How Long Does a Gold Rush Last?

Evidence from Africa's Gold Price Cycle

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November 2026

Abstract

Artisanal gold mining spread across Africa as the gold price rose until 2012. How long does such a gold rush last? I exploit the interaction between geology suitable for artisanal gold mining and the rise, fall and second rise of the world gold price, using household surveys from 33 African countries and satellite data. In the eight countries surveyed on both sides of the 2012 peak, men in gold-suitable places leave farming as the price rises, by 16 percentage points at the peak, and return to it when the price falls, recovering 9.5 points. The return is faster per unit of the price than the departure, and when the price climbed past its earlier peak after 2019, far fewer men left farming than in the first boom. Forest loss rises with the price and stays high after the peak. Teenagers in gold-suitable places attend school less after the boom, but completed schooling shows no detectable loss, and part of the gain in household wealth is a move toward towns.

JEL codes: I25, J24, O13, O17, Q23, Q32.

Keywords: artisanal mining, gold, resource booms, structural change, deforestation, Africa.

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1 Introduction

Between 2000 and 2012, the world price of gold rose from $279 to $1,670 an ounce, and across Africa people moved into artisanal mining, a labour-intensive and largely informal activity on which 130 to 270 million people depend worldwide (Girard et al., 2025). Then the price fell. By 2015 it was 30 percent below its peak, and it stayed near that level until 2018, before rising again to a new record by 2024. What happened to the people the gold rush had drawn in, and to the places it had changed?

Recent work shows what the boom did to gold-suitable places: it cleared forest and raised household wealth (Girard et al., 2025), lowered school attendance among adolescents (Ghazarian and Khan, 2025), raised women's employment in mining and trade and reduced violence by their partners (Byambasuren and Nguyen, 2026), and created new small towns (Girard and Pignède, 2026). A full price cycle shows how long these changes last. Artisanal mining needs little more than labour and tools, so people can leave it as cheaply as they entered, and work should follow the price in both directions. Other changes need not reverse. Cleared forest does not regrow when miners leave, a teenager who leaves school for the pits may not go back when the pits close, and assets bought in the boom outlast it. Who bears each change also differs, because men, women and children enter the gold economy in different ways.

Two features of the setting make the question hard to answer. Most African countries keep no record of where artisanal mining happens, and few household surveys code mining separately. And through most of the years that recent papers study, the gold price rose steadily: its correlation with the calendar year over 1990 to 2018 is 0.83, so a differential trend in gold-suitable places would look like a response to the price. The fall after 2012 and the rise after 2019 separate the two, because a trend continues in one direction while a response to the price turns with it.

In this paper, I follow work, land use, schooling and household wealth in gold-suitable places through the full price cycle. Following Girard et al. (2025), I measure exposure by the share of each half-degree cell's land on geology suitable for artisanal gold mining, and I compare cells within the same country and year as the lagged world price moves. Geology predates the boom and no African mining area sets the world price, so the variation is plausibly exogenous. I compare the peak of 2012 to 2014 with the years of low prices that followed, in the eight countries surveyed on both sides of the peak, and the years of low prices with the second rise of 2019 to 2024.

I build the household data from the Demographic and Health Surveys: 166 surveys from 33 countries between 1986 and 2025, in which 1.6 million women, 0.7 million men and 1.6 million households are linked to their half-degree cell through the survey's cluster coordinates. The data include the men's own interviews, which record each man's occupation, the surveys fielded after 2018, household rosters with school attendance and completed schooling, the survey's wealth index and the birth histories of mothers.

Forest loss, night lights and the footprint of mines come from satellite data.

The findings follow the cycle. First, men's work leaves farming with the price and returns to it. Across all countries, farming in gold-suitable places falls as the price rises, by about 4 percentage points over the rise to the peak in a fully gold-suitable cell, and men and women leave it in equal measure. In the eight countries surveyed on both sides of the peak, men's farming is 16.1 points lower at the peak than before the boom, on a mean of 41, and it recovers 9.5 points when the price falls; their manual work, where most artisanal miners are recorded, rises by 5.6 points and gives up 4.9. The farming cycle holds in rural clusters alone and in cells surveyed in every window. It also holds with controls for urban residence, for industrial mines of other minerals at their own world prices and for armed conflict, and with standard errors that allow correlation across cells up to 500 kilometres apart. Women move into trade, which rises by 5.5 points and gives up 4.0, and the share of women in any work falls by 8 points at the peak, on a mean of 57.

Second, men return to farming faster than they left it, and the second rush draws far fewer of them out. Per unit of the price index, men's farming fell by 19 points on the way up and recovered by 41 on the way down, although the price after the peak stayed far above its level before the boom; in local currency, deflated by consumer prices, the gold price fell even less after the peak, and the gap between the departure and the return is larger still. The surveys of 2019 to 2024 interviewed people when the lagged price was 13 percent above its level in the peak surveys. Scaled by the response during the boom, men's farming in the ten countries surveyed in both later windows should have fallen by about 6 points; it rose by 2. Men's manual work did not move, which rules out the rise of about 9 points implied by the response after the peak but not the rise of about 2.5 points implied by the response during the boom. With a yearly price and a trend for gold-suitable cells, men's farming still responds to the price after 2019, but by about a third less per unit than before.

Third, the land does not recover. Forest loss rises with the price, and at the peak it is about 22 percent higher in a fully gold-suitable cell than in 2001 to 2005. It does not fall when the price drops, and in the second rise it grows by a further 6 percent. Year by year, forest loss follows the price beyond any common trend in gold-suitable land: with a linear trend for these cells, a unit rise in the price index still raises loss by about 19 percent. The further clearing lies away from the mines, in cells with no record of gold or artisanal mining and with no mine on a satellite map of mine footprints (Tang and Werner, 2023), and on a global map of the drivers of forest loss most of the extra clearing lies in pixels attributed to farming, shifting cultivation and logging.

Fourth, the boom leaves a longer trace on places than on work. Compared with children aged 6 to 11 in the same cell and survey, whom school closures or mercury would affect as well, teenagers aged 16 to 20 attend school 5.5 points less at the peak, on an attendance rate of 47 percent. Half of the gap remains after the peak and through

the second rise. Completed schooling shows no detectable loss: among adults aged 21 to 45, years of schooling do not fall with the price their cohort faced at ages 12 to 20, although the test cannot rule out the loss of about 0.2 years that the attendance gap implies. The wealth index rises by 0.29 standard deviations at the peak and keeps two thirds of the gain; in rural households the rise is 0.16, so part of it reflects a move toward towns. Night lights keep rising after the peak, and child mortality does not change on average and rises only in towns that predate the boom.

Before turning to the data, I note three limits of this evidence. First, the cycle in work rests on the eight countries surveyed on both sides of the peak. When inference treats each country as one cluster, only the fall in men's farming at the peak is statistically significant at the 5 percent level.[1] Dropping each country in turn leaves the recovery of men's farming between 7.9 and 10.6 points, and the five countries that enter both comparisons show the same cycle. Second, part of the cycle is common to whole regions or follows the timing of fieldwork. With region-by-year effects or with effects for the month of interview, men's farming still falls and recovers, but the fall in manual work and trade after the peak is small. When the suitability map is shifted at random across the continent, cycles in farming as large as the actual one appear in 5 to 7 percent of the shifted maps, and cycles in manual work and trade in 13 to 32 percent. Third, the surveys are repeated cross-sections, so the persistence in schooling and wealth describes places, and the wealth index ranks each household within its survey. Still, a full price cycle gives a test that a rising price cannot, of whether each change follows the price back down, and work, land and schooling answer it differently.

These results add to work on local resource booms. Large mines raise local incomes through their demand for inputs (Aragón and Rud, 2013) and move women from farming into services (Kotsadam and Tolonen, 2016), and Huang et al. (2026) find that higher mineral prices shift work from agriculture to services around mines worldwide. Evidence on what happens when a boom ends comes mainly from the United States, where wages and employment in oil and gas counties rise in booms and fall in busts (Allcott and Keniston, 2018), and incomes in the boomtowns of the American West fell below their earlier path once the boom ended (Jacobsen and Parker, 2016). I show that men's work in Africa's gold-suitable places leaves farming with the price and returns to it faster than it left, while forest clearing does not fall back, and that a later boom raised clearing without drawing men out of farming again.

The schooling results join work on how local labour demand shapes education. Export factories in Mexico raised school dropout (Atkin, 2016), the fracking boom in the United States reduced schooling among young men (Cascio and Narayan, 2022), and the US housing boom lowered college attendance in ways that persisted after the bust (Charles et al., 2018). Ghazarian and Khan (2025) show that the rise in the gold

[1] Standard errors are clustered by cell. With eight country clusters, the wild cluster bootstrap gives a p-value of 0.02 for the fall in men's farming at the peak and of 0.08 to 0.51 for the other statistics of the cycle.

price lowered school attendance among adolescents near gold-suitable land. I find that lower attendance in gold-suitable places outlasts the shift in work, since only half of the lost attendance returns when the price falls, while the completed schooling of the cohorts who were teenagers during the boom shows no detectable loss.

The closest papers use the same geology and the world gold price. Girard et al. (2025) show that the boom raised deforestation and household wealth, Byambasuren and Nguyen (2026) that it raised women's employment and reduced violence by their partners, and Girard and Pignède (2026) that it created small towns without structural change. In Ghana, Duodu and Danquah (2026) combine gold-bearing Birimian geology with the gold price and find that fully gold-suitable districts host 19 percent fewer formal firms. Bazillier and Girard (2020) compare the two kinds of mining in Burkina Faso and find that household consumption rises with the gold price near artisanal mines but not near industrial ones. Each studies a rising price. I follow the same places through the fall that followed the peak and the rise that followed the fall, and I find that work, land, schooling, wealth and health respond to the cycle on different clocks.

Section 2 describes artisanal mining and the price cycle. Sections 3 and 4 describe the data and the empirical strategy. Section 5 reports the results and Section 6 their robustness. Section 7 concludes.

2 Artisanal Gold and the Price Cycle

2.1 Artisanal Gold Mining in Africa

"Artisanal and small-scale mining refers to formal or informal mining operations with predominantly simplified forms of exploration, extraction, processing, and transportation" (OECD, cited in Girard et al., 2025). It employs an estimated 44.75 million people worldwide (World Bank, 2020), and in Africa its main mineral is gold (Girard et al., 2025). The tools are simple. Miners dig pits and shafts, or wash river gravel, with picks, shovels, pans and sluices, and they often separate the gold with mercury. Most miners work close to home, many in the dry season between harvests (Bazillier and Girard, 2020), and much of it without a licence.

Men do most of the digging. Women are a large share of the workforce, estimated at 40 to 50 percent of artisanal miners in Africa, and many work in processing, including amalgamation with mercury (Hinton et al., 2003). Adolescents work on sites as well, and school attendance near gold-suitable land falls when the gold price rises (Ghazarian and Khan, 2025). Few household surveys record this work under its own name. In the occupation codes of the Demographic and Health Surveys, most diggers appear as manual workers.

Industrial gold mines differ in scale and in their links to the local economy. In Burkina Faso in 2014, an estimated 640,800 people worked as gold diggers, while the in-

dustrial mining sector reported 6,464 employees (Bazillier and Girard, 2020). Industrial mines are capital-intensive projects licensed by the state, run by international companies with skilled employees on formal contracts, and they import most of their equipment (Bazillier and Girard, 2020); their local effects run mainly through their purchases of local inputs (Aragón and Rud, 2013). The two kinds of mining often sit on the same geology: of the 139 half-degree cells that ever host an industrial gold mine, 133 contain land suitable for artisanal mining.

Artisanal mining has also changed its technology. In Ghana, tens of thousands of Chinese miners arrived from the late 2000s (Hilson et al., 2014) and brought excavators and large wash plants to artisanal sites, which turned over far larger areas of land than digging by hand (Crawford and Botchwey, 2017). Where machines do the digging, a rise in the price can raise output and the land cleared without a matching rise in employment. The machines also drew the state in. In 2017 Ghana suspended small-scale mining, and soldiers sent to enforce the ban burned excavators at illegal sites (Hilson, 2017).

2.2 The Gold Price Cycle

After two decades of decline, the world price of gold stood at $279 an ounce in 2000. It rose from 2001, nearly tripled between 2005 and 2010 and peaked at an annual average of $1,670 in 2012. Then it fell. By 2015 it was 30 percent lower, at $1,161, a fall of 22 percent in real terms, and it stayed close to that level until 2018. The second rise began in 2019: the price reached $1,770 in 2020 and $2,388 in 2024, 43 percent above its 2012 level, or 37 percent in real terms (World Bank Pink Sheet).

Figure 1 shows the lagged price index that I use, with 2013 equal to one, and the five windows that organise the analysis. The index averages 0.23 in 2000 to 2005, the reference period; 1.10 at the peak, 2012 to 2014; 0.87 after the peak, 2015 to 2018; and 1.18 in the second rise, 2019 to 2024. The rise between 2006 and 2011 and the years before 2000 complete the path. African mining areas take the world price as given, and the geology that decides where artisanal gold can be mined predates the boom.

Household surveys cover the cycle unevenly (Figure 1, Panel B). Each country fields a survey only every four to six years, so only eight countries were surveyed both at the peak and after it: Benin, Chad, Guinea, Mali, Nigeria, Rwanda, Senegal and Zambia. Ten were surveyed both after the peak and in 2019 to 2024, five of them among the eight. The first group carries the comparison of the peak with the years after it; the second carries the comparison of those years with the second rise.

