

Extractive Industries and Gender Equality

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Introduction

A key issue raised in the economic development literature is the linkage between economic growth and inequality, including gender inequality. Correlational analyses indicate that low- and middle-income countries tend to have less gender equality on average (Jayachandran 2015); this raises the important question of whether economic development leads to gender equality or gender equality spurs economic development. However, to date, empirical evidence on the direction and magnitude of these linkages is very limited.

Extractive industries—mining, oil, and natural gas—offer the opportunity to explore the effects of the structural transformation of economies (i.e., the reallocation of economic activity across different sectors in the economy) on gender inequality through quasi-natural experiments. This is because natural resource industries are largely determined by random geological endowments (Eggert 2002), which arguably makes them exogenous to local labor markets. This contrasts with endogenously determined industries such as manufacturing, which depend on local labor conditions. Extractive industries also provide important opportunities for economic development in low- and middle-income countries. Among the top 40 countries in which minerals constitute the highest-value export sector, 35 percent are low- or lower-middle-income economies (Dietsche et al. 2013). Moreover, about 80 percent of natural resource-dependent countries have a per capita income that is below the global average (Cameron and Stanley 2017).

The issue of the gender effects of extractive industries is timely. First, although the economics field has emphasized the natural resource curse (e.g., Sachs and Warner 2001; van der Ploeg 2011), there has been little research on the gender-specific impacts of extractive industries. For example, a recent review of the local economic impacts of natural resource

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extraction (Cust and Poelhekke 2015) mentioned “gender” only once and cited only one study that explores effects on “women.” In fact, the majority of economics research papers on extractive industries have implicitly assumed that the industry is gender neutral or that gender-related impacts are negligible or of second-order importance. In contrast, there is one review that discusses the qualitative literature on gender and extractive industries (Gamu, Le Billon, and Spiegel 2015).

Second, although the policy world has long been interested in the gender-related impacts of these industries, policy documents have generally tended to make dystopian predictions for women (Eftimie, Heller, and Strongman 2009; African Mining Vision 2011), suggesting that because of extractive industries, women will suffer from exclusion from labor markets, decreased household bargaining power, and a larger environmental burden relative to men. Thus, an empirical analysis on the topic of the gender-related impacts of extractive industries could help to inform policy debates about extractive industries worldwide and especially in developing countries.

This article seeks to fill this gap. We conduct an empirical analysis of correlational relationships between natural resource dependence and indicators of gender equality. We also conduct a review of the empirical literature on extractive industries and gender, which includes 35 published studies that cover a time period of more than 150 years across developing and developed countries. We find that countries that are highly dependent on natural resource rent tend to exhibit higher levels of gender inequality, lower levels of absolute female welfare, and more conservative attitudes toward women. Our review of the literature suggests that extractive industries have highly gender-specific impacts on labor markets, health outcomes, gender-based violence, and political participation that are a “mixed blessing” for women. However, the literature also suggests that these impacts are highly context specific. We conclude with a discussion of the limitations of the literature and suggestions for future research.

Exploring Correlations between Extractive Industries and Gender-Related Outcomes

In this section, we empirically examine (in a broad sense) how natural resource dependence impacts gender equality and women’s human development. We regress several measures of gender inequality on countries where natural resource rents are highest relative to GDP. We also explore the role of resource rents in education, maternal mortality, female labor force participation, and GDP per capita. We first present cross-country correlations of extractive industries and gender equality and then present several measures of absolute female welfare and gender norms.¹ It is important to emphasize that the results and relationships presented here are correlational, not causal.

¹To shed light on the causal links between natural resource extraction and gender outcomes, we present a theoretical framework in figure A1. Further details concerning our conceptual framework can be found in the online appendix.

Natural Resource Rents and Gender Inequality

Using several composite indexes measuring gender inequality,² we find that countries in which natural resource rents (from oil, natural gas, coal, minerals, and forests) account for a greater share of GDP have higher levels of gender inequality and lower levels of absolute female welfare (in terms of female reproductive health, political participation, and economic status). These countries are concentrated in Africa and the Middle East. In fact, sub-Saharan Africa accounts for 62 percent of the countries that are most dependent on resource rents, a finding that is correlated with higher levels of gender inequality. This correlation between natural resource dependence and gender inequality is driven partly by level of economic development because such countries generally have smaller and less diversified economies (Ross 2019). Our analysis also indicates that countries with higher GDP per capita have lower resource rents and lower levels of gender inequality (as measured by UNDP's GII). We find that a higher share of resource rents as a share of GDP is associated with lower parity between men and women (as measured by UNDP's GDI) and higher gender inequality (GII); it is also negatively associated with the HDI for men.³

Natural Resource Rents and Education, Maternal Health, and Gender Norms

Natural resource dependence is negatively correlated with secondary education for both men and women. In particular, resource-rich countries in sub-Saharan Africa have the lowest share of women with postsecondary education and the highest maternal mortality rates, and they are among the countries with the lowest GDP per capita.⁴

When we control for GDP per capita, natural resource rents (as a share of GDP) are positively correlated with maternal mortality and negatively correlated with education for both men and women. We also find that regional and cultural factors, including gender norms, may be important determinants of these relationships. Exploring one dimension of gender norms (attitudes toward domestic violence) in countries with higher levels of resource rents, we find that respondents are more likely to agree that domestic violence is justified.⁵ However, these findings should be interpreted with caution because of the small sample size (24 low- and middle-income countries located primarily in sub-Saharan Africa).

