with the lagged value of the international gold price. The measure of industrial gold mining is represented by an interaction between an indicator variable, indicating if the cell hosts an industrial gold mine in the initial period, and the lagged gold price. All regressions include the baseline demographic and environmental controls and fixed effects. 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 8: Effects on Broad Forms of Domestic Violence Controlling for Industrial Mineral Mining

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
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)
N	70276	70273	70265	70258
R^2	0.18	0.17	0.13	0.13
	Panel B. Sometimes experienced			
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)
N	70099	68552	69762	68950
R^2	0.21	0.17	0.14	0.12
	Panel C. Often experienced			
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)
N	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 forms of intimate partner violence. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence 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). All regressions include the baseline demographic and environmental controls and fixed effects. 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 9: Effects on Broad Forms of Domestic Violence Controlling for Temperature-Induced Push Factor

	Dependent variable: Domestic violence ever experienced			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
Gold suitable × Gold price	-0.113***	-0.087**	-0.030	-0.050
	(0.040)	(0.041)	(0.035)	(0.045)
Gold suitable × Temperature	-0.023	0.050	-0.041	-0.029
	(0.043)	(0.048)	(0.040)	(0.045)
Temperature	-0.020	-0.069	-0.048	0.031
	(0.038)	(0.042)	(0.033)	(0.041)
N	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13

Notes: The table presents the OLS estimates on the heterogeneous temperature effects of artisanal gold mining on overall and different forms of intimate partner violence. The dependent variables are dummy variables if a woman ever experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence are considered in Columns (1)-(4), respectively. The key explanatory variable is an interaction of the gold suitability share with the log of the one-year lagged gold price index and the interaction between gold suitability share and average annual temperature. All regressions include the baseline demographic and environmental controls and fixed effects. 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 10: Effects on Broad Forms of Domestic Violence Controlling for Husband's Characteristics

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
Gold suitable × Gold price	-0.123***	-0.100**	-0.034	-0.054
	(0.041)	(0.043)	(0.038)	(0.046)
N	57686	57684	57677	57672
R^2	0.16	0.16	0.14	0.14
	Panel B. Sometimes experienced			
Gold suitable × Gold price	-0.113**	-0.085*	-0.046	-0.030
	(0.045)	(0.045)	(0.035)	(0.041)
N	57574	56456	57371	56656
R^2	0.20	0.17	0.15	0.13
	Panel C. Often experienced			
Gold suitable × Gold price	-0.013	-0.010	0.013	-0.021
	(0.032)	(0.028)	(0.017)	(0.029)
N	57577	55801	57112	55607
R^2	0.21	0.23	0.09	0.12

Notes: The table presents results from OLS regressions checking the robustness of the baseline results on the effects of ASgM on overall and different forms of intimate partner violence by controlling for husband's characteristics. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence are considered in Columns (1)-(4), respectively. The key explanatory variable is our baseline measure of ASgM (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 demographic and environmental controls and fixed effects in addition to husband's age and education level. 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 11: Effects on Broad Forms of Domestic Violence Excluding Current Marital Status

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
Gold suitable × Gold price	-0.112***	-0.096**	-0.023	-0.046
	(0.038)	(0.038)	(0.034)	(0.045)
N	69990	69987	69979	69972
R^2	0.16	0.16	0.12	0.13
	Panel B. Sometimes experienced			
Gold suitable × Gold price	-0.124***	-0.103**	-0.052*	-0.031
	(0.043)	(0.043)	(0.031)	(0.038)
N	69813	68275	69478	68665
R^2	0.18	0.16	0.13	0.12
	Panel C. Often experienced			
Gold suitable × Gold price	-0.009	-0.010	0.010	-0.022
	(0.029)	(0.026)	(0.018)	(0.028)
N	69840	67703	69250	67516
R^2	0.19	0.20	0.09	0.11

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different forms of intimate partner violence using the same specifications in Table 3, except that the woman's current marital status is excluded from the covariates. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence 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). All regressions include the baseline demographic variables, except for current marital status, as well as environmental controls and fixed effects. 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: Heterogeneous Effects on Broad Forms of Domestic Violence by 3G Coverage

	Dependent variable: A dummy variable for domestic violence			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
	Panel A. Ever experienced			
Gold suitable × Gold price × 3G	-0.744**	-0.771**	-0.208	-0.373*
	(0.297)	(0.307)	(0.238)	(0.216)
Gold suitable × Gold price	-0.077*	-0.050	-0.053	-0.047
	(0.040)	(0.040)	(0.037)	(0.055)
N	69990	69987	69979	69972
R^2	0.18	0.17	0.12	0.13
	Panel B. Sometimes experienced			
Gold suitable × Gold price × 3G	-0.517	-0.550*	0.064	-0.342*
	(0.324)	(0.327)	(0.181)	(0.200)
Gold suitable × Gold price	-0.074*	-0.039	-0.072**	-0.014
	(0.044)	(0.045)	(0.034)	(0.047)
N	69813	68275	69478	68665
R^2	0.21	0.17	0.14	0.12
	Panel C. Often experienced			
Gold suitable × Gold price × 3G	-0.407**	-0.269*	-0.198	-0.220*
	(0.181)	(0.158)	(0.131)	(0.112)
Gold suitable × Gold price	-0.016	-0.013	0.010	-0.028
	(0.034)	(0.030)	(0.021)	(0.035)
N	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 forms of intimate partner violence heterogeneous by 3G coverage. The dependent variables are dummy variables if a woman ever (Panel A), sometimes (Panel B), and often (Panel C) experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence are considered in Columns (1)-(4), respectively. The key explanatory variable is a triple interaction between the proportion of the cell's surface suitable for gold, the lagged value of the international gold price, and the lagged dummy for a cell with 3G coverage. All regressions include the double interaction terms, baseline individual and household characteristics, cell-level covariates, and fixed effects. 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 on Women's Intrahousehold Bargaining Power Outcomes