The setting suggests how each outcome should move over the cycle. Because artisanal mining needs little more than labour and tools, people can leave it as cheaply as they entered, and men's work should follow the price in both directions. Land cleared for pits does not regrow when miners leave, and assets bought during the boom outlast it. Where excavators replace diggers, a later rise in the price can raise output and the

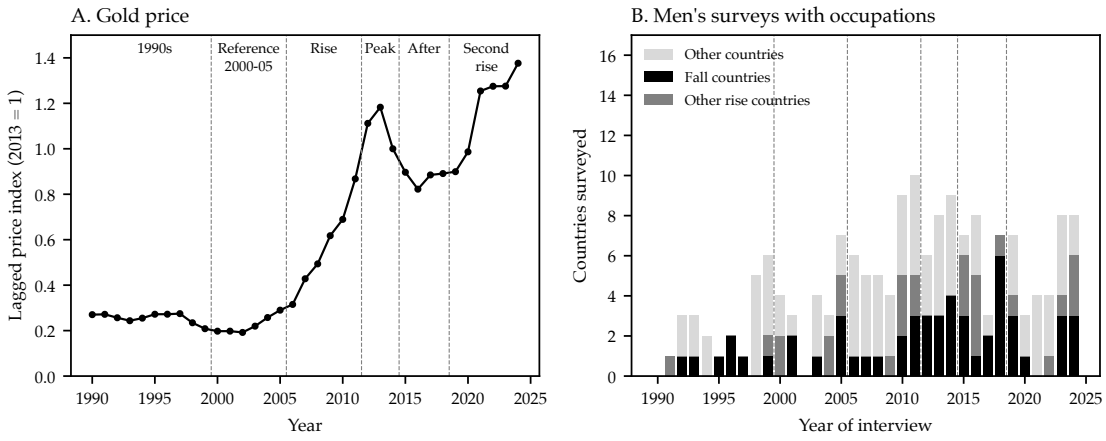


Figure 1—The gold price and the timing of the surveys

Notes: Panel A plots the gold price index lagged by one year (nominal, 2013 equal to one), with the windows used in Section 4. Panel B counts countries with a men's survey recording occupations in each interview year. Fall countries are the eight surveyed both at the peak and after it; other rise countries are those surveyed after the peak and in 2019 to 2024 that are not fall countries. Sources: World Bank Pink Sheet; Demographic and Health Surveys.

land cleared without drawing workers back. For teenagers, the boom raises the return to work against school; whether they return to school when the price falls depends on how hard it is to resume after leaving. Section 5 takes these outcomes in this order.

3 Data

I combine a map of geology suitable for artisanal gold mining, household surveys that I assemble and link to the map, and satellite data on forest loss. Appendix A describes the construction of each file.

3.1 Gold-Suitable Land

Most African countries keep no register of artisanal mines, and where a site opens may depend on local labour supply. Following Girard et al. (2025), I measure where artisanal gold could be mined. Their map classifies bedrock across Africa as suitable for artisanal gold mining by its age, chemistry and structure, and it marks about 18 percent of the continent (Figure 2, Panel A). For each of the 10,686 half-degree PRIO-GRID cells of the continent, I compute the share of its area on that bedrock. The share is positive in 4,514 cells, where it averages 0.43 (Panel B). Exposure is this share times the world gold price index lagged by one year: it is zero in a cell without suitable land in every year and rises with the price in a cell with it. The map captures where artisanal mining takes place. Other records of gold or artisanal gold mining, from exploration surveys, administrative and survey records of sites, mercury emissions and sites detected in satellite images, exist in 44 percent of cells with suitable land and in 8 percent of the

others (Panel C). On the satellite map of mine footprints of Tang and Werner (2023), a fully gold-suitable cell with no industrial gold mine is 5.4 percentage points more likely to contain a mine than a cell without suitable land, against an average of 2.7 percent, and the artisanal mercury emissions that Steenhuisen and Wilson (2019) allocate across space are higher there as well. Of the 139 cells that ever host an industrial gold mine, 133 also contain suitable land. Section 6 therefore adds an industrial-mine indicator times the same price index to the main cycle estimates.

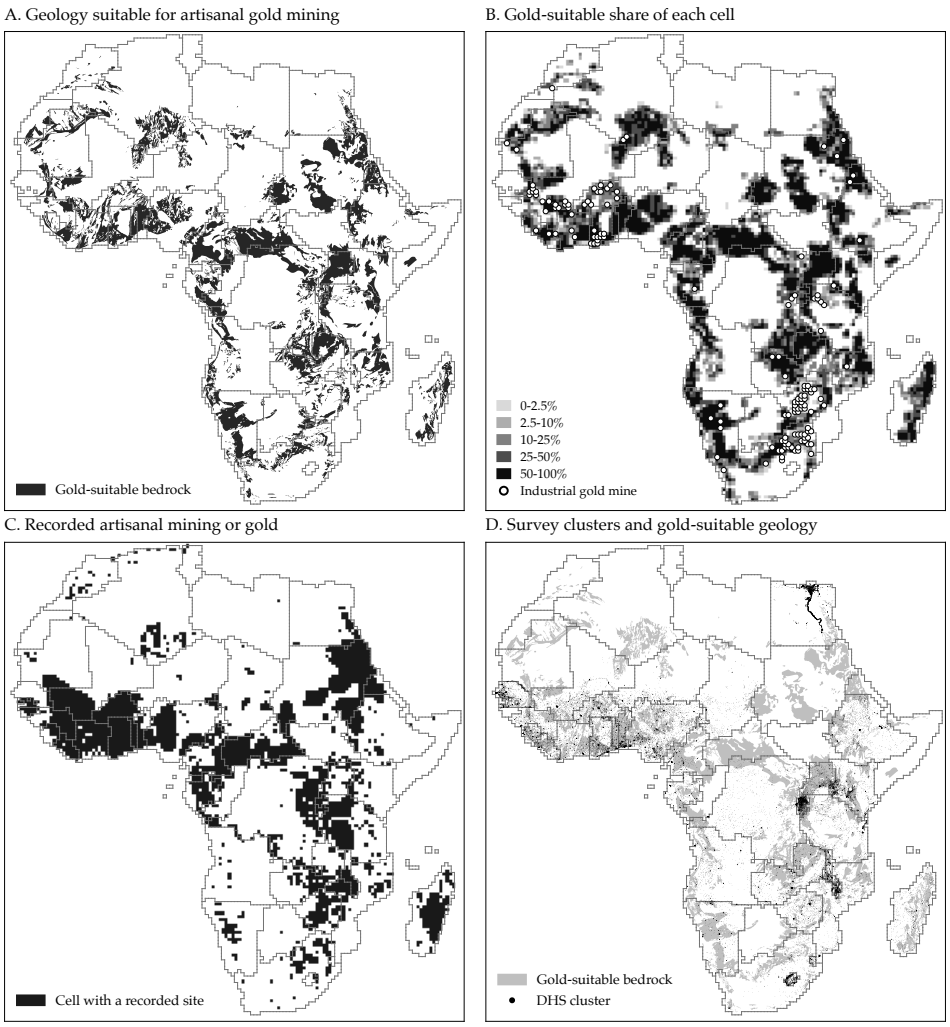


Figure 2—Where artisanal gold can be mined

Notes: Panel A maps the bedrock that Girard et al. (2025) classify as suitable for artisanal gold mining. Panel B shades each 0.5-degree cell by the share of its land on that bedrock, which is the exposure measure; white cells have none, and circles mark cells that ever host an industrial gold mine. Panel C marks cells with any other record of gold or artisanal gold mining in the data of Girard et al. (2025): exploration records, gold deposits, administrative and survey records of artisanal sites, mercury emissions and artisanal sites detected in satellite images. Such records exist in 44 percent of cells with gold-suitable land and in 8 percent of other cells. Panel D overlays the 65,746 survey clusters of the Demographic and Health Surveys used in the paper on the bedrock of Panel A; cluster coordinates are displaced by up to 5 kilometres in rural areas and, for a few, up to 10.

3.2 Household Surveys

The household data come from the Demographic and Health Surveys (ICF, 2025), which I assemble from the raw files of every standard survey in 33 African countries: 166 surveys fielded between 1986 and 2025. The surveys form repeated cross-sections, so I follow places over time. The 132 surveys that record the coordinates of their sampling clusters locate 65,746 clusters, and I assign each cluster to its half-degree cell (Figure 2, Panel D); 99 percent of interviewed people in these surveys are linked to a cell. To protect respondents, DHS displaces urban clusters by up to 2 kilometres and rural clusters by up to 5 kilometres, and a few by up to 10. Displacement adds noise to exposure without shifting it toward gold-suitable land, and 26 percent of clusters lie close enough to a cell edge to have crossed it. I flag them and drop them in Section 6.

Working from the raw files gives three things that the survey data of earlier studies lack: the men's interviews, in which each man reports his own occupation; the surveys fielded after 2018; and the household rosters, which record school attendance for every member.[2]

3.3 Outcomes

Work comes from the occupation each respondent reports, coded into the survey's standard groups. Each work and attendance outcome is an indicator equal to one if the person works in the sector or attends school, which I multiply by 100, so that coefficients are in percentage points. Manual work is skilled or unskilled manual work, where most artisanal miners are recorded, and agriculture includes farming on one's own account and as an employee. In the surveys whose detailed occupation codes name mining without pooling it with other trades, I also measure mining directly. For men, the outcomes are their own occupations: 664,621 men in 119 surveys from 32 countries. For women, I use their own occupation and whether they currently work, for 1.64 million women in 130 surveys, and the measure of Girard et al. (2025), which equals one if the woman or her partner works in the sector. School attendance is attendance at any time in the current school year, recorded for every member of the household. Household wealth is the survey's index of assets and housing, which DHS standardises within each survey; I compare it within surveys only, for 1.36 million households in 101 surveys from 2003. Table 1 reports the means of each outcome.

3.4 Forest Loss

Forest loss comes from Global Forest Change, version 1.12, which maps tree cover in 2000 and its loss in each year from 2001 to 2024 at a resolution of 30 metres (Hansen

[2]Ethiopian surveys before 2024 record dates in the Ethiopian calendar, which I convert to the Gregorian calendar. In six surveys more than 40 percent of couples have no sector recorded, and I treat their occupations as missing.

Table 1—Summary statistics

	All	Gold-suitable cells	Other cells
Panel A: Men, own occupation			
Gold-suitable share of cell	0.28	0.45	0.00
Manual work (%)	20.0	19.4	20.9
Agriculture (%)	39.1	41.4	35.5
Mining, named in occupation (%)	0.81	0.93	0.59
Age	30.9	30.8	31.1
Men	664,621	409,939	254,682
Surveys	119	115	112
Panel B: Women			
Currently working (%)	54.4	61.2	46.0
Agriculture, own occupation (%)	25.4	32.5	16.5
Manual work, own occupation (%)	7.2	8.0	6.4
Manual work, woman or partner (%)	20.7	19.5	22.3
Women	1,640,605	909,101	731,504
Surveys	130	126	123
Panel C: Children and households			
Attending school, ages 12–15 (%)	75.8	77.8	73.2
Attending school, ages 16–20 (%)	46.5	46.5	46.5
Children aged 12–20	1,454,629	804,361	650,268
Wealth index (within-survey z-score)	0.00	−0.04	0.06
Bottom two national wealth quintiles (%)	41.1	42.4	39.4
Households	1,361,516	796,054	565,462
Panel D: Cells with forest in 2000, 2001–2024			
Tree cover in 2000 (km^2)	1272	1413	1105
Forest loss (% of 2000 cover a year)	0.57	0.59	0.54
Cells	4,627	2,505	2,122

Notes: Means. Counts are respondents and households with the outcomes shown; Appendix Table A1 counts every interview linked to a cell. Gold-suitable cells have any land on the bedrock of Figure 2. Panels A to C are drawn from the 132 Demographic and Health Surveys with cluster coordinates, 1986 to 2025; the count of surveys differs by panel because not every survey has a men's file or records occupations. Occupations follow the survey's standard groups: manual is skilled and unskilled manual work, agriculture includes agricultural employees. Mining is the share of men whose survey-specific occupation names mining, quarrying or gold digging without pooling it with other trades, in the surveys that code it. The woman-or-partner measure follows Girard et al. (2025). Attendance is attendance at any time in the current school year. The wealth index is the survey's asset index, standardised within each survey. Forest loss is from Hansen Global Forest Change, version 1.12.

et al., 2013). I aggregate it to cells as the area of canopy above 30 percent in 2000 and the area of that forest lost each year, and I keep the 4,627 cells with at least one square kilometre of forest in 2000. Measured loss across Africa doubles between 2012 and 2014, in part because the product detects loss better from those years. Country-by-year effects absorb the common change, and Figure 5, Panel B, lets it differ with each cell's forest cover. Night lights come from the harmonised series of Li et al. (2020), which calibrates DMSP images for 1992 to 2013 and converts VIIRS images for 2014 to 2024 to the same scale; I average them over each cell.

Table 1 compares cells with and without gold-suitable land. Men in gold-suitable cells farm more (41 against 36 percent), and women there are more likely to work, mostly in agriculture (32.5 against 16.5 percent). Men name mining as their occupation in 0.9 percent of cases in gold-suitable cells and 0.6 percent elsewhere, a small share because most miners report another occupation. Attendance at ages 16 to 20 is the same in both groups, and wealth is slightly lower in gold-suitable cells. These are differences in levels, which cell fixed effects absorb; the design compares the same cells as the price moves.