Recognizing that there are variations in female labor force participation among countries with high resource dependence (e.g., sub-Saharan Africa and the Middle East and North Africa),⁶ we also explore gender attitudes toward women's work. Respondents in resource-rich countries tend to agree more with the following statements: when jobs are scarce, men should

²We measure gender inequality using three indexes from the UN Development Program (UNDP): the human development index (HDI), which measures health, knowledge, and living standards; the gender development index (GDI), which measures the disparities between women and men in terms of the HDI; and the gender inequality index (GII), which measures gender inequalities in health, empowerment, and labor force participation.

³See table A1. The regression analysis uses several different specifications. We control for region fixed effects in panel B and institutional quality and rule of law in panel C. Including these controls reduces some of these effects.

⁴These results are presented in the scatterplots in figure A2, where each country is an observation.

⁵These results are shown in table A1.

⁶See figure A2.

have more of a right to a job than women; men make better business executives than women; and, on the whole, men make better political leaders than women.⁷ There are large regional differences, with agreement highest in the Middle East and North Africa region (77 percent), followed by sub-Saharan Africa (62 percent), and lowest in the Americas (23 percent).

Empirical Literature on the Gender-Related Impacts of Extractive Industries

With this background on correlations between countries' dependence on natural resources and gender-related outcomes, in the next four sections we review the empirical literature. Our review examines more than 30 studies that cover the time period from 1850 to today and include data from all continents. The industries analyzed include oil, large-scale and artisanal small-scale mining, and natural gas. The literature can be divided into four distinct topics related to extractive industries and women: (1) labor markets, (2) health, (3) gender-based violence, and (4) female political participation.⁸

Extractive Industries and Labor Markets

We begin our review by exploring research on the intersection of extractive industries and labor markets, focusing on how extractive booms at the macrolevel have clear gender implications. We then examine how these broad shifts trickle down to affect local labor markets and intrahousehold dynamics. Finally, we discuss how these shifts in labor markets affect migration, marriage, and fertility.

The Macroeconomy, Gender Segregation, and Labor Markets

Macroeconomic models often consider extractive industry–induced structural changes to be gender neutral (or they simply do not discuss gender implications), even though it is well known that there is gender segregation in labor markets.⁹ Indeed, where men and women occupy different roles in the economy, structural changes and increased specialization affect men and women differently.

Economies experiencing new wealth created from extractive resource booms often show signs of “Dutch disease”: the real exchange rate appreciates, and the economy shifts away from the traded sector (e.g., manufacturing and agriculture) and toward the nontraded sector (e.g., services and construction).¹⁰ The presence of occupational segregation in the labor

⁷See figure B2 in the online appendix for details.

⁸See table A2 for an overview of these studies.

⁹The existence of gender segregation in labor markets is rooted in three interconnected theories (Anker 1997). First, systematic gender differences in human capital lead to differential productivity and wages. Second, segmentation of the labor market creates barriers to switching between primary (i.e., extractive) and secondary (i.e., manufacturing) sectors. Third, social norms provide noneconomic explanations for the occupational segregation observed and the differential accumulation of human capital.

¹⁰With increased natural resource revenue, a country's currency appreciates. This means that exports become more expensive for other countries to buy and imports become cheaper, making those sectors less competitive. Additionally, with new wealth, demand for nontradable goods will increase, which draws labor away from the traded sector.

market and household production means that resource-induced structural transformation and Dutch disease symptoms affect men and women differently (Frederiksen 2007).

Ross (2008) illustrates this theory in the context of oil-rich economies. In his model, oil production shifts the national economy away from the female-dominated secondary sector (manufacturing) to the primary sector (extractives) and the nontraded sector. As the manufacturing sector declines due to exchange rate appreciation, declining demand for female labor reduces the prevailing female wage, and thus the supply of female labor decreases. Simultaneously, male wages and government transfers from the rising natural resource rents boost total household income and increase women's reservation wage—the wage at which a woman finds it worthwhile to join the labor force. Together, these mechanisms reduce the supply of and demand for female labor. Ross (2008) finds empirical support for this theory. Simmons (2016) finds that more egalitarian gender norms offset some of the effect that oil wealth has on female labor force participation, thus confirming some of Ross's findings.

Local Labor Markets

The literature also examines how this extractive industry-induced transformation leads to gender-specific impacts at the local level. For example, using household data, Kotsadam and Tolonen (2016) analyze how the opening and closing of 874 large-scale mines in sub-Saharan Africa over the course of 3 decades affected female labor force participation. They find that large-scale mining causes women to switch from the agriculture to the service sector or out of the labor force altogether and that the drop in agricultural activity among women is larger than the increase in their employment in other sectors. They also find that the service sectors that generate welfare benefits for women, such as increased cash and work opportunities that are less bound by agricultural seasons (e.g., preharvest, harvest, and postharvest seasons), suffer once the mines close down production. These results suggest that large-scale mining creates a mixed blessing for women whereby some positive labor market effects are offset by negative effects.

Aragón, Rud, and Toews (2018) also find evidence of a mixed blessing in a study that compares employment in districts close to coal mines (within 30 miles) with employment in districts farther away for more than 200 mines in the United Kingdom between 1981 and 2011. They find that coal mine closures increase the number of male manufacturing workers but decrease the share of women in manufacturing. Moreover, these outcomes are persistent, lasting for more than 20 years after most mine closures, suggesting that bust-related downturns have long-term consequences for the local economy and for women.

Sectors that can absorb female labor, including the service sector, may alleviate and even offset the potential negative side effects of extractive industry booms on women's work. For example, in a study of the southern United States between 1900 and 1940, Maurer and Potlogea (2021) compare oil-rich counties before and after the discovery of oil with counties that have no major oil deposits. They find that oil booms shift male labor from agriculture to other sectors and increase male wages. At the same time, female labor force participation increases, especially in services, driven by a stronger response from single women. This suggests that the service sector's absorption of women's labor may be particularly important in determining impacts on women in the wake of resource booms.