	(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	0.053***	0.070***	0.013	0.063***	0.053**	0.094***	0.095***	0.035	-0.012
× Gold price	(0.016)	(0.019)	(0.017)	(0.023)	(0.022)	(0.035)	(0.026)	(0.039)	(0.038)
N	618830	611155	291523	606803	611011	245800	610991	146505	467840
R^2	0.36	0.34	0.12	0.28	0.27	0.29	0.24	0.19	0.28

Notes: The table presents the effects of artisanal gold mining on women's intrahousehold bargaining 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 one-year lagged gold price index. All regressions include the baseline demographic and environmental controls and fixed effects. 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 14: 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	-0.003	0.023***	-0.023	-0.026**	0.030
	(0.005)	(0.007)	(0.016)	(0.011)	(0.019)
Industrial gold mines × Gold price	0.007	0.009	-0.049*	-0.007	0.031
	(0.010)	(0.013)	(0.027)	(0.014)	(0.023)
N	721271	571404	700555	693798	693798
R^2	0.09	0.08	0.43	0.12	0.19
	Panel B. Male				
Gold suitable × Gold price	-0.004	0.011**	-0.028**	-0.020**	0.002
	(0.004)	(0.005)	(0.014)	(0.009)	(0.010)
Industrial gold mines × Gold price	0.012	0.003	-0.041	0.005	0.016
	(0.011)	(0.009)	(0.027)	(0.012)	(0.014)
N	689874	547190	670454	655202	655202
R^2	0.08	0.08	0.37	0.08	0.09
	Panel C. Female				
Gold suitable × Gold price	-0.016	0.022***	-0.034*	-0.016	0.039*
	(0.019)	(0.006)	(0.020)	(0.011)	(0.021)
Industrial gold mines × Gold price	-0.006	0.010	-0.049	-0.014	0.030
	(0.033)	(0.012)	(0.039)	(0.016)	(0.034)
N	716031	420407	504699	505505	505505
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 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 twelve 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 the baseline demographic and environmental controls and fixed effects. 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 15: Effects of Artisanal Gold Mining on Household Wealth

	Dependent variable: Household wealth index, standardized				
	(1)	(2)	(3)	(4)	(5)
Gold suitable × Gold price (lag 1)	0.097**				0.092**
	(0.045)				(0.045)
Gold suitable × Log price		0.072**			
		(0.031)			
Gold suitable × Current price			0.101**		
			(0.049)		
Gold suitable dummy × Gold price				0.074**	
				(0.033)	
Industrial gold mines × Gold price	0.120**	0.117**	0.121**	0.117*	
	(0.060)	(0.059)	(0.060)	(0.062)	
Industrial mining × Mineral price					0.140***
					(0.050)
Crop suitable × Crop price	-0.018	-0.018	-0.017	-0.021	-0.017
	(0.040)	(0.041)	(0.041)	(0.039)	(0.040)
Temperature	-0.168***	-0.169***	-0.168***	-0.169***	-0.168***
	(0.038)	(0.037)	(0.037)	(0.037)	(0.037)
N	553028	553027	553037	553022	555207
R^2	0.63	0.63	0.63	0.63	0.63

Notes: The table presents the effects of artisanal gold mining on household wealth 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 one-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 the baseline demographic and environmental controls and fixed effects. 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 16: Effects of Artisanal Gold Mining on Household Wealth with and without Alternative Industrial Gold Mining Status

	Dependent variable: Household wealth index, standardized		
	(1)	(2)	(3)
Gold suitable × Gold price	0.096**	0.096**	0.095**
	(0.045)	(0.045)	(0.045)
Industrial gold mines (initial missing = missing) × Gold price	0.101		
	(0.074)		
Industrial gold mines (initial missing = zero) × Gold price		0.100	
		(0.074)	
Crop suitable × Crop price	-0.017	-0.017	-0.018
	(0.041)	(0.041)	(0.041)
Temperature	-0.169***	-0.169***	-0.169***
	(0.037)	(0.037)	(0.037)
N	552629	553018	555210
R^2	0.63	0.63	0.63