4 Empirical Strategy

I compare cells within the same country and year that have more or less gold-suitable land, as the world price of gold moves. For person or household i in cell c, country k and year t, I estimate

$$Y_{ickt} = \beta \left(S_c \times P_{t-1} \right) + X'_{ickt}\gamma + \alpha_c + \lambda_{kt} + \varepsilon_{ickt}, \tag{1}$$

where S_c is the share of the cell on gold-suitable bedrock and P_{t-1} is the world gold price index in the year before the interview, with 2013 equal to one. The coefficient β measures how much more the outcome moves with the price in a fully gold-suitable cell than in a cell with no suitable land. Between 2000–05 and the peak of 2012–14, the index rose by 0.87, so 0.87β is the effect of the boom on a fully gold-suitable cell.

To follow the price through its cycle, I replace $S_c \times P_{t-1}$ with the suitable share interacted with indicators for the windows of Figure 1:

$$Y_{ickt} = \sum_{w \in \mathcal{W}} \beta_w \left(S_c \times \mathbf{1}[t \in w] \right) + X'_{ickt}\gamma + \alpha_c + \lambda_{kt} + \varepsilon_{ickt}, \tag{2}$$

where $\mathcal{W}$ contains the 1990s, the rise (2006 to 2011), the peak (2012 to 2014), the years after the peak (2015 to 2018) and the second rise (2019 to 2024), and 2000 to 2005 is the reference period. The reference is the trough of the price, when the lagged index averaged 0.23 and artisanal gold paid least, so each coefficient measures how far a phase of the cycle moved gold-suitable places from their position before the boom; the 1990s,

with fewer surveys and a slightly higher price, enter as a separate window. Each β_w is the change in the outcome in a fully gold-suitable cell between the reference period and window w. Three comparisons carry the results. The peak coefficient measures the boom. The difference between the coefficients after the peak and at the peak measures the response to the fall, estimated in the eight countries surveyed on both sides of the peak. The difference between the second rise and the years after the peak measures the response to the second rise, estimated in the ten countries surveyed in both windows. The 1990s coefficient shows whether gold-suitable cells were already moving apart from other cells before the price rose.

Cell effects α_c absorb every fixed difference between places, including the differences in levels in Table 1 and the direct effect of geology. Country-by-year effects λ_{kt} absorb national shocks and policies and the effect of the gold price on each national economy, so the main effect of the price is not identified and does not appear. The price enters with a lag because survey questions on work refer to the past year and because a change in the world price takes time to reach the price paid at a site. The controls X_{ickt} are age and its square for individuals and, following Girard et al. (2025), extreme temperature and the cell's suitability for its main cash crop times that crop's lagged world price. The two cell controls end in 2018, so estimates that use the surveys after 2018 omit them, and Section 6 reports the earlier estimates with and without them. Industrial gold mines sit on the same geology, in 133 of the 139 cells that host one, so β is the response of gold-suitable places as a whole, including any response of industrial mines there. I leave industrial mines out of equation (1) because some opened during the boom, so their presence partly responds to the price; Section 6 adds mines producing by 2000, and then every industrial mine, each interacted with the price.

The same equation applies to each outcome, with the unit adapted. For men's and women's own work and for school attendance, the unit is the person. For the measure that counts the woman's or her partner's work, I weight each woman by the inverse of the number of interviewed women in her household, so that each household counts once; co-wives would otherwise contribute the same husband's occupation several times. For wealth the unit is the household, and for forest loss it is the cell and year. I cluster standard errors by cell, the level at which exposure varies.[3]

Identification rests on one assumption: had the gold price not changed, outcomes in more and less gold-suitable cells of the same country would have followed the same trends. No African mining area sets the world price of gold, and the geology that decides where artisanal gold can be mined predates the boom, so neither side of the interaction responds to local conditions. The assumption could still fail if gold-suitable places were on different paths for other reasons. Because the price rose steadily for a decade, a differential trend would look like a response to the boom, which is why the

[3]The comparisons of the peak with the years after it rest on eight countries. For these, I also report p-values from a wild cluster bootstrap with country clusters, which enumerates all 2^8 sign patterns (Section 6).

results follow the price down after 2012 and up again after 2019: a trend continues in one direction, while a response to the price turns with it.

Surveys sample different people in each round, and a boom may change who lives in gold-suitable cells. Men report their own occupations, so changes in household structure do not move the men's results, and the results for teenagers compare them with younger children in the same cell and survey; Section 6 also re-estimates the cycle for respondents who have lived in the place for at least five years. Displacement of the survey coordinates places some clusters in the wrong cell, which biases the estimates toward zero, so Section 6 drops the clusters near a cell edge as well. Because the comparisons across the peak rest on eight countries, I report each result without each country in turn.

5 Results

5.1 Farming Follows the Price

In Table 2, I report the average effects of the gold price on work, from equation (1) in all countries with surveys up to 2018, for all adults and for men and women separately. As the price rises, people in gold-suitable places leave farming. Agriculture falls by 4.9 percentage points per unit of the price index (Panel A, column 4), or by about 4.3 points over the rise to the peak, 14 percent of its mean of 31, and men and women leave it in equal measure. They go to different work. Women move into sales, by 3.8 points per unit of the index on a mean of 17 (Panel C, column 5), while men's sales do not change and services fall slightly for both (column 6). Manual work rises for both, by about 1 point per unit of the index, but imprecisely.

These averages pool the boom with the decades before it, and they cannot show what happened when the price fell. In Figure 3, I therefore follow all adults, men and women through the windows of the price cycle in the eight countries surveyed both at the peak and after it, with the price in each window drawn behind the estimates; Appendix Table B1 reports the coefficients.

The shifts in occupation reverse when the price falls, and farming moves most. At the peak, adults in a fully gold-suitable cell farm 12.9 percentage points less than in 2000 to 2005, and more of them work in manual jobs (2.2 points) and in sales (4.5 points). After the peak, farming recovers 5.2 points, and manual work and sales give up 2.4 and 2.8 points, although the price after the peak stayed well above its level before the boom.

The average hides two paths. Men carry the swing between farming and manual work (Panels A and B). At the peak, their farming is 16.1 points lower on a mean of 40.8, and their manual work is 5.6 points higher, 29 percent of its mean of 19.0. Of all the cycle estimates, this fall in farming is the one that remains statistically significant at

Table 2—Artisanal gold and work: average effects

	Working (1)	Manual (2)	Extraction (3)	Agriculture (4)	Sales (5)	Services (6)
Panel A: All adults						
Suitable × lagged price	−1.32	1.05	0.29	−4.90***	2.98***	−0.95*
	(1.42)	(0.77)	(0.37)	(1.71)	(1.00)	(0.50)
Mean of outcome (%)	61.0	10.3	0.9	31.1	14.0	4.2
Observations	1,691,736	1,657,666	1,116,355	1,657,666	1,657,666	1,657,666
Panel B: Men						
Suitable × lagged price	−0.65	1.16	0.22	−5.04***	0.55	−0.61
	(1.73)	(1.11)	(0.63)	(1.91)	(0.73)	(0.59)
Mean of outcome (%)	77.3	18.4	1.9	41.2	7.6	5.2
Observations	474,271	475,389	344,150	475,389	475,389	475,389
Panel C: Women						
Suitable × lagged price	−1.43	1.40	0.53	−4.85**	3.84***	−1.06*
	(1.70)	(0.88)	(0.41)	(1.94)	(1.35)	(0.61)
Mean of outcome (%)	54.7	7.0	0.5	27.0	16.5	3.8
Observations	1,217,450	1,182,257	772,198	1,182,257	1,182,257	1,182,257

Notes: Each entry reports equation (1) for an indicator equal to 100 if the respondent's own occupation is in the sector and 0 otherwise, so that coefficients are in percentage points, in all countries with surveys up to 2018. The coefficient is the change in a fully gold-suitable cell, relative to a cell with no suitable land, as the lagged gold price index (2013 equal to one) rises by one; the index rose by 0.87 between 2000–05 and the peak, so 0.87 times a coefficient is the effect of the boom (divide by 100 for the units of Girard et al. (2025)). Panel A stacks the men's and women's interviews and controls for sex. Extraction is manual work whose occupation label names mining or quarrying, in the surveys whose labels code it. All regressions control for temperature, the crop-price index, age and age squared, with cell and country-by-year effects. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the 5 percent level when inference treats each of the eight countries as a single cluster.[4] After the peak, farming recovers 9.5 of its 16.1 points and manual work gives up 4.9 of its 5.6, so manual work is back near its level before the boom and farming has recovered more than half of its fall. The return is faster than the departure. The price index at the interview dates rose from 0.25 in 2000 to 2005 to 1.12 at the peak and fell only to 0.89 after it. Per unit of the index, men's farming therefore fell by 18.5 points during the boom and recovered by 40.7 after it, and their manual work rose by 6.4 points and fell by 20.8; both differences are statistically significant at the 5 percent level. A response proportional to the price would have left most of the boom's jobs in place after 2014. The contrast is larger in local currency. Converted at official exchange rates and deflated by consumer prices, the gold price fell after the peak in all eight countries but by less than the dollar price, and per unit of it men's farming fell by 22.2 points during the boom and recovered by 58.5 after it (Appendix Table B6, Panel E). Only part of the manual response is recorded as mining. In the seven countries whose occupation codes

[4]Wild cluster restricted bootstrap with country clusters, over all 256 Rademacher draws: $p = 0.02$ for men's farming at the peak and 0.12 for their manual work, and 0.16 and 0.18 for the recovery of farming and the fall of manual work after the peak.

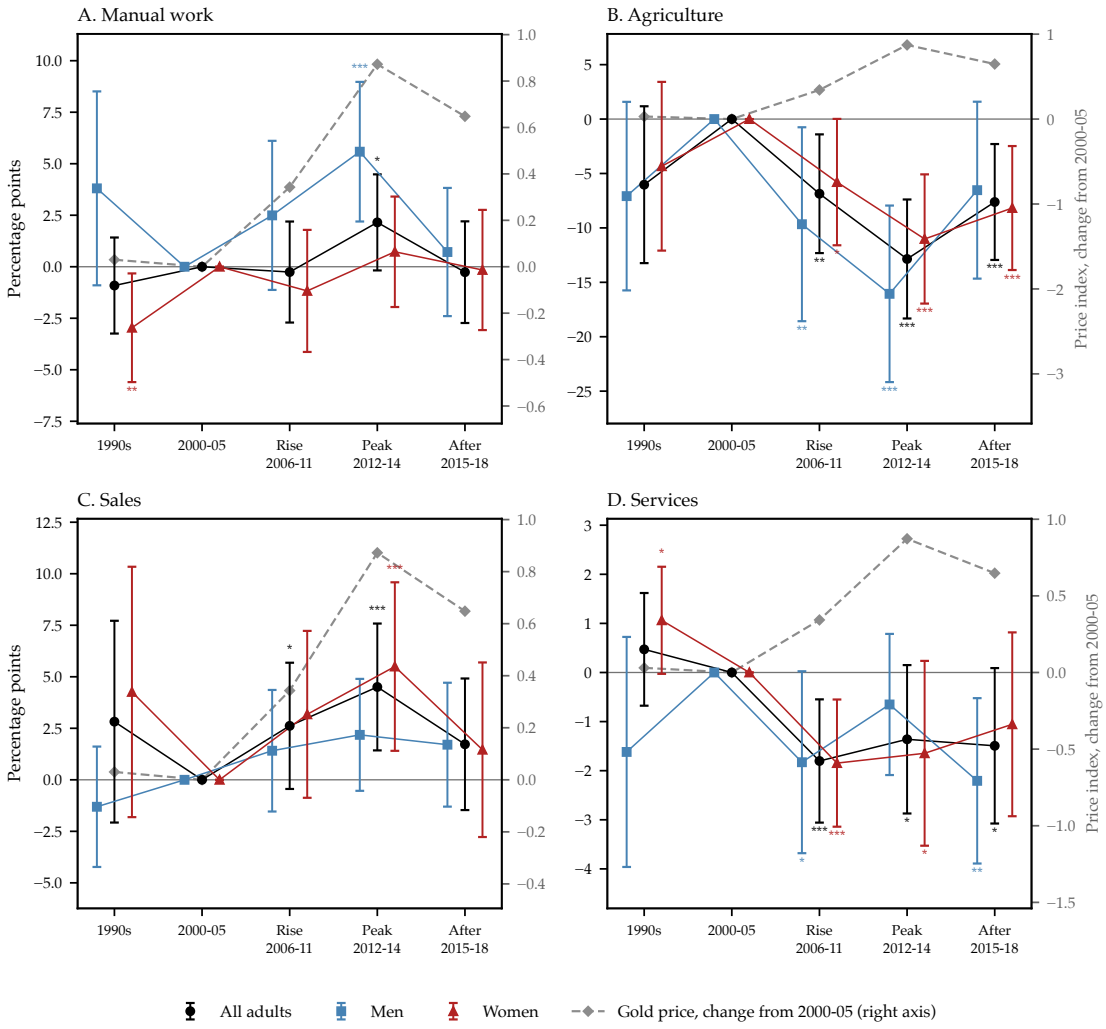


Figure 3—Work over the gold price cycle

Notes: Coefficients of equation (2) for manual work (Panel A), agriculture (Panel B), sales (Panel C) and services (Panel D), for all adults, men and women, each respondent's own occupation as an indicator equal to 100 or 0, so that coefficients are in percentage points, in the eight countries surveyed both at the peak and after it, surveys to 2018, relative to 2000 to 2005; Appendix Table B1 reports the estimates. The dashed line (right axis) is the mean lagged gold price index in each window minus its mean in 2000 to 2005, the trough of the price (2013 equal to one): 0.03 in the 1990s, 0.34 during the rise, 0.87 at the peak and 0.65 after it. Figure 4 reports the second rise. Controls and effects as in Appendix Table B1: temperature, the crop-price index, age and age squared (and sex for all adults), with cell and country-by-year effects. Data from the Demographic and Health Surveys (ICF, 2025). Bars are 95 percent confidence intervals from standard errors clustered by cell. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

name mining or quarrying, men's manual work rises by 6.9 points at the peak and falls by 5.3 after it, while extraction rises by 1.2 points on a mean of 1.3 (Appendix Table B1, column 3, and Appendix Table B6). Extraction nearly doubles, yet it is about a fifth of the manual response; the rest appears under other manual labels, consistent with diggers whom the surveys record as manual workers (Section 2).