To summarize, there is evidence in the literature that women switch to the service sector or out of the labor force in response to oil or mining booms (Kotsadam and Tolonen 2016; Maurer and Potlogea 2021). According to Kotsadam and Tolonen (2016), such booms in sub-Saharan Africa have resulted in more than 90,000 women entering the service sector and more than 280,000 women leaving the labor force. Busts, in contrast, unambiguously lead to lower levels of labor force participation by women. Increased service sector employment is offset in the case of mine closures because women are inhibited from going back to agricultural production (Kotsadam and Tolonen 2016). For women who moved into manufacturing during mining booms, for every mine closure, there was a decrease of 0.78 percentage points in the share of female manufacturing workers (Aragón, Rud, and Toews 2018). This illustrates the importance of carefully analyzing the gender composition of the labor force during and after natural resource booms. Our conclusions also emphasize the potential for policy to strengthen job creation for women in the service sector during booms and to protect those jobs during busts.

Inequality at the Local and Household Level

The gender composition of the labor market also shapes economic inequality across households and between men and women. For example, evidence from different types of mines in sub-Saharan Africa indicates that mining operations increase food insecurity among women but not among men (Wegenast and Beck 2020). Women and migrant households may be more vulnerable to food insecurity because they are more likely to lack property rights, land access, community influence, and, in the case of women, access to direct mining employment. Evidence from Ghana shows that the inequality between migrant households and non-migrant households increases in the wake of industrial gold mining (Benshaul-Tolonen et al. 2019), although further disaggregation by gender is needed.

Increases in mining employment have been linked to rising income inequality among women in Australia. Analyzing areas with high levels of mining employment, Reeson, Measham, and Hosking (2012) find that income inequality rises with increases in mining activity and then decreases at medium to high levels of employment. However, when they disaggregate for women, they find that as mining employment increases, so does income inequality for all employed women, regardless of industry. The authors suggest that the gender difference in income equality is a function of male domination of the mining sector.

Integrating evidence on local labor dynamics with our understanding of the household, one might expect that a greater wage differential between men and women, combined with the decrease in female labor market participation, would lead to a reduction in the household bargaining power of women (e.g., African Mining Vision 2011). However, Benshaul-Tolonen (2018) finds that women report no decrease in their intrahousehold decision-making power in response to structural shifts induced by large-scale gold mining. Indeed, the prediction by African Mining Vision (2011) that women's intrahousehold bargaining power decreases is due to the assumption that male wages increase more than female wages in the wake of a natural resource boom. Using data on wages from Ghana, Benshaul-Tolonen (2018) finds that in response to active mining, female wages actually increase more in percentage terms than male wages. However, initial reported wage earnings among women are few because few women

earn wages and their mean earnings are lower; thus, these results should be interpreted with caution.

Demographic Changes and Marriage Markets

Given gender segregation, extractive industry–induced changes to local labor markets can also have implications for migration. For example, male populations grew faster in resource extraction–dependent areas during mining boom and bust periods in the United States (Ouedraogo 2016). Fracking booms in the United States have been found to drive short-term in- and out-migration of men who are often unmarried, young, and less educated than the general population (Wilson 2020).

Marriage markets are affected by extractive industries through migration and the gender ratio (there is an oversupply of men), with less educated men experiencing increased marriageability due to higher wages. In the case of the US gold rush, skewed gender ratios led to few marriage opportunities among men but higher marriage rates among women (Aguilar-Gomez and Benshaul-Tolonen 2018). Fertility rates, but not necessarily marriage, may respond to higher male earning. For example, during the US fracking booms of the late 2000s, both marital and nonmarital births increased, without a corresponding increase in the likelihood of marriage (Kearney and Wilson 2018). This result contrasts with findings that increased earnings from coal booms in the 1970s and 1980s increased both marriage rates and marital birth rates while decreasing the nonmarital birth rate (Black, McKinnish, and Sanders 2005).

Extractive Industries and Health

Extractive industries can affect the health of the population through several pathways, including gender. While some studies disaggregate health effects for men and women, authors generally do not address the mechanisms that underlie the disease differences between genders (e.g., Hurtig and San Sebastián 2002; Hendryx and Ahern 2008). In other cases, such as a study of mortality among South African gold miners, gender is implicit under the assumption that miners are predominantly male (Hnizdo and Sluis-Cremer 1991). In this section, we examine the literature on extractive industries and sexual, reproductive, and infant health. We begin by considering the health-wealth trade-off with respect to mining: health outcomes are influenced by the positive economic opportunities generated by extractive industries, which can also have negative impacts on the environment.

The Local Health-Wealth Trade-Off

The causal impact of extractive industries on human health in surrounding communities cannot be easily identified because of the health-wealth trade-off (i.e., while income may rise, pollution exposure and environmental burdens may also increase). In addition, the supply and demand of health services may change, especially through local fiscal spending,¹¹ corporate social responsibility programs, and pressure from inward migration.

¹¹The negative health effects related to pollution or exposure to heavy metals such as mercury may be mitigated by increased government spending on the provision of health services. However, it is unknown

Romero and Saavedra (2016) clearly illustrate the two competing mechanisms of wealth and health in a study of gold mining in Colombia, where some communities reap the benefits of higher incomes while others are burdened by environmental pollution. In particular, they find that newborns of mothers living within 20 km of different types of mines have a higher likelihood of being healthier than newborns of mothers living downstream from a mine, who may face higher contamination exposure.

The health-wealth trade-off is probably more likely to play out in the same community. In a study of 44 developing countries from 1986 to 2012, von der Goltz and Barnwal (2019) find that local asset wealth increases with large-scale mining but that there is a reduction in health. Specifically, the real economic benefits (i.e., the increases in asset wealth) generated in communities within 5 km of mines go hand in hand with an increased incidence of anemia, a common symptom of lead pollution, in adult women. They also find increases in stunted growth among children born within 5 km of mines that are associated with lead pollution.