Notes: The table presents the effects of artisanal gold mining on household wealth using OLS regressions under different specifications with alternative measures of ISgM (Columns (1) and (2)) and without the ISgM measure (Column (3)). The dependent variable is the standardized household wealth index. The key explanatory variable is our baseline continuous measure of gold suitability interacted with the lagged value of the international gold price. In Column (1), the measure of industrial gold mining is an interaction between an indicator variable, indicating if the cell hosted an industrial gold mine in the initial period, and the lagged gold price. If the ISgM status is missing in the initial period, we treat it as missing in Column (1). In Column (2), we treat the missing ISgM status in the initial period as zero. In Column (3), we drop the ISgM measure. All regressions include the baseline demographic and environmental controls and fixed effects. 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: Effects on Broad Forms of Domestic Violence (Household Wealth Controlled)

	Dependent variable: Domestic violence ever experienced			
	(1) Overall violence	(2) Less severe physical violence	(3) Severe physical violence	(4) Sexual violence
Gold suitable × Gold price	-0.107***	-0.092**	-0.022	-0.044
	(0.039)	(0.039)	(0.034)	(0.045)
Industrial gold mines × Gold price	0.129***	0.171***	0.017	0.049
	(0.048)	(0.058)	(0.051)	(0.062)
Household wealth	-0.027***	-0.031***	-0.016***	-0.018***
	(0.003)	(0.003)	(0.003)	(0.003)
N	69990	69987	69979	69972
R^2	0.18	0.17	0.13	0.13

Notes: The table presents the OLS estimates on the effects of artisanal gold mining on overall and different forms of intimate partner violence. The dependent variables are dummy variables if a woman ever experienced broad forms of domestic violence in the last twelve months. Experiences of overall, less severe physical, severe physical, and sexual violence 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 the baseline demographic and environmental controls and fixed effects in addition to the household wealth index. 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: Effects of ASgM on Individual and Household Characteristics

	Dependent variable: Observable characteristics							
	(1) Married	(2) Living together	(3) Widowed	(4) Divorced	(5) Separated	(6) Age	(7) Non-mover	(8) HH size
Gold suitable	0.009	-0.021	0.004	-0.004	0.012***	-0.161	-0.017	-0.016
× Gold price	(0.016)	(0.015)	(0.003)	(0.003)	(0.004)	(0.181)	(0.032)	(0.019)
N	733098	733098	733098	733098	733098	745481	456427	745481
R^2	0.20	0.25	0.05	0.04	0.05	0.07	0.19	0.24

Notes: The table presents the effects of artisanal gold mining on observable characteristics of the full DHS sample using OLS regressions. Non-movers (Column (7)) 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 only household characteristic is urban/rural status. 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: Effects of ASgM on Migration

	(1) 0 year	(2) 1 year	(3) 2 years	(4) 3 years	(5) 4 years
Gold suitable × Gold price	0.008	0.005	0.003	-0.002	-0.004
	(0.005)	(0.008)	(0.010)	(0.012)	(0.014)
N	733098	733098	733098	733098	733098
R^2	0.06	0.10	0.14	0.17	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 only household characteristic is urban/rural status. 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: Effects of ASgM on Alcohol Drinking

	(1)	(2)	(3)	(4)
	Panel A. Husband or partner's drinking status			
Gold suitable × Gold price	-0.016	-0.020	0.015	0.016
	(0.022)	(0.023)	(0.024)	(0.023)
Industrial gold mines × Gold price	-0.055	-0.080	-0.032	-0.063*
	(0.057)	(0.050)	(0.033)	(0.035)
N	235324	235324	235324	235324
R^2	0.23	0.23	0.23	0.26
	Panel B. Woman's drinking status			
Gold suitable × Gold price	-0.064*	-0.064*	-0.063*	-0.063*
	(0.034)	(0.034)	(0.034)	(0.033)
Industrial gold mines × Gold price	0.240***	0.240***	0.237***	0.253***
	(0.021)	(0.021)	(0.021)	(0.036)
N	60941	60941	60941	60941
R^2	0.29	0.29	0.29	0.30
Cell FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	No	No
Country FE	No	Yes	No	No
Country × Year FE	No	No	Yes	Yes
Controls	No	No	No	Yes

Notes: The table presents the effects of artisanal and industrial gold mining on husband or partner's (Panel A) and woman's (Panel B) alcohol-drinking status using OLS regressions. 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 controls include the woman's age, education level, current marital status, religion, urban/rural status, household size, 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 21: Effects of ASgM on Fertility Decisions

	Dependent variable: Number of children		
	(1) Total ever born	(2) Living children	(3) Under-5 children
Gold suitable × Gold price	-0.005	0.010	-0.021
	(0.053)	(0.044)	(0.030)
Industrial gold mines × Gold price	-0.170**	-0.098	0.025
	(0.082)	(0.076)	(0.038)
N	733098	733098	733098
R^2	0.56	0.51	0.57

Notes: The table presents the effects of artisanal and industrial gold mining on fertility decisions or the number of children using OLS regressions. The fertility outcomes include the total number of children ever born (Column (1)), the number of living children (Column (2)), and the number of under-five children (Column (3)). The key explanatory variable is the 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 controls and fixed effects. The unit of observation is the woman. Standard errors clustered by cells are in parentheses. Significance: *$p < 0.10$, **$p < 0.05$, and ***$p < 0.01$.