Women follow a different path. They leave farming at the peak, by 11.0 points on a mean of 25, but the jobs they take are in sales (Panel C), up 5.5 points at the peak

and down 4.0 after it, and their manual work does not change. Services fall slightly for everyone during the boom (Panel D). Fewer women work at all: the share of women in any work is no different in the 1990s, falls by 7.5 points during the rise and by 8.1 points at the peak, 14 percent of its mean of 57, and recovers only 2.1 of those points after the peak, an estimate whose 95 percent interval reaches 5.9. I return to women's work in the second rise in Section 5.2.[5]

The 1990s coefficients are mostly imprecise. Farming in gold-suitable cells was 4 to 7 points lower than in 2000 to 2005, and women's manual work 3 points lower. In both halves of the decade the lagged price index was within 0.04 of its mean in 2000 to 2005, so I also split the 1990s into the surveys of 1990 to 1995 and those of 1996 to 1999.[6] None of the 12 estimates for all adults' farming and manual work, men's farming and manual work and women's sales and current work is statistically significant at the 5 percent level. In neither half of the decade was farming more than 3 points higher than in 2000 to 2005, so gold-suitable places were not already leaving farming before the price rose. Section 6 pools the 1990s with 2000 to 2005 as the reference. The responses to the fall compare the peak with the years after it, so they do not depend on the reference period.

The censuses do not show the move out of farming. In Online Appendix OA3, I estimate equation (1) on the IPUMS-International censuses of 13 countries. Men's employment in mining rises with the price, by 0.8 points per unit of the price index on a mean of 1.8, but the share of workers in agriculture rises too, by 2.8 points on a mean of 45, where the surveys show a fall. The two sources measure different things. No country has a census both at the peak and after it, so the censuses cannot follow the cycle, and their units are districts or regions, several times larger than a cell, in which gold-suitable land is a smaller share of where people live. I therefore treat the censuses as evidence that the mining response reaches official employment counts, and not as a test of the farming result.

5.2 The Second Rise Draws Fewer Men out of Farming

From 2019, the price rose again, and the surveys of 2019 to 2024 interviewed men at a higher price than the peak surveys did: the lagged index averaged 1.28 at their interview dates, against 1.13 at the peak and 0.88 in 2015 to 2018. Two benchmarks bound what this rise should have done. Scaled by the response during the boom, men's farming in a fully gold-suitable cell should have fallen by 6.2 points between the two

[5] Byambasuren and Nguyen (2026) find that women's employment in mining and in retail rises with the gold price. They measure employment by industry, for ever-married women and the husbands they report, while I measure each respondent's own occupation and current work; both patterns can hold if the women who keep working move toward mining and trade while others stop working.

[6] The early surveys are Nigeria 1990, Senegal 1992 and 1993 and Mali 1995; the late ones are Benin and Mali 1996, Senegal 1997 and Guinea 1999. Men's farming is 2.9 points higher in 1990 to 1995 and 8.7 points lower in 1996 to 1999 than in 2000 to 2005, and their manual work is 5.6 and 3.5 points higher.

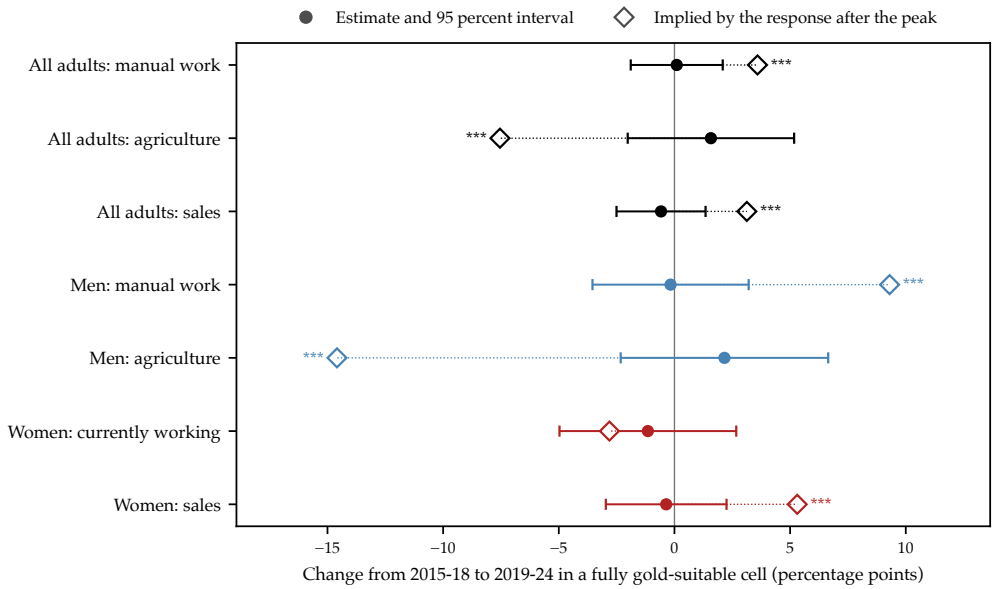


Figure 4—Work in the second rise of the gold price

Notes: Each row plots the difference between the 2019–24 and 2015–18 coefficients of equation (2) in a fully gold-suitable cell (filled circle, with its 95 percent confidence interval) and the change implied if the outcome had responded to the second rise as it responded to the peak (hollow diamond): the change from 2015–18 to the peak, scaled by the change in the mean lagged price index at the interview dates. Each respondent's own occupation, as an indicator equal to 100 or 0, in the ten countries surveyed both in 2015–18 and in 2019–24, surveys to 2024. Stars test the estimate against the implied change: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Appendix Table B2 reports the estimates. Standard errors clustered by cell.

windows and their manual work risen by 2.5; scaled by the steeper response after the peak, farming should have fallen by 14.6 points and manual work risen by 9.3.

In Figure 4, I plot the change from 2015–18 to 2019–24 in the ten countries surveyed in both windows, against the change that the response after the peak implies (Appendix Table B2 reports the estimates). Men's farming does not fall: it rises by 2.2 points, which excludes both benchmarks, the fall of 6.2 points as well as that of 14.6, at the 1 percent level, and also excludes the boom benchmark with the price deflated by US consumer prices. Men's manual work does not move either: the estimate is −0.2 points, and the 95 percent interval, from −3.5 to 3.2, rules out the rise of 9.3 points implied by the response after the peak but not the rise of 2.5 implied by the response during the boom. The estimate for manual work holds without the interviews of 2020 and 2021, when COVID-19 disrupted fieldwork, without any single country, and among men aged 15 to 24, who were children at the peak.[7] Women's trade does not return either. Had their sales responded as they did at the peak, they would have risen by 5.3 points; the estimate is −0.4, with an interval that ends at 2.3; among all adults, manual work and sales stay flat against implied rises of 3.6 and 3.1 points.

[7]The estimates are 0.3 points without 2020 and 2021, −1.2 among men aged 15 to 24, and between −1.1 and 0.8 when each of the ten countries is dropped in turn; the upper end of the 95 percent interval is at most 4.2 points in every case.

The fall and the second rise are measured in different countries, eight for the first and ten for the second, so the contrast could reflect which countries were surveyed. Five countries enter both groups: Mali, Nigeria, Rwanda, Senegal and Zambia. In these five alone, men's farming falls by 19.5 points at the peak and recovers 9.2 after it, men's manual work gives up 5.8 points after the peak, and women's sales give up 4.0. In the second rise, men's manual work changes by -1.0 points against an implied rise of 9.8, their farming by 3.6 against an implied fall of 14.7, and women's sales by 0.3 against an implied rise of 6.3. Men in the same countries returned to farming when the price fell and did not leave it again when the price rose.

Insecurity does not explain the weaker response. In Appendix Table B5, Panel B, I split the second rise by whether the cell had any armed conflict event in 2019 to 2024 (Sundberg and Melander, 2013). Men's manual work is flat in both groups, and in cells without conflict it changes by -1.0 points against an implied rise of 12.3. The only sign of a response is in the few cells with a mine on the satellite map of Tang and Werner (2023), which hold 6 percent of respondents: there, men's manual work rises by 9.1 points and their farming falls by 12.1, both imprecisely. In the gold-suitable cells away from mapped mines, the second rise left work unchanged.

Two further checks bound the result. In local currency, converted at official exchange rates and deflated by consumer prices, the response during the boom implies a fall in men's farming of 4.7 points over the second rise, which the estimate of 2.2 also excludes (Appendix Table B6, Panel E). The windows overstate the contrast, however. With the suitable share times the yearly lagged price, its interaction with the years from 2019 and a linear trend for gold-suitable cells, men's farming falls by 17.2 points per unit of the price index before 2019 and by 11.4 after it. The second rise drew men out of farming, but about a third less per unit of the price than the first.

5.3 The Land Does Not Recover

The land follows a different path from the jobs. In Figure 5, Panel A, I plot equation (2) for the area of forest lost each year in all 4,626 forested cells of the continent. During the rise, a fully gold-suitable cell loses about 7.5 percent more forest a year than in 2001 to 2005, and at the peak about 22 percent more. After the price falls, the excess barely changes. Clearing continues at its peak rate in the years when men return to farming, so the land cleared during the boom keeps growing. Panel B allows the improvement in satellite detection after 2012 to differ with each cell's forest cover. The coefficients are smaller, but the shape is the same: loss rises with the boom and does not fall after the peak.

In the second rise, clearing speeds up again. Forest loss in a fully gold-suitable cell grows by a further 6 percent between 2015–18 and 2019–24 (Panel A), and by 4 percent when detection is allowed to change with forest cover (Panel B); both differences are statistically significant at the 1 percent level. The change from the peak to 2015–18 is

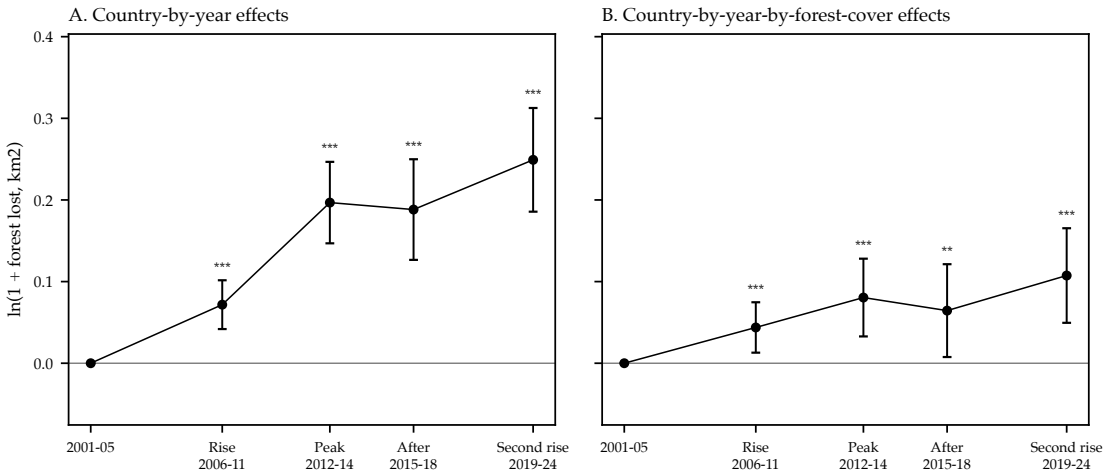


Figure 5—Forest loss over the gold price cycle

Notes: Coefficients of equation (2) for the logarithm of one plus the area of 2000 forest lost in the year (km^2), in the 4,626 African cells with at least 1 km^2 of forest in 2000, 2001 to 2024, relative to 2001 to 2005, the reference period of equation (2) from the first year of the forest data. Panel A uses cell and country-by-year effects; Panel B replaces the country-by-year effects with country-by-year effects for each tercile of 2000 forest cover. Forest loss from Hansen et al. (2013), version 1.12. Bars are 95 percent confidence intervals from standard errors clustered by cell. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

−1 percent, and its 95 percent interval excludes a fall larger than 4.3 percent. Clearing of gold-suitable land sped up in the years when the higher price drew no men out of farming (Section 5.2).

A steady rise in clearing would look like this if gold-suitable land were simply being cleared faster over time. The yearly price separates the two, because it fell from 2013 to 2016 and rose again from 2019. Section 6 applies the same test to work; for forest, I estimate equation (1) with the suitable share times a linear trend added. A unit rise in the lagged price index raises forest loss in a fully gold-suitable cell by 0.17 log points, about 19 percent, with the trend included, against 0.26 without it, and by 0.12 when detection is allowed to differ with forest cover, where the trend is zero. Forest loss follows the price beyond any common trend in gold-suitable land.