There is clear evidence that the level of economic development affects the strength of observed health-wealth effects. In particular, the potential for health improvement from a positive income shock is much larger in a location characterized by high poverty-related mortality (e.g., due to malnutrition, diarrheal disease, and malaria). For example, Benshaul-Tolonen (2019) explores how large-scale gold mining affects the survival rates of infants in nine countries in sub-Saharan Africa that have high infant mortality rates—as high as 15 percent in some districts. She finds that the opening of large gold mines decreases mortality rates by 50 percent. However, the applicability of these findings to wealthier countries is unclear. For example, large-scale mining could have negative effects on infant health in areas where the marginal utility of income is lower.

Negative economic shocks due to mining can also affect human health. For example, sanctions on “conflict minerals” in the Democratic Republic of Congo (which caused production and exports to decrease dramatically) increased child mortality in mining villages by more than 143 percent as mothers experienced negative employment and income shocks (Parker, Foltz, and Elsea 2016). Similarly, community members living near a large-scale gold mine in Tanzania lamented the negative effect of the mine’s partial closure and transition of ownership on access to employment and health services (Rhee et al. 2018). Conflict related to mining can also have direct negative health impacts. For example, Dagnelie, De Luca, and Maystadt (2018) find that mining-related conflict in the Democratic Republic of Congo increased both fetal and infant mortality.

The net effect of the health-wealth effect likely depends on the initial health burden, income levels, and environmental regulation. In richer countries with strong environmental protection, there will likely be small or no deterioration in health among infants. In the poorest countries, income effects may outweigh the effect of pollution exposure because of the high marginal utility of income and the high poverty-related disease burden, generating short-term increases in infant health—unless the lack of environmental protection leads to disasters. The effects in middle-income countries are largely ambiguous.

whether spending on the health-care sector increases with revenue from the natural resources sector. Cockx and Francken (2014) identify a potential resource curse in terms of health-care spending using a panel data set from 1995–2009. They find a robust negative relationship between natural resource dependence and public health spending relative to GDP.

Impacts of Oil and Natural Gas on Reproductive and Infant Health

While much of the literature on extractive industries and gender-related health focuses on mining, a subset explores the effects of oil pollution and fracking on reproductive and infant health. These studies focus on oil spills and air pollution induced by fracking. For example, because of oil pollutants in river water, women living close to oil fields in the Ecuadorean Amazon Basin had a 2.34 times higher risk of miscarriage compared with women living farther away (San Sebastián, Armstrong, and Stephens 2002). Bruederle and Hodler (2019) find that oil spills in Nigeria have significant detrimental effects on infant mortality for mothers living less than 10 km away from the closest oil spill and that these effects are persistent. However, the authors do not find that oil spills that occur during a mother's pregnancy increase neonatal mortality.

Two studies find that fracking in the state of Pennsylvania had a similar effect on newborn health and birth weight. Hill (2018) analyzes the effect of the introduction of 2,459 shale gas wells between 2006 and 2010 on the health of infants born to mothers residing within 2.5 km of a fracking well compared with the health of infants born close to wells that had yet to be drilled. The author finds that drilling has adverse effects on infant health and concludes that the main issue is air pollution. Similarly, Currie, Greenstone, and Meckel (2017) analyze more than 1.1 million births between 2004 and 2013 and conclude that adverse health effects are localized, occurring within 3 km of a well site, with mothers living within 1 km of a well experiencing a 25 percent increase in the probability of giving birth to an infant with a low birth weight (less than 2,500 g).

Synthesis: Health-Wealth Trade-Off of Extractive Industries

With respect to reproductive health, the local health-wealth trade-off is most apparent in the mining literature, where studies find decreases in infant mortality of 50 percent (Benshaul-Tolonen 2019) and better health at birth (Romero and Saavedra 2016). At the same time, communities in close proximity to—or downstream of—mining sites associated with lead contamination experience a 3–10-percentage-point increase in anemia among women, a 5-percentage-point increase in child stunting (von der Goltz and Barnwal 2019), and a 0.45-percentage-point increase in poor health at birth (Romero and Saavedra 2016). Proximity also remains a key determinant of reproductive health impacts from oil and natural gas that are driven by water and air pollution (Currie, Greenstone, and Meckel 2017; Hill 2018; Bruederle and Hodler 2019). Extrapolating to births within close proximity to active fracking sites in the United States, Currie, Greenstone, and Meckel (2017) estimate that nearly 29,000 births could be at risk of poor health outcomes. These results suggest that geography, such as proximity to extractive industry sites and waterways, can be used to predict clusters of poor health outcomes and thus can inform the design of policies to offset negative health outcomes.

Mining and Sexual Health

Much of the literature on extractive industries and sexual health focuses on HIV, which has been found to be more prevalent near large-scale mining sites than in other locations (e.g.,

Desmond et al. 2005). Migration, which is a common and important feature of the mining industry, is generally considered a risk factor for HIV because both mining and migration generally result in frequent absence from family, a lack of social support, and difficult working and housing conditions (Weine and Kashuba 2012). Corno and de Walque (2012) compare how migration of male mine workers affects HIV prevalence in Eswatini and Lesotho, which have limited domestic mining and supply labor to the South African mines, and in Zimbabwe, which has a large domestic mining sector. They find that women in Eswatini and Lesotho who are partners of migrant mine laborers are 8 percentage points more likely to be HIV positive than women whose partners are not mine workers. They also find that male migrant mine workers in Eswatini and Lesotho aged 30–44 are 15 percentage points more likely to be HIV positive than other men. This finding is consistent with the hypothesis that being a male migrant worker—that is, away from home and the family—is a risk factor for HIV. The authors are not able to confirm whether miners and their partners are at higher risk than the population at large in Zimbabwe, where the mining industry is domestic.

Similarly, in a study of a mining community in northwestern Tanzania, Clift et al. (2003) find that female food and recreational facility workers are at particularly high risk of being HIV positive. These workers were found to be more likely to exhibit risky behavior (e.g., to have a higher number of sexual partners and more likely to report having received money or gifts for sex to supplement income) than other women. Men employed in the mines were likely to have a better understanding of HIV transmission than men in the surrounding community, although they were not more likely to report safer sexual behavior than women. This suggests that receiving information may not necessarily change behavior.

However, the findings concerning the impact of migration on sexual health behavior are mixed. For example, in a study in Zambia, Wilson (2012) finds reduced rates of risky sexual behavior (of up to 20 percent) during the copper mining boom in the early 2000s and that the reduction was actually greatest among migrant women and young adults living within 10 km of a mining town.

The results from the studies reviewed here are mixed. For instance, as we have discussed, male migrant mine workers and their partners are at higher risk of contracting HIV. On the other hand, while transactional sex is seen as a primary mechanism for high rates of HIV among this population, in some instances, mining booms actually reduce the supply of transactional sex when other economic opportunities improve for women in mining communities. These results highlight the need for inclusive job creation that can benefit women and thus reduce their economic vulnerability.

Extractive Industries and Conflict

Our understanding of the link between conflicts and gender-based violence is largely based on research from the Democratic Republic of Congo. For example, Rustad, Østby, and Nordas (2016) analyze whether armed conflict in eastern Democratic Republic of Congo has an effect on sexual violence in artisanal small-scale mining areas. In particular, they examine violence perpetrated by armed actors, as well as violence that is secondary to a mining culture that is both violent and masculine. They find that women living close to the mining sites have a

5-percentage-point higher risk of experiencing sexual violence from a nonpartner. However, living close to a mining site where there is also an armed actor present increases the risk of sexual violence from a nonpartner from 5.7 to 16.2 percentage points. These findings suggest that there is a clear link between mining and gender-based violence, both inside and outside the home.

Foltz and Sambo (2018) explore sanctions imposed through the US Dodd-Frank Act, which discouraged the sourcing of conflict minerals from eastern Democratic Republic of Congo. Their findings suggest that the sanctions had no significant effect on partner sexual violence but rather that the decreases in sexual violence were likely due to changes in local society that improved security.

The literature also reveals that while extractive industries, in particular artisanal small-scale mining, can spur violence against women (Rustad, Østby, and Nordas 2016), the sector also provides an opportunity for economic independence and empowerment for some women (e.g., Werthmann 2009). Thus, failing to account for the agency of women who voluntarily migrate to these communities, especially with policies aimed at excluding women from these industries, can actually further disempower them. Indeed, a few qualitative studies highlight the complexities of the link between violence and mining and caution against enacting policy responses to sexual violence that fail to consider women's involvement in extractive industries. For example, Werthmann (2009) notes that women in Burkina Faso view artisanal small-scale mining communities as providing economic and social independence and thus opportunities for female empowerment. Similarly, Maclin et al. (2017) find that two-thirds of female migrants in artisanal small-scale mining communities in the Democratic Republic of Congo attributed their decision to migrate to such communities to a lack of money and employment. Bashwira et al. (2014) note that to protect women from sexual violence and other forms of oppression, policy makers tend to take steps to encourage women to leave artisanal small-scale mining communities in countries like the Democratic Republic of Congo.

The literature on gender-based violence in nonconflict settings focuses mostly on intimate partner violence, but it is largely inconclusive regarding the determinants of such violence. Extractive industries may increase exposure to and acceptance of domestic violence; women's dependency increases when male wages rise. For instance, Jayasundara et al. (2016) suggest that one explanation for the significant rise in domestic and dating violence following a 2007 oil boom in the Bakken Region of the United States may be the increased financial dependency of women. Similarly, Kotsadam, Østby, and Rustad (2017) find that mine openings in 15 sub-Saharan African countries between 1999 and 2013 are associated with increased domestic violence in areas with higher general acceptance of abuse.

In contrast, Benschaul-Tolonen (2018) finds lower levels of acceptance of domestic violence among women in active gold mining communities in sub-Saharan Africa and suggests that this cultural change may be due in part to changes in women's earning potential as many women shift from agriculture to service sector employment. This change in gender norms also coincides with increased access to media, such as newspapers and radio, that discuss women's issues.

There have been only a small number of empirical analyses that have examined violence related to extractive industries other than mining (e.g., Couttenier, Grosjean, and Sangnier

2017; Axbard, Benshaul-Tolonen, and Poulsen 2019). Thus, more research is needed in this area.

Extractive Industries and Women's Political Participation

Preexisting gender norms may interact with natural resource abundance to affect outcomes such as women's political participation. In the first study that specifically links the natural resource curse and gender, Ross (2008) posits that oil wealth reduces women's labor force participation and, by extension, diminishes their political influence. His conclusions are based on the argument that the workforce acts as a mechanism through which the growing role of women in the economy forces the government to take their interests into account. Thus, as women are pushed out of labor markets, their political influence decreases. Similarly, Liou and Musgrave (2016) find that at the country level, oil rents are used to fund policies that restrict women's autonomy in order to maintain autocratic rule.

Simmons (2016) analyzes the state-level effects of mining in the United States from 1997 to 2012 and finds that resource wealth has a significant negative effect on women's political participation. More specifically, a 1 percent increase in per capita mining production decreases female labor force participation by 0.007 percentage points and decreases both female voter turnout and the number of female legislators by 0.01 percentage points. Simmons (2016) concludes that mining production and inegalitarian gender attitudes work together to suppress women's economic and political influence.