In Table 3, I ask what kind of clearing this is. Sims et al. (2025) map the dominant driver of tree-cover loss over 2001 to 2024 for each square kilometre, and I split each year's loss by the driver of the pixel it falls in. Loss in pixels attributed to mining and energy infrastructure roughly doubles at the peak in a fully gold-suitable cell, by 0.024 log points on a mean of 0.021; it does not fall after the peak and rises by a further 0.013 in the second rise (column 2). Most of the additional clearing lies in pixels attributed to other drivers, such as permanent agriculture, shifting cultivation and logging, whose loss rises by about 21 percent at the peak and by a further 6 percent in the second rise (column 3). The map assigns one driver to each pixel for the whole period and is least accurate for the rare mining class, so this loss mixes land cleared for farms and settlements around the sites with mining that the map assigns to another driver. The

Table 3—Forest loss by driver and by place

	All forested cells			Recorded gold or mining		Clearing in 2001–05	
	All loss	Mining pixels	Other pixels	Yes	No	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rise, 2006–11	0.072***	0.005*	0.071***	0.078***	0.060***	0.048*	0.085***
	(0.015)	(0.002)	(0.015)	(0.024)	(0.021)	(0.025)	(0.019)
Peak, 2012–14	0.197***	0.024***	0.194***	0.237***	0.162***	0.173***	0.178***
	(0.025)	(0.006)	(0.025)	(0.041)	(0.035)	(0.040)	(0.033)
After, 2015–18	0.188***	0.023***	0.188***	0.252***	0.144***	0.159***	0.173***
	(0.031)	(0.007)	(0.031)	(0.051)	(0.043)	(0.047)	(0.041)
Second rise, 2019–24	0.249***	0.036***	0.247***	0.240***	0.232***	0.188***	0.255***
	(0.032)	(0.008)	(0.032)	(0.051)	(0.045)	(0.046)	(0.044)
After minus peak	−0.009	−0.001	−0.007	0.016	−0.018	−0.014	−0.005
	(0.018)	(0.003)	(0.018)	(0.028)	(0.025)	(0.026)	(0.025)
Second rise minus after	0.061***	0.013***	0.059***	−0.012	0.088***	0.029	0.083***
	(0.014)	(0.004)	(0.014)	(0.023)	(0.019)	(0.021)	(0.019)
Mean of outcome	1.142	0.021	1.138	1.298	1.059	1.389	0.900
Cell-years	111,024	111,024	111,024	38,904	72,000	55,128	55,848
Cells	4,626	4,626	4,626	1,621	3,000	2,297	2,327

Notes: Each column reports equation (2), suitable × window, for the logarithm of one plus the area of 2000 forest lost in the year (km^2), in cells with at least 1 km^2 of forest in 2000, 2001 to 2024, relative to 2001 to 2005, with cell and country-by-year effects; coefficients and means are in log points. The 4,626 forested cells in the estimation sample lie in 49 countries; the splits in columns 4 to 7 lose cells that lack the splitting variable. Column 1 repeats Figure 5, Panel A. Columns 2 and 3 split each year's loss by the dominant driver of tree-cover loss in 2001 to 2024 mapped by Sims et al. (2025) at 1 km: column 2 counts loss in pixels whose driver is hard commodities (mining and energy infrastructure), column 3 loss in all other pixels. Columns 4 and 5 split cells by any record of gold or artisanal gold mining in the data of Girard et al. (2025) (Figure 2, Panel C); columns 6 and 7 by whether the cell's mean share of forest lost each year in 2001 to 2005 is above its country's median. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

second-rise clearing lies away from the mines. It rises by 9 percent in cells with no record of gold or artisanal mining and not at all in cells with such a record, and it is concentrated in cells that cleared little forest in 2001 to 2005 (columns 4 to 7).[8]

The household surveys record no mining equipment. In Online Appendix OA4, I relate each African country's imports of excavators, other mining machines and mercury to the gold-suitable share of its land. Excavator imports rise with the boom and stay high after it, but imports of road rollers, a construction machine, also rise after the peak, and mercury imports do not rise again in the second rise, so the trade data do not separate machines for artisanal mining from a wider construction boom.

5.4 Human Development over the Cycle

Men move between farming and manual work as the price moves, and women move out of farming and out of work (Section 5.1). For schooling, living standards and health, the cycle leaves a longer trace. In Figure 6, I follow living standards, household wealth,

[8]On the satellite map of mine footprints of Tang and Werner (2023), the increase from 2015–18 to 2019–24 is 0.066 log points (standard error 0.015) in the 4,366 forested cells without a mapped mine and 0.004 (0.060) in the 254 cells with one.

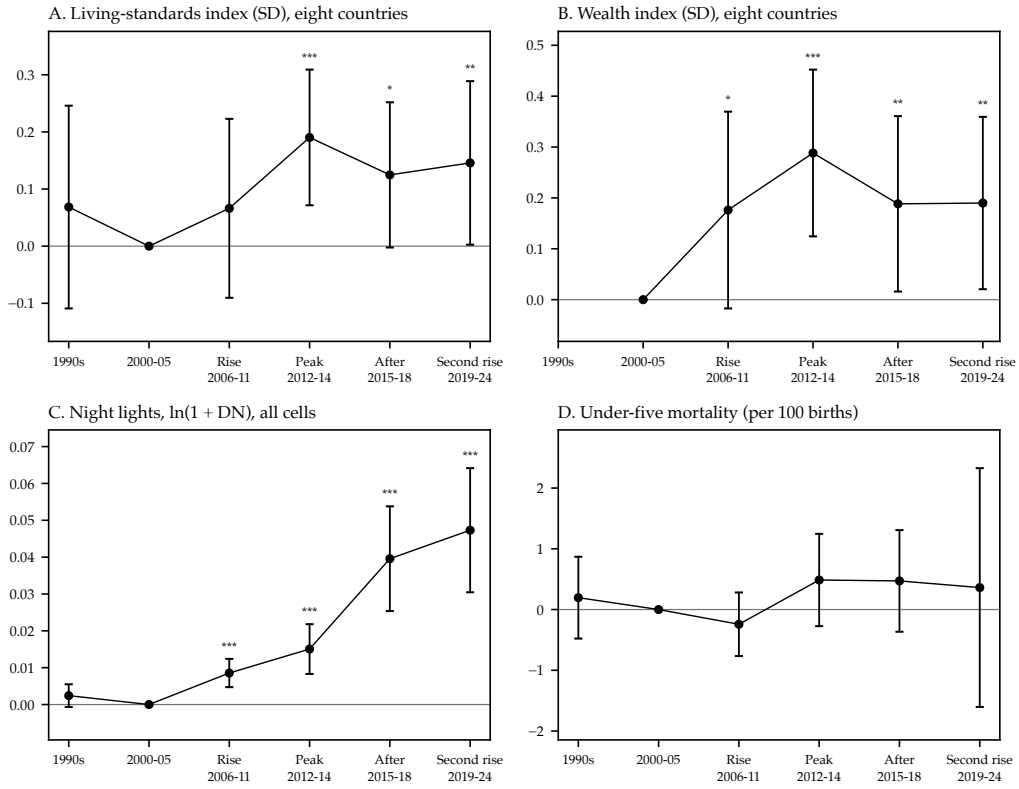


Figure 6—Living standards and health over the gold price cycle

Notes: Coefficients of equation (2) in a fully gold-suitable cell, relative to 2000 to 2005. Panel A is the living-standards index, the mean of the wealth index, electricity, improved water and (negatively) no toilet facility, each standardised on the households of 2000 to 2005; Panel B is the wealth index, standardised within each survey; both use households in the eight countries surveyed both at the peak and after it. Panel C is the logarithm of one plus mean harmonised night lights in all African cells, 1992 to 2024. Panel D is under-five mortality per 100 births, by year of birth, with cell-by-survey and country-by-birth-year effects; Panel C uses country-by-year effects for each 2010–12 brightness group. Household and birth data from the Demographic and Health Surveys (ICF, 2025); night lights from Li et al. (2020). Appendix Table B3 reports the estimates, the specifications and Holm-adjusted p-values. Bars are 95 percent confidence intervals from standard errors clustered by cell. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

night lights and child mortality through the same windows; Appendix Table B3 reports these estimates together with school attendance and three household amenities. Living standards and wealth come from households in the eight countries surveyed on both sides of the peak, and night lights and mortality from all countries with data.

For teenagers, the comparison can be made within a place. Children aged 6 to 11 in the same cell and survey would also feel a school closure, a mining camp or mercury, but they are too young for the pits. I therefore estimate

$$D_{gcs} = \sum_{w \in \mathcal{W}} \beta_{wg} \left(S_c \times \mathbf{1}[t \in w] \right) + \alpha_{cg} + \lambda_{ktg} + u_{gcs}, \tag{3}$$

where D_{gcs} is the attendance rate of age group g (12 to 15, 16 to 20 or 21 to 24) minus that of children aged 6 to 11 in cell c and survey s, α_{cg} are cell-by-age-group effects and λ_{ktg} country-by-year-by-age-group effects. I weight by the number of children and start

in 2000, because only one earlier survey records attendance.

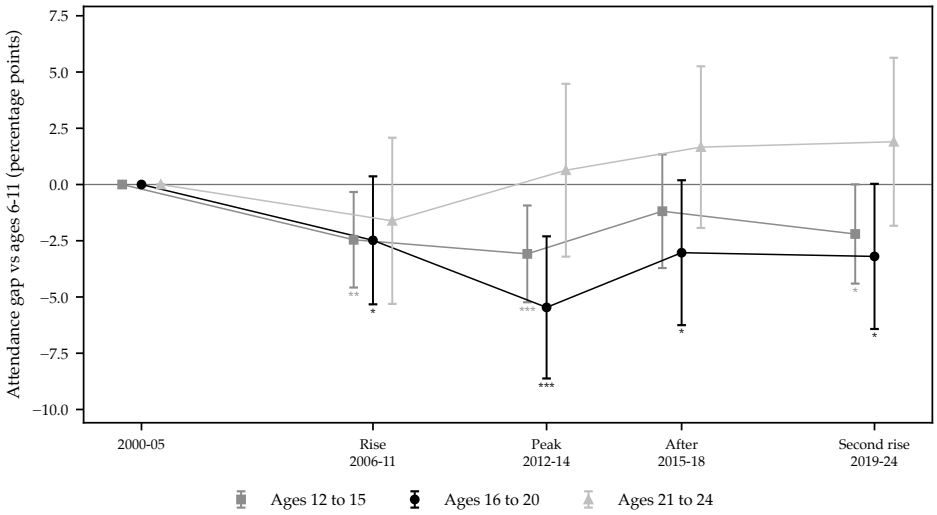


Figure 7—School attendance by age over the gold price cycle

Notes: Coefficients of equation (3): the attendance rate of each age group minus that of children aged 6 to 11 in the same cell and survey, in a fully gold-suitable cell, relative to 2000 to 2005, in percentage points (attendance is an indicator equal to 100 or 0). All countries with household rosters recording attendance, 2000 to 2025. Bars are 95 percent confidence intervals from standard errors clustered by cell. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In Figure 7, I plot the result for each age group. At the peak, attendance at ages 16 to 20 in a fully gold-suitable cell is 5.5 points lower than among younger children in the same place, against an attendance rate of 47 percent at those ages, and at ages 12 to 15 it is 3.1 points lower. Young adults aged 21 to 24, who have mostly left school, show no change, so the fall is specific to school-age teenagers. Boys and girls lose attendance alike (Figure 8, Panel A). Measured against younger children in the same place, the fall is similar where the household head has no schooling and where the head has some, at 6.1 and 5.3 points. Young men aged 15 to 19 leave farming at the peak, by 18 points on a mean of 32, and return to it after the peak, as older men do. Attendance returns only in part, imprecisely. The gap at ages 16 to 20 narrows by about half after the peak, to 3.0 points, and remains at 3.2 points in the second rise (Appendix Table B3, column 1). Completed schooling shows no detectable loss. Among household members aged 21 to 45, years of schooling do not fall with the price their cohort faced at ages 12 to 20: the estimate is -0.14 years on a mean of 5.9, with a 95 percent interval from -0.36 to 0.09. The attendance gaps at ages 12 to 20 imply a loss of about 0.19 years per unit of the index, and the smallest loss this test detects with 80 percent power is 0.32 years, so it cannot distinguish a full return from no return. Those born in 1990 to 1999, teenagers during the boom, have as much schooling relative to other cells as those born in 1985 to 1989.[9] The persistence I find is therefore a feature of places: teenagers in gold-suitable

[9]The cell is the place of residence at the interview, not in the teenage years. Schooling in gold-suitable cells has fallen behind that of other cells since the cohorts born in the 1960s, by 0.08 years per decade of

cells attend school less after the peak than before the boom.

Households in gold-suitable places rise in their country's wealth ranking and stay there. The wealth index, built from assets and housing and standardised within each survey, rises by 0.29 standard deviations at the peak in a fully gold-suitable cell (Figure 6, Panel B); among rural households alone it rises by 0.16, so part of the gain is a move toward towns.[10] When the price falls, it gives up 0.10 standard deviations, a third of its gain, and it holds the rest through 2019 to 2024; the second rise adds nothing to it, as it added nothing to men's work. Night lights tell the same story at the scale of the cell (Panel C); the peak estimate does not depend on the change of satellite sensor in 2014, since the years before the change alone give 0.01 log points against 0.015 in the full series, although the later rise rests on the newer sensor. They brighten during the boom, and instead of dimming when the price falls they keep rising, so that gold-suitable cells are brighter after the peak and in the second rise than at the peak itself.