Doepke, Tertilt, and Voena (2012) find that when women acquire political rights as voters and policy makers, they tend to shift government expenditures toward health and children. This finding is supported by several case studies. For example, in Peru, women were found to be more likely to invest in social development programs, while men invested in infrastructure projects such as highways (Ward 2010). It has also been found that women often push for investments in health or education rather than new trucks or company buses (Keenan, Kemp, and Ramsay 2016). There is evidence that engaging women in decision-making can impact community development and gender relations. For example, company-community negotiations with the Ok Tedi Mine (a large copper, gold, and silver mine) in Papua New Guinea in 2007 involved women in community decision-making. When women were included in the negotiations, they ensured that 10 percent of compensation went to women, that cash transfers were paid to family accounts, and that there was gender equity in scholarship distribution (Menzies and Harley 2012). Moreover, these rights became legally enforceable. These results indicate that involving women in company-community negotiations can have a dramatic impact on women's welfare.

Summary and Conclusions

This article has examined the impact of extractive industries on gender equality. We have shown that natural resource-dependent countries tend to have higher levels of gender inequality and that this correlation persists when we control for the level of economic development. However, our analysis does not identify the causal pathways between natural

resource dependence and gender outcomes. To better understand the causal links, we reviewed the evidence in the literature on extractive industries and gender.

Although extractive industries affect economies at all levels, from the macroeconomy to local communities, only a small subset of the literature has begun to examine the gender-specific impacts of these industries. This literature indicates that the effects of extractive industries on women's income opportunities are mixed and depend on whether the employment generated in the service sector exceeds the potential crowding out of labor opportunities in agriculture or manufacturing. In the case of oil and mining booms, there is evidence that female labor force participation increases as women switch to the service sector or decreases as they exit the labor force altogether. Busts, in contrast, unambiguously lead to lower levels of labor force participation by women.

The literature also indicates that the labor market implications of resource wealth have implications for women's political influence, with increases in extractive industries being associated with decreases in both female labor market participation and female political participation. There is also evidence that resource shocks have implications for fertility, marriage, and migration.

We have presented an overview of two health channels—reproductive and sexual health—that are inherently gendered in nature. There is evidence suggesting that a health-wealth trade-off emerges because resource shocks can increase local income levels but also lead to environmental degradation. The evidence suggests that geographic proximity to extractive sites and generation of economic opportunities are key factors in determining health outcomes. Sexual health, on the other hand, is intricately linked to migration, which is often spurred during natural resource booms. Migration, in turn, is often associated with poorer sexual health. These findings suggest that policies aimed at improving the extractive industry sector's effect on human health should focus on reducing the environmental burden from both everyday low-level pollution and serious accidents while strengthening the local economic effects and increasing access to risk information.

The literature on extractive industries and gender equality has several limitations. First, while there is extensive qualitative literature on artisanal and small-scale mining, we identified only three papers (Parker, Foltz, and Elsea 2016; Rustad, Østby, and Nordas 2016; Foltz and Sambo 2018) that explicitly conduct quantitative analysis of this sector. The quantitative literature focuses mostly on industrial-scale production such as large-scale mining and giant oil fields. Second, the quantitative literature rarely identifies the specific causes of the gender-related effect identified in the data; this is because it is often very difficult to identify a specific causal mechanism when extractive industries result in changes to society at a macrolevel. For example, is poor health due to changes in access to health care, changes in household income, or changes in environmental pollution? Failing to pinpoint the exact causal mechanism impedes our understanding of which policies could be effective in harnessing these industries to improve women's welfare. Third, there has been limited research on the relationship between extractive industries and public spending, including how public spending impacts women (such as through welfare transfers), and the relationship between extractive industries and women's political participation.

Although research on the gender effects of natural resources has been limited, the existing literature clearly indicates that the effects of extractive industries are by no means gender

neutral. The literature suggests that extractive industries provide both opportunities for—and challenges to—gender-inclusive growth. However, our review of the literature suggests that extractive industries have been more of a mixed blessing for women’s welfare.

These findings also suggest several avenues for future research, including identifying ways to ensure that the benefits of extractive industries are accessible to women. In particular, program evaluations, which have thus far been completely lacking from the literature, could provide guidance about effective approaches for mitigating the undesirable gender-related impacts of the extractive industries sector. In addition, research is needed on the design of programs to promote the inclusion of women in local decision-making about extractive industries, encourage local corporate social responsibility policies aimed at generating economic opportunities for women, and implement health information campaigns to reduce pollution exposure. Such research would provide policy makers with the information they need to identify management practices and policies that would mitigate the negative effects of extractive industries on women while strengthening the potential positive effects (e.g., increased service sector employment) that have been identified in the literature.