The household amenities move less cleanly. Electricity and improved drinking water are both higher at the peak than in 2000 to 2005 (Appendix Table B3, columns 6 and 7), but each already differed in the 1990s, electricity in the same direction and water in the opposite one, so I cannot attribute either to the boom. The share of households without a toilet facility does not change at the peak and falls by 4.3 points from 2015–18 to the second rise (column 8). Taken together, the index of the four rises by 0.19 standard deviations at the peak and stays 0.12 above its level of 2000 to 2005 after it (Figure 6, Panel A); its fall after the peak, 0.07, is imprecise. Under-five mortality does not respond in any window (Panel D): the estimates are small relative to a mean of 11 deaths per 100 births. After a Holm adjustment for the four main outcomes (attendance, night lights, mortality and the living-standards index; Holm, 1979), the peak estimates for attendance, night lights and the living-standards index keep p-values below 0.01 and that for mortality is 0.21; the changes after the peak in attendance, mortality and the living-standards index do not survive the adjustment, while the continued rise in night lights does. Below, I show that child deaths rise in towns and not elsewhere.

In Figure 8, I split these outcomes by group. Wealth rises among rural and urban households alike, by 0.16 and 0.18 standard deviations at the peak (Panel B). Both are smaller than the 0.29 for all households, because the boom also moved households into towns: the share of surveyed households living in urban areas rises by 9 points at the peak, on a mean of 36 percent, as in the small towns that artisanal gold created (Girard and Pignède, 2026). Light comes first to places that were already lit (Panel C). Cells lit in 2010 to 2012 brighten at the peak and again after it, while cells that were dark then light up only after the peak. At the peak, under-five mortality does not respond for

birth, and no cohort of the boom departs from that trend; with the trend included, the estimate for the teenage price is 0.07 years.

[10] With country clusters, the wild cluster bootstrap p-value is 0.19 for the wealth index at the peak and 0.06 for the living-standards index; dropping each country in turn leaves the wealth estimate between 0.22 and 0.32.

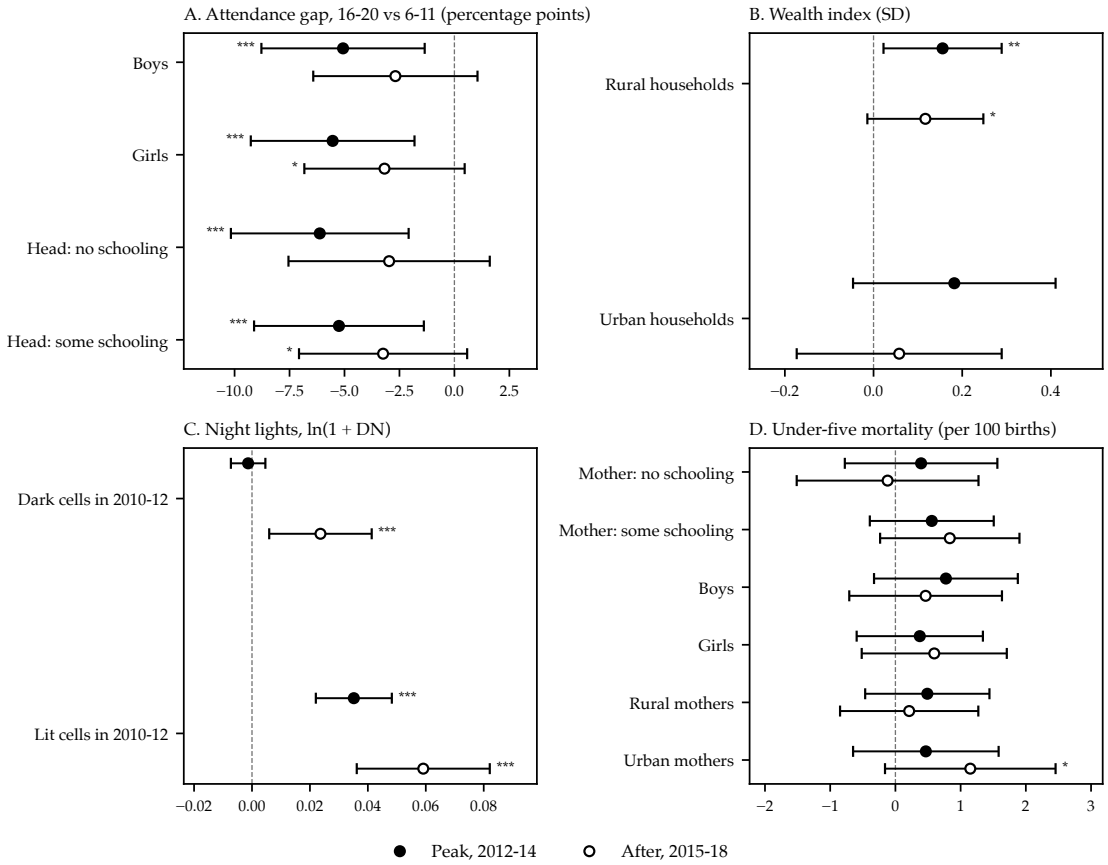


Figure 8—Human development over the gold price cycle, by group

Notes: Coefficients of equation (2) at the peak (2012 to 2014, filled) and after it (2015 to 2018, hollow), relative to 2000 to 2005, estimated separately for each group with the specifications of Appendix Table B3: the attendance gap of equation (3) by sex and by the schooling of the household head (Panel A), the wealth index for rural and urban households in the eight countries surveyed both at the peak and after it (Panel B), night lights for cells dark and lit in 2010 to 2012 (Panel C), and under-five mortality by the mother's schooling, the child's sex and the mother's urban or rural residence at interview (Panel D). Bars are 95 percent confidence intervals from standard errors clustered by cell. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

any group, whether split by the mother's schooling, the child's sex or residence (Panel D). After the peak, it is 1.1 points higher among children of urban mothers, on a mean of 8.4 deaths per 100 births, and 0.2 points higher among children of rural mothers. Residence at interview moves with the boom, so in Appendix Table B8, I instead split cells by whether they held an urban cluster in a survey fielded before 2006, close to the towns of 1975 that Girard and Pignède (2026) follow. In these towns, under-five mortality is 1.0 points higher at the peak and 1.2 points higher after it, on a mean of 10.5, and in the other cells it does not change. Like Girard and Pignède (2026), I find that child mortality rises with artisanal gold in towns, which the boom also made larger, and not in other cells.[11]

[11]The rise is smaller and imprecise for deaths before age one: 0.6 points at the peak and 0.8 after it in the towns, on a mean of 6.5. Defining towns as cells lit at night in 1992 to 1999 gives 0.7 points at the peak, imprecisely, and 1.0 after it, but that definition counts 83 percent of births as urban.

6 Robustness

In Figure 9, I re-estimate the cycle for the four outcomes that carry Section 5.1 under 16 changes to the specification, and Appendix Table B4 reports the estimates. The first row repeats Appendix Table B1. Measuring exposure as any gold-suitable land in the cell, as a suitable share of at least one half, or as the share of the cell within 10 km of suitable land rescales the coefficients but leaves the cycle in place. Controlling for industrial gold mines times the price, for industrial mines of other minerals valued at their own world prices, or for armed conflict in the cell moves no estimate of the farming cycle by more than 1.0 point, and neither does dropping the temperature and crop controls; conflict events in fact fall in gold-suitable cells of the eight countries at and after the peak. Pooling 1990 to 2005 as the reference period lowers the peak coefficients, to 4.5 points for men's manual work, −13.9 for their farming and 4.0 for women's sales, because the 1990s already differed, but it leaves every change after the peak within 0.1 points.

Changes in who was surveyed do not explain the cycle either. The urban share of surveyed households in gold-suitable cells rises by 9 points at the peak, on a mean of 36 percent, and farming is far less common in towns. In rural clusters alone, men's farming falls by 14.0 points at the peak and recovers 12.0. The cycle keeps its shape, if smaller, with urban residence interacted with each window, in cells with respondents in every window, and without the clusters whose displacement could have moved them across a cell edge, where men's farming recovers 6.2 to 7.9 points. With other mines, conflict and urban residence controlled together, men's farming falls by 12.8 points and recovers 7.8, and their manual work rises by 4.9 and gives up 4.3.

The cycle in work is not produced by people moving in at the peak and out after it. Among respondents who have always lived in the place or have lived there for at least five years, men's manual work rises by 8.2 points at the peak and falls by 5.8 after it, and men's farming falls by 16.0 points and recovers 13.0. In Appendix Table B7, I estimate equation (2) for who lives in the surveyed households. At the peak, households in gold-suitable cells are larger by 0.4 people on a mean of 5.9, the share of young men is 1.0 point higher and the share of women 0.8 points lower, and none of these changes after the peak. Households were already larger in gold-suitable cells before the boom, by 1.4 people in the 1990s, and the cell fixed effects absorb that level. Women who arrived in the previous five years are no more common at the peak; they are 6.5 points more common after it, when manual work had already fallen. The one outcome that differs among stayers is women's current work, whose fall at the peak is 2.2 points against 8.1 in the full sample, so part of women's withdrawal from work may come from women who moved.

Fieldwork timing does not explain the farming cycle. Assigning each survey to the window of its first interview year, which places the 2014–15 surveys of Chad and Rwanda wholly in the peak, leaves the cycle slightly larger: men's farming falls by

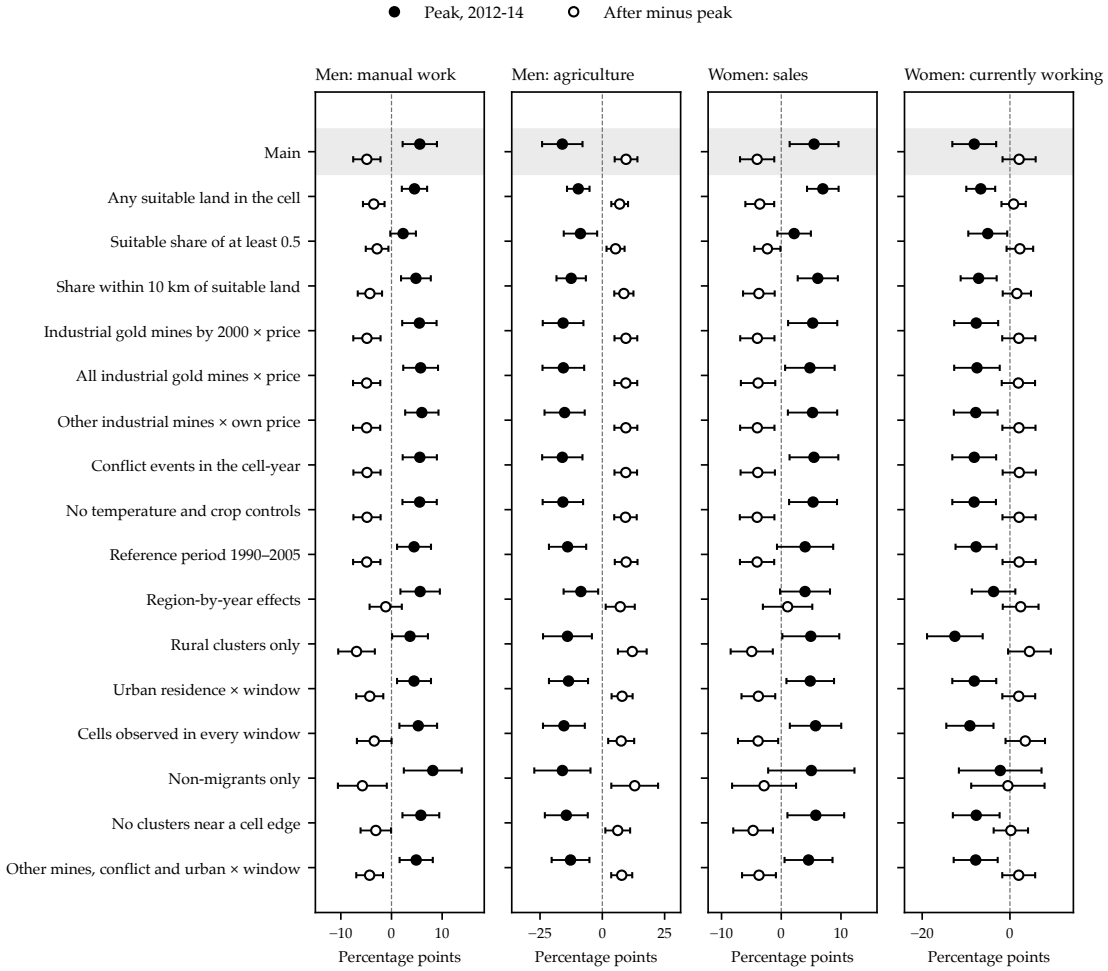


Figure 9—Robustness of the cycle

Notes: Each row reports equation (2) for the outcome in the panel title, in percentage points, in the eight countries surveyed both at the peak and after it, surveys to 2018, with the change named in the row: the coefficient at the peak, 2012–14 (filled), and the change from the peak to 2015–18 (hollow), each relative to 2000–05. The first row is the specification of Appendix Table B1. Appendix Table B4 defines each row and reports the estimates, the range when one country is dropped, and wild bootstrap and placebo p-values. Bars are 95 percent confidence intervals from standard errors clustered by cell.

16.5 points and recovers 11.0. With country-by-year-by-interview-month effects and the suitable share times calendar-month indicators, men's farming still falls by 12.5 points and recovers 8.1, while the fall in manual work after the peak shrinks to 2.5 points and that in women's sales to 2.7, both imprecisely (Appendix Table B6, Panel E).

Two checks weaken the reversal in manual work and trade further. With region-by-year effects, which compare each cell only with others in the same survey region, men's manual work still rises by 5.7 points at the peak and men's farming still falls and recovers, by 8.6 and 7.2 points, but manual work falls by only 1.1 points after the peak and women's sales no longer fall. A placebo that shifts the whole suitability map across the continent tells the same story. Shifted maps keep the regional structure of geology. Across about 320 shifts of at least two degrees, a cycle in men's farming as large as the

actual one appears in 5 percent of the shifts at the peak and 7 percent after it, and cycles in manual work and trade in 13 to 32 percent. Part of the reversal in manual work and trade is therefore common to whole regions, while the reversal in farming holds within them.

A differential trend does not explain the cycle. Adding the suitable share times a linear trend to the windows is not informative, because in eight countries the windows and the trend are almost collinear: the trend has an R^2 of 0.99 on the window regressors and the suitable share. The yearly price separates them, because it fell from 2013 to 2016. In Appendix Table B4, Panel C, the suitable share times the lagged price index lowers men's farming by 11.8 points per unit of the index, and by 21.9 with a linear trend for gold-suitable cells; men's manual work and women's sales rise with the price in both specifications.

Dropping any one of the eight countries leaves the rise of men's manual work at the peak between 4.8 and 7.3 points and its fall after the peak between 3.2 and 5.7 points; farming recovers by 7.9 to 10.6 points in every sample. Standard errors that allow correlation across cells up to 100 or 500 kilometres apart (Conley, 1999) leave every cycle statistic that is significant with cell-clustered errors significant at the 5 percent level, except the fall of women's sales after the peak at 500 kilometres, and across the 24 cycle statistics for all adults, men and women in Appendix Table B1, a Holm adjustment leaves men's farming and manual work at the peak and after it below 0.05. With eight countries, inference across countries is weak.[12] The placebo does not depend on the number of countries. In 1,000 reassignments of the suitable share across cells within each country, no more than 2 percent of draws give a rise at the peak or a reversal after it as large as the actual estimates, for men's manual work and farming and for women's sales, and no more than 0.1 percent give a fall in women's current work as large as the actual one (Appendix Table B4).

The cycle does not depend on restricting the sample to the eight countries surveyed on both sides of the peak. Estimated on every country, with surveys to 2018, men's farming falls by 6.4 points at the peak and recovers 6.1, their manual work rises by 2.6 and gives up 3.1, and women's sales rise by 4.1 and give up 3.1 (Appendix Table B5, Panel A). The estimates are 40 to 80 percent as large, because different countries identify each window, but every one has the same sign and is statistically significant at the 5 percent level.

Online Appendix OA2 re-estimates Table 2 and the cycle with exposure measured as the share of the cell within 10 km of gold-suitable land (see also Ghazarian and Khan, 2025), and the estimates change little: the cycle in men's manual work and women's sales is within a point of the main estimates, and the fall in men's farming at the peak is smaller, 12.5 points against 16.1.

[12] Wild cluster restricted bootstrap p-values with country clusters, over all 256 Rademacher draws, are 0.02 for the fall of men's farming at the peak and 0.08 for the rise of women's sales, and between 0.12 and 0.51 for the other six statistics in Appendix Table B4.

7 Conclusion

Between 2000 and 2012, the gold price rose sixfold; by 2015 it had fallen by 30 percent, and from 2019 it rose above its earlier peak. I follow work, land and human development in Africa's gold-suitable places through this cycle, using 166 household surveys linked to the geology that artisanal mining needs. The jobs lasted as long as the price. In the eight countries surveyed on both sides of the peak, men in a fully gold-suitable cell took up manual work and left farming as the price rose, and farming recovered when it fell, faster than it had declined; women moved into trade and back out of it, and fewer women worked at all. When the price rose again after 2019, far fewer men left farming than in the first boom, while forest loss grew further.

Other changes outlast the price. Forest clearing in gold-suitable cells did not slow when the price fell, so the land taken by the boom kept growing. Households kept about two thirds of their rise in the wealth ranking, part of it from a move toward towns, and the night lights of gold-suitable cells kept rising after the peak. Teenagers aged 16 to 20 lost 5.5 points of school attendance relative to younger children in the same place, and half of that loss remained after the jobs had gone, while the completed schooling of the boom cohorts shows no detectable loss. In cells that held towns before 2006, child mortality was about 1 point per 100 births higher at and after the peak, in one of several splits by group.

The asymmetry matters for how artisanal mining is judged. Employment at the peak is a poor measure of what a gold rush leaves behind: the move out of farming partly reversed within a few years, and the cleared forest, the lower school attendance of gold-suitable places and the assets households bought remain. The second rise cleared more forest, much of it on land with no earlier record of mining, and drew far fewer workers out of farming. Why the second rush drew fewer of them is the open question. The household surveys record neither equipment nor the scale of operations, the trade data cannot place a machine at a site, and the new clearing lies away from mapped mines. Repeated satellite maps of mining pits, or licence registers, would tell whether the second rush was mined by machines, by fewer people, or elsewhere.

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A Data

A.1 Household Surveys

I assemble the Demographic and Health Surveys from the raw recode files of every standard survey in 33 African countries: 166 surveys fielded between 1986 and 2025 (Table A1). From each survey I keep the women's, men's, household, household-member and birth recodes, and I link each sampling cluster to its half-degree cell through the survey's GPS file. The 132 surveys with coordinates locate 65,746 clusters, and 99 percent of the people interviewed in them are linked to a cell. Ethiopian surveys record dates in the Ethiopian calendar, and I convert them to the Gregorian calendar by adding 92 months to the century-month codes, except in the 2024 survey, which already uses Gregorian dates.

Online Appendix OA1 compares this build with the survey file of Girard et al. (2025): of their 189 survey-years, 145 are in this build, and in those I match 97.6 percent of their women one to one.

B Additional Results

This appendix reports the estimates behind Figures 3, 4 and 6, the robustness checks of Section 6, which Figure 9 plots, and the other checks cited in Section 5.

Table A1—Demographic and Health Surveys by country

Country	Survey years	Women	Men	Households	Fall	Rise
Angola	2015, 2023	29,096	12,288	32,352		Yes
Benin	1996, 2001, (2006), 2012, 2017	43,731	16,792	41,376	Yes	
Burkina Faso	1993, 1999, 2003, 2010, 2021	58,909	22,670	45,803		
Burundi	(1987), 2010, 2016	26,591	11,815	24,517		
Cameroon	1991, (1998), 2004, 2011, 2018	44,540	20,200	39,817		Yes
Chad	(1997), (2004), 2014	17,719	5,248	17,233	Yes	
Congo Democratic Republic	2007, 2013, 2023	54,755	25,305	51,706		
Cote d'Ivoire	1994, 1998, 2012, 2021	35,816	16,028	32,217		
Egypt	(1988), 1992, 1995, 2000, 2003, 2005, 2008, 2014	104,735	0	119,674		
Eswatini	2006	4,908	4,086	4,756		
Ethiopia	2000, 2005, 2011, 2016, 2019, 2024	90,463	46,911	89,614		Yes
Gabon	(2000), 2012, 2019	19,408	12,477	21,419		
Ghana	(1988), 1993, 1998, 2003, 2008, 2014, 2022	44,200	23,693	59,269		
Guinea	1999, 2005, 2012, 2018	34,608	13,012	26,302	Yes	
Kenya	(1989), (1993), (1998), 2003, 2008, 2014, 2022, (2025)	79,680	34,223	91,710		
Lesotho	2004, 2009, 2014, 2023	27,297	12,072	36,599		
Liberia	1986, 2007, 2013, 2019	29,390	14,213	24,967		
Madagascar	(1992), 1997, (2004), 2008, 2021	42,993	17,476	45,244		
Malawi	(1992), 2000, 2004, 2010, 2015, 2024	93,538	29,755	101,528		Yes
Mali	(1987), 1996, 2001, 2006, 2012, 2018, 2023	77,746	26,666	62,580	Yes	Yes
Mozambique	(1997), (2003), 2011, 2022	26,910	9,410	28,149		
Namibia	(1992), 2000, 2006, 2013	26,409	11,285	25,277		
Niger	1992, 1998, (2006), 2012	25,240	9,040	21,920		
Nigeria	1990, 2003, 2008, 2013, 2018, 2024	169,021	60,489	168,706	Yes	Yes
Rwanda	(1992), (2000), 2005, 2008, 2010, 2015, 2019, 2025	74,499	37,120	70,048	Yes	Yes
Senegal	(1986), 1993, 1997, 2005, 2010, 2012, 2014, 2015, 2016, 2017, 2018, 2019, 2023	130,745	45,261	66,514	Yes	Yes
Sierra Leone	2008, 2013, 2019	38,990	17,487	32,816		
South Africa	(1998), 2016	8,514	3,618	11,083		
Tanzania	(1992), (1996), 1999, (2004), 2010, 2015, 2022	42,234	15,206	41,112		Yes
Togo	1988, 1998, 2013	21,378	8,283	17,027		
Uganda	(1988), (1995), 2000, 2006, 2011, 2016	40,960	11,543	43,293		
Zambia	(1992), (1996), (2002), 2007, 2013, 2018, 2024	50,884	45,732	48,441	Yes	Yes
Zimbabwe	(1988), (1994), 1999, 2005, 2010, 2015	33,389	25,258	35,366		
Total	166 surveys, 132 with GPS	1,649,296	664,662	1,578,435	8	10

Notes: Standard DHS surveys in Africa, 1986 to 2025, listed by the year of the survey's name. Years in parentheses are surveys without cluster coordinates, which cannot be linked to cells and do not enter the estimates. Women, men and households are interviews linked to a cell. Fall marks the eight countries with interviews both at the peak (2012–14) and after it (2015–18), by interview date, which can fall in the year after the survey's name; rise marks the ten countries surveyed both in 2015–18 and in 2019–24.

Table B1—Work over the gold price cycle

	Working (1)	Manual (2)	Extraction (3)	Agriculture (4)	Sales (5)	Services (6)
Panel A: All adults						
Suitable × 1990s	−2.25	−0.91		−6.03	2.82	0.47
	(2.29)	(1.19)		(3.68)	(2.50)	(0.59)
Suitable × rise, 2006–11	−8.41***	−0.26	0.88	−6.86**	2.62*	−1.80***
	(2.46)	(1.25)	(0.62)	(2.78)	(1.56)	(0.64)
Suitable × peak, 2012–14	−7.50***	2.15*	1.09	−12.86***	4.51***	−1.36*
	(2.46)	(1.19)	(0.70)	(2.79)	(1.57)	(0.77)
After minus peak	1.25	−2.42***	−0.83*	5.24***	−2.78***	−0.13
	(1.60)	(0.85)	(0.45)	(1.97)	(1.04)	(0.82)
Mean of outcome (%)	63.6	10.1	0.9	29.6	19.7	4.2
Observations	637,014	620,509	408,237	620,509	620,509	620,509
Panel B: Men						
Suitable × 1990s	−3.73	3.80		−7.08	−1.31	−1.62
	(3.89)	(2.40)		(4.42)	(1.49)	(1.20)
Suitable × rise, 2006–11	−9.30**	2.49	1.32**	−9.66**	1.41	−1.83*
	(3.93)	(1.85)	(0.56)	(4.55)	(1.50)	(0.95)
Suitable × peak, 2012–14	−4.56	5.58***	1.24**	−16.06***	2.18	−0.65
	(3.93)	(1.73)	(0.58)	(4.14)	(1.39)	(0.73)
After minus peak	−1.62	−4.87***	−0.50	9.52***	−0.48	−1.56**
	(1.91)	(1.37)	(0.54)	(2.33)	(0.86)	(0.74)
Mean of outcome (%)	79.0	19.0	1.3	40.8	10.0	4.6
Observations	181,812	185,152	133,282	185,152	185,152	185,152
Panel C: Women						
Suitable × 1990s	−1.15	−2.96**		−4.34	4.26	1.06*
	(2.60)	(1.35)		(3.96)	(3.10)	(0.56)
Suitable × rise, 2006–11	−7.52***	−1.17	0.76	−5.79*	3.18	−1.85***
	(2.63)	(1.51)	(0.77)	(2.96)	(2.07)	(0.66)
Suitable × peak, 2012–14	−8.14***	0.73	1.11	−11.02***	5.50***	−1.65*
	(2.55)	(1.37)	(0.89)	(3.03)	(2.09)	(0.96)
After minus peak	2.09	−0.88	−1.01*	2.84	−4.04***	0.59
	(1.93)	(1.04)	(0.60)	(2.17)	(1.46)	(1.06)
Mean of outcome (%)	57.4	6.3	0.7	24.8	23.8	4.0
Observations	455,201	435,356	274,954	435,356	435,356	435,356

Notes: Each column reports equation (2) for an indicator equal to 100 if the respondent's own occupation is in the sector and 0 otherwise, so that coefficients are in percentage points, in the eight countries surveyed both at the peak and after it (Benin, Chad, Guinea, Mali, Nigeria, Rwanda, Senegal and Zambia), surveys to 2018. Coefficients are the change in a fully gold-suitable cell relative to 2000 to 2005; the window 2015–18 enters the regression and is reported as its difference from the peak. Panel A stacks the men's and women's interviews and controls for sex. Extraction is manual work whose occupation label names mining or quarrying, in the surveys whose labels code it; no survey before 2000 codes it, so column 3 has no 1990s window. All regressions control for temperature, the crop-price index, age and age squared, with cell and country-by-year effects. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B2—Work in the second rise of the gold price

		2019–24 minus 2015–18 (1)	Implied by response after the peak (2)	Mean (3)	Observations (4)
All adults	Manual work	0.1	3.6	12.0	1,072,390
		(1.0)			
	Agriculture	1.6	−7.5	29.1	1,072,390
		(1.8)			
	Sales	−0.6	3.1	15.9	1,072,390
		(1.0)			
Men	Manual work	−0.2	9.3	21.4	323,711
		(1.7)			
	Agriculture	2.2	−14.6	39.5	323,711
		(2.3)			
Women	Currently working	−1.1	−2.8	53.8	768,233
		(1.9)			
	Sales	−0.4	5.3	18.8	748,678
		(1.3)			

Notes: Column 1 is the difference between the 2019–24 and 2015–18 coefficients of equation (2) in a fully gold-suitable cell, in percentage points, for each respondent's own occupation, as an indicator equal to 100 or 0, in the ten countries surveyed both in 2015–18 and in 2019–24, surveys to 2024, with age controls (and sex for all adults) and without the temperature and crop controls, which end in 2018, and with cell and country-by-year effects. Column 2 scales the change from 2015–18 to the peak, estimated in the same regression and countries, by the change in the mean lagged price index at the interview dates, 1.13 at the peak, 0.88 in 2015–18 and 1.28 in 2019–24. Standard errors clustered by cell in parentheses. Figure 4 tests column 1 against column 2.