Appendix

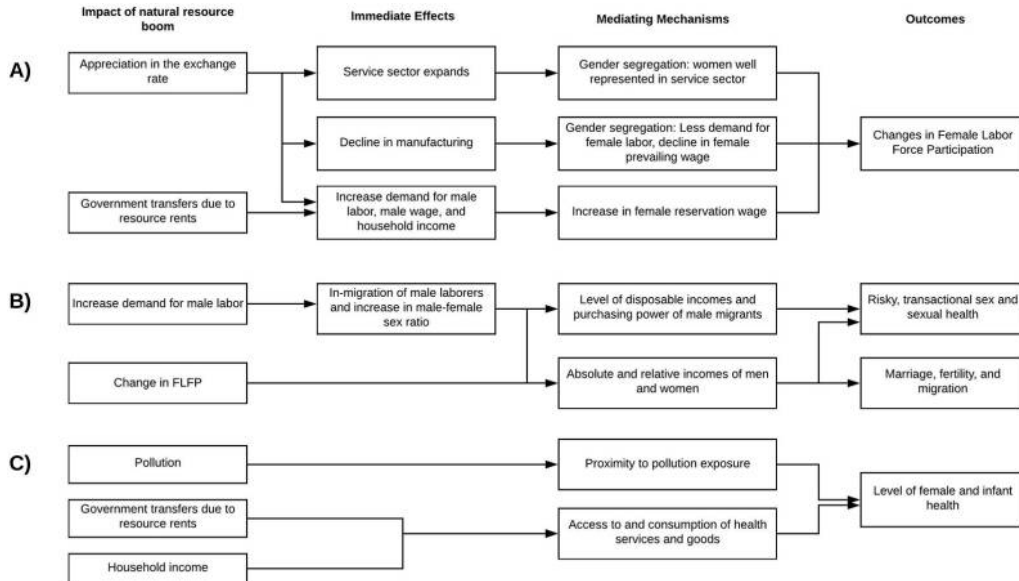


Figure A1 Theoretical framework: drivers and impacts of extractive industries on women. We present three channels through which natural resource booms can affect female outcomes: female labor force participation (FLFP; A), marriage markets and female reproductive health (B), and female and infant health (C). Mediating mechanisms affect the extent to which a natural resource boom and its immediate impacts affect each of the three outcomes. Source: The authors.

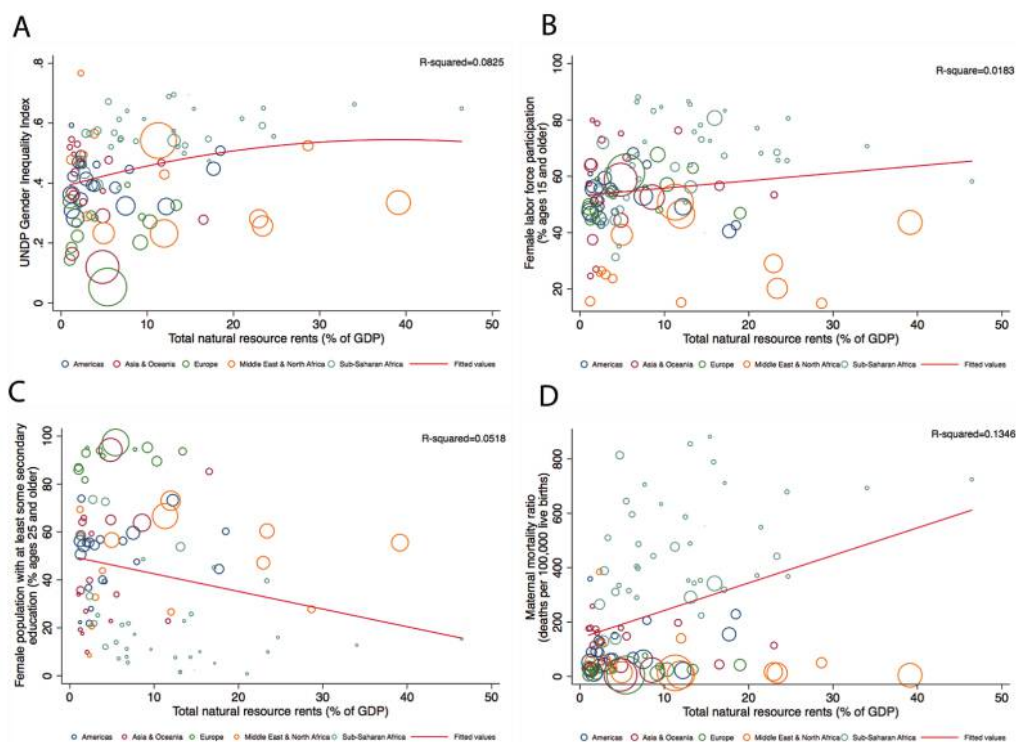


Figure A2 Correlations between natural resource dependence and gender inequality, female labor force participation, female education, and maternal mortality. Country's total natural resource rent as a share of GDP (2015) plotted against its UNDP gender inequality index (2015; A), female labor force participation (2015; B), share of female population with some secondary education (2015; C), and maternal mortality ratio (2014; D). Restricted to countries where natural resource rents make up at least 1 percent of a country's GDP. Each observation (circle) represents a country. The color reflects the region of that country, and its size reflects the country's total GDP per capita (US\$, 2015). Sources: International Labour Organization (2015; female labor force participation); UNDP (2015; gender inequality index); World Bank (2015a; total natural resource rents, female education).

Table A1 Regression results: natural resource rents and gender equality measures

	Female		Female		Female		Female		Female		Female		Female		Female		Female		Female	
	GDI	HDI	Male HDI	GII	labor force participation rate	Parliament seats held by women (%)	Maternal mortality ratio	Female education	Male education	Domestic violence justified										
Panel A																				
Total natural resource rents (% of GDP)	-0.003*** (0.001)	-0.009*** (0.002)	-0.008*** (0.002)	0.010*** (0.002)	0.383** (0.183)	-0.200** (0.087)	12.967*** (2.650)	-1.461*** (0.279)	-1.233*** (0.264)	0.011 (0.007)										
GDP (current US\$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Observations	153	153	153	152	168	178	171	153	153	22										
R ²	0.125	0.250	0.252	0.221	0.040	0.020	0.254	0.176	0.160	0.189										
Panel B																				
Total natural resource rents (% of GDP)	-0.003 (0.001)	-0.002* (0.001)	-0.002** (0.001)	0.002 (0.001)	0.275* (0.145)	-0.228** (0.103)	4.506** (1.813)	-0.215 (0.225)	-0.074 (0.193)	0.0136* (0.007)										
GDP (current US\$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Observations	153	153	153	152	168	178	171	153	153	22										
R ²	0.390	0.634	0.657	0.628	0.420	0.138	0.675	0.571	0.600	0.257										
Panel C																				
Total natural resource rents (% of GDP)	0 (0.001)	-0.001 (0.001)	0 (0.001)	0.001 (0.001)	0.259* (0.151)	-0.128 (0.107)	2.182 (1.412)	0.186 (0.166)	0.257 (0.175)	0.014* (0.007)										
GDP (current US\$)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Institutional quality and rule of law	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes										
Observations	152	152	152	151	166	176	169	152	152	22										
R ²	0.613	0.909	0.908	0.844	0.483	0.297	0.797	0.73	0.706	0.449										

Note: Robust standard errors. GDP (current US\$) controls for country-level GDP. Region fixed effects include fixed effects for Africa, Asia, America, Europe, and the Middle East and North Africa. "Domestic violence justified" is an index variable ranging from 0 to 1 if the respondent agreed that "a husband is justified to beat his wife if she burns the food, argues with him, refuses sex, goes out without his permission, neglects the children" (Inglehart et al. 2014).

Source: Total natural resource rents: World Bank (2015c); GDI, HDI, and GII: UNDP (2015); female labor force participation rate: International Labour Organization (2015); parliament seats held by women: Inter-parliamentary Union (2015); institutional quality and rule of law: World Bank (2015b).

*p < 0.1.

**p < 0.05.

***p < 0.01.

Table A2 Summary of empirical literature on extractive industries and gender

Topic, reference	Sector	Region	Main result
Labor markets			
Aragón, Rud, and Toews 2018	Mining (coal)	United Kingdom	Mine closures reduced female labor force participation, especially in manufacturing
Benshaul-Tolonen 2018	Mining (gold)	Ghana	Women did not report decreases in intrahousehold decision-making power
Black, McKinnish, and Sanders 2005	Mining (coal)	United States	Booms increased marriage rates and marital birth rates and decreased nonmarital birth rates
Kearney and Wilson 2018	Fracking	United States	Fracking increased male earnings and fertility without increasing marriage rates
Kotsadam and Tolonen 2016	Mining (large-scale)	SSA	Women shifted from agriculture to services or out of workforce (<20 km)
Maurer and Potlogea 2021	Oil	United States	Increased employment of single women offset female labor force participation declines
Ouedraogo 2016	Mining (large-scale)	United States	Out-migration of women from mining communities
Reeson, Measham, and Hosking 2012	Mining (large-scale)	Australia	As mining activity increased, inequality in personal income among employed women increased
Ross 2008	Oil	Global	Reduced female labor force participation and subsequently reduced political participation
Wilson 2020	Fracking	United States	Inward migration of young, single, less educated males
Gender-based violence			
Benshaul-Tolonen 2018	Mining (gold)	SSA	Reduced female acceptance of domestic violence and improved access to services
Foltz and Sambo 2018	Mining (3TG)	DRC	Dodd-Frank sanctions on conflict did not decrease sexual violence against women in mining
Jayasundara et al. 2016	Oil	United States	Increase in dating and domestic violence (2009–2014) following 2007 oil boom
Kotsadam, Østby, and Rustad 2017	Mining (large-scale)	SSA	Effect of mining openings on domestic violence heterogeneous
Rustad, Østby, and Nordas 2016	Mining (ASM)	DRC	Proximity to mines and mines with armed actors increased sexual violence by intimate partners and nonpartners
Health			
Benshaul-Tolonen 2019	Mining (gold)	SSA	Infant mortality declined by up to 50% along with increase in night lights (<10 km)
Bruederle and Hodler 2019	Oil	Nigeria	Nearby oil spills before conception increased infant mortality
Clift et al. 2003	Mining (gold)	Tanzania	Female food and recreational workers had highest HIV prevalence compared with male mine workers and community members
Corno and de Walque 2012	Mining (large-scale)	SSA	Migrant mine workers infected female partners at home with HIV

Table A2 (Continued)

Topic, reference	Sector	Region	Main result
Currie, Greenstone, and Meckel 2017	Fracking	United States	25% increased incidence of low birth weights (<1 km)
Dagnelie, De Luca, and Maystadt 2018	Mining (3TG)	DRC	In utero exposure to conflict increased fetal mortality
Hill 2018	Shale gas	United States	Well drilling decreased birth weights and Apgar scores of children as a result of air pollution
Parker, Foltz, and Elsea 2016	Mining (3TG)	DRC	Sanctions on conflict minerals increased child mortality rates in mining villages
Romero and Saavedra 2016	Mining (gold)	Colombia	Likelihood of higher Apgar scores increased for infants born close to a mine (<20 km) compared with infants born downstream
San Sebastián, Armstrong, and Stephens 2002	Oil	Ecuador	Risk of spontaneous abortion was 2.34 times greater for women in communities surrounded by oil fields
von der Goltz and Barnwal 2019	Mining (large-scale)	Global	Increases in wealth of mining communities coincided with increases in anemia and stunting within 5 km of mine
Wilson 2012	Mining (copper)	Zambia	Women shifted away from high-risk behavior when their outside economic opportunities improved
Political participation			
Ross 2008	Oil	Global	Reduced female labor force participation resulted in reduced female political participation
Simmons 2016	Mining (large-scale)	United States	Decreased female labor force participation was compounded by inequalitarian gender attitudes that decreased political participation

Note: 3TG = tantalum, tin, tungsten, and gold; ASM = artisanal and small-scale mining; DRC = Democratic Republic of Congo; SSA = sub-Saharan Africa.

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