Table B3—Human development over the gold price cycle

	All countries			Eight countries surveyed at and after the peak				
	Attendance 16–20 vs 6–11 (1)	Night lights ln(1 + DN) (2)	Under-five mortality (3)	Living-standards index (SD) (4)	Wealth index (SD) (5)	Electricity (6)	Improved water (7)	No toilet facility (8)
Suitable × price, eq. (1)	−2.5*	0.042***	0.33	0.11**	0.12**	4.4*	3.9	−4.6**
	(1.3)	(0.008)	(0.46)	(0.05)	(0.06)	(2.3)	(2.8)	(2.2)
Suitable × window, eq. (2)								
1990s		0.002	0.20	0.07		9.9***	−9.7**	3.1
		(0.002)	(0.34)	(0.09)		(3.0)	(4.3)	(5.3)
Rise, 2006–11	−2.5*	0.009***	−0.24	0.07	0.18*	2.6	7.6*	3.0
	(1.5)	(0.002)	(0.27)	(0.08)	(0.10)	(3.3)	(4.1)	(2.7)
Peak, 2012–14	−5.5***	0.015***	0.49	0.19***	0.29***	7.3***	9.8***	−1.3
	(1.6)	(0.003)	(0.39)	(0.06)	(0.08)	(2.8)	(3.6)	(2.2)
After, 2015–18	−3.0*	0.040***	0.47	0.12*	0.19**	8.8***	4.9	−0.2
	(1.6)	(0.007)	(0.43)	(0.06)	(0.09)	(2.9)	(3.6)	(2.3)
Second rise, 2019–24	−3.2*	0.047***	0.36	0.15**	0.19**	6.9**	5.1	−4.5
	(1.6)	(0.009)	(1.00)	(0.07)	(0.09)	(3.2)	(3.7)	(2.9)
After minus peak	2.4*	0.025***	−0.01	−0.07	−0.10**	1.5	−4.9**	1.1
	(1.4)	(0.005)	(0.33)	(0.05)	(0.04)	(2.3)	(2.3)	(1.7)
Second rise minus after	−0.2	0.008*	−0.11	0.02	0.00	−2.0	0.1	−4.3*
	(1.4)	(0.004)	(0.97)	(0.06)	(0.05)	(2.6)	(2.8)	(2.2)
Holm-adjusted p, columns 1 to 4								
Suitable × price	[0.12]	[<0.01]	[0.47]	[0.10]				
Peak	[<0.01]	[<0.01]	[0.21]	[<0.01]				
After minus peak	[0.24]	[<0.01]	[0.96]	[0.32]				
Second rise minus after	[1.00]	[0.25]	[1.00]	[1.00]				
Mean of outcome	−23.0	0.192	11.30	0.26	0.00	38.1	65.2	25.5
Observations	33,853	352,044	1,948,162	491,641	447,602	491,661	490,049	490,522
Countries	33	54	33	8	8	8	8	8

Notes: The first row reports equation (1) and the rows below it equation (2); column 1 uses equation (3). Column 1 is the attendance rate of household members aged 16 to 20 minus that of members aged 6 to 11 in the same cell and survey, in percentage points, in all countries with household rosters recording attendance, from 2000; observations are cell-survey-age-group means, weighted by the number of household members in the age group, with cell-by-age-group and country-by-year-by-age-group effects. Column 2 is the logarithm of one plus mean harmonised night lights in all African cells, 1992 to 2024, with country-by-year effects for each 2010–12 brightness group. Column 3 is an indicator equal to 100 if a child died before age five, for births in the 15 years before interview and at least 60 months before it, by year of birth, with cell-by-survey and country-by-birth-year effects and controls for the mother's age at birth and its square, sex and twin birth. Columns 4 to 8 use households in the eight countries surveyed both at the peak and after it: the wealth index, standardised within each survey (column 5), and indicators equal to 100 or 0 for electricity, an improved source of drinking water (piped, borehole, protected well or spring, rainwater or bottled) and no toilet facility (columns 6 to 8). The living-standards index (column 4) is the mean of the four, each standardised by its mean and standard deviation among households surveyed in 2000 to 2005 and no toilet facility entering with a negative sign, for households with at least three of them, divided by its standard deviation in 2000 to 2005 (Kling et al., 2007; Anderson, 2008). Columns 4 to 8 have cell and country-by-year effects. Attendance (column 1) starts in 2000 and the wealth index (column 5) is not recorded in the 1990s surveys of these countries, so neither has a 1990s window. Holm p-values adjust for testing four outcomes, columns 1 to 4, separately for each row (Holm, 1979). Surveys to 2024, without the temperature and crop controls. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B4—Robustness of the cycle estimates

	Men		Women	
	manual work (1)	agriculture (2)	sales (3)	working (4)
Panel A: Suitable × peak, 2012–14				
Main	5.58*** (1.73)	−16.06*** (4.14)	5.50*** (2.09)	−8.14*** (2.55)
Any suitable land in the cell	4.54*** (1.27)	−9.65*** (2.31)	6.96*** (1.35)	−6.66*** (1.68)
Suitable share of at least 0.5	2.29* (1.29)	−8.78** (3.42)	2.16 (1.43)	−5.06** (2.26)
Share within 10 km of suitable land	4.82*** (1.50)	−12.50*** (3.01)	6.12*** (1.71)	−7.13*** (2.09)
Industrial gold mines by 2000 × price	5.51*** (1.73)	−15.74*** (4.16)	5.26** (2.10)	−7.70*** (2.56)
All industrial gold mines × price	5.75*** (1.75)	−15.64*** (4.27)	4.79** (2.12)	−7.52*** (2.65)
Other industrial mines × own price	5.99*** (1.68)	−15.13*** (4.11)	5.24** (2.11)	−7.79*** (2.55)
Conflict events in the cell-year	5.58*** (1.72)	−16.05*** (4.13)	5.47*** (2.08)	−8.14*** (2.55)
No temperature and crop controls	5.55*** (1.73)	−15.83*** (4.14)	5.32*** (2.05)	−8.17*** (2.54)
Reference period 1990–2005	4.45*** (1.71)	−13.94*** (3.81)	3.99* (2.40)	−7.73*** (2.38)
Region-by-year effects	5.65*** (1.99)	−8.60** (3.54)	3.98* (2.13)	−3.73 (2.53)
Rural clusters only	3.65** (1.80)	−13.99*** (5.00)	4.94** (2.43)	−12.55*** (3.24)
Urban residence × window	4.44*** (1.71)	−13.57*** (4.00)	4.85** (2.03)	−8.13*** (2.56)
Cells observed in every window	5.28*** (1.90)	−15.41*** (4.28)	5.74*** (2.20)	−9.13*** (2.74)
Non-migrants only	8.15*** (2.92)	−16.02*** (5.75)	5.03 (3.69)	−2.22 (4.81)
No clusters near a cell edge	5.79*** (1.85)	−14.45*** (4.39)	5.78** (2.42)	−7.68*** (2.72)
Other mines, conflict and urban × window	4.87*** (1.67)	−12.75*** (3.87)	4.57** (2.05)	−7.81*** (2.56)
Drop one country, range	[4.8, 7.3]	[−19.1, −12.3]	[3.3, 6.8]	[−11.8, −5.2]
Wild bootstrap p, countries	0.12	0.02	0.08	0.16
Placebo permutation p	0.005	<0.001	0.009	0.001
Panel B: After minus peak				
Main	−4.87*** (1.37)	9.52*** (2.33)	−4.04*** (1.46)	2.09 (1.93)
Any suitable land in the cell	−3.50*** (1.09)	6.97*** (1.71)	−3.60*** (1.23)	0.83 (1.41)
Suitable share of at least 0.5	−2.84** (1.14)	5.31*** (1.85)	−2.32** (1.12)	2.26 (1.55)
Share within 10 km of suitable land	−4.26*** (1.22)	8.64*** (1.96)	−3.75*** (1.35)	1.57 (1.64)
Industrial gold mines by 2000 × price	−4.85*** (1.37)	9.46*** (2.33)	−4.00*** (1.46)	2.02 (1.93)
All industrial gold mines × price	−4.91*** (1.37)	9.43*** (2.34)	−3.88*** (1.47)	1.92 (1.94)
Other industrial mines × own price	−4.91*** (1.37)	9.44*** (2.35)	−4.01*** (1.47)	2.05 (1.93)
Conflict events in the cell-year	−4.84*** (1.37)	9.41*** (2.31)	−3.94*** (1.47)	2.12 (1.93)
No temperature and crop controls	−4.84*** (1.37)	9.29*** (2.30)	−4.04*** (1.48)	2.08 (1.93)
Reference period 1990–2005	−4.89*** (1.37)	9.56*** (2.33)	−4.05*** (1.46)	2.09 (1.93)
Region-by-year effects	−1.14 (1.62)	7.19** (2.98)	1.06 (2.11)	2.44 (2.08)
Rural clusters only	−6.90*** (1.84)	12.03*** (2.94)	−4.94*** (1.80)	4.45* (2.49)
Urban residence × window	−4.29*** (1.36)	7.94*** (2.15)	−3.83*** (1.44)	2.01 (1.91)
Cells observed in every window	−3.41* (1.74)	7.57*** (2.66)	−3.88** (1.72)	3.49 (2.29)
Non-migrants only	−5.75** (2.46)	13.00*** (4.79)	−2.88 (2.73)	−0.47 (4.27)
No clusters near a cell edge	−3.10** (1.54)	6.19** (2.54)	−4.71*** (1.69)	0.21 (2.00)
Other mines, conflict and urban × window	−4.32*** (1.35)	7.79*** (2.15)	−3.73*** (1.45)	2.00 (1.91)
Drop one country, range	[−5.7, −3.2]	[7.9, 10.6]	[−5.4, −2.2]	[0.3, 5.8]
Wild bootstrap p, countries	0.18	0.16	0.30	0.51
Placebo permutation p	0.005	<0.001	0.019	0.384
Panel C: Suitable × lagged price index, all years				
Without trend	2.89* (1.59)	−11.77*** (3.19)	4.03* (2.35)	−7.03*** (2.21)
With suitable × linear trend	8.66*** (2.38)	−21.85*** (4.27)	10.22*** (2.57)	−6.62* (3.48)
Suitable × trend (per decade)	−4.39*** (1.37)	7.66*** (2.35)	−4.38** (1.74)	−0.29 (1.82)
Observations, main	185,152	185,152	435,356	455,201
Cells, main	1,166	1,166	1,168	1,168

Notes: Panels A and B report equation (2) for the respondent's own occupation or current work, in percentage points, in the eight countries surveyed both at the peak and after it, surveys to 2018, with the change named in the row; Figure 9 plots them. The first row is the specification of Appendix Table B1: temperature, the crop-price index, age and age squared, with cell and country-by-year effects. Any suitable land and a share of at least 0.5 replace the suitable share with an indicator, so their coefficients compare cells with and without that exposure. Industrial gold mines are cells with a mine producing by 2000, or at any date, times the lagged price; other industrial mines are the price index of Girard et al. (2025), in which each industrial mine of any mineral is valued at the world price of its main mineral. Conflict events are $\ln(1 + \text{events})$ in the cell and interview year (Sundberg and Melander, 2013). With the 1990–2005 reference, the 1990s window is dropped. Region-by-year effects use the survey regions. Rural clusters are those the survey classifies as rural; urban residence × window adds an urban indicator and its interaction with each window; cells observed in every window have respondents in 2000–05, at the peak and after it. Non-migrants have always lived in the place or for at least five years. Clusters near a cell edge lie within the DHS displacement distance of it. Dropping one country reports the range of estimates over the eight samples. Bootstrap p-values are from the wild cluster restricted bootstrap with Rademacher weights over all 256 draws. Placebo p-values are the share of 1,000 reassignments of the suitable share across cells within country whose estimate exceeds the actual one in absolute value, estimated on cell-by-year means. Panel C replaces the windows with the suitable share times the lagged gold price index (2013 equal to one) in each year; the trend is the suitable share times decades since 2000. Observations and cells refer to the main specification. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B5—The cycle in all countries, and the second rise by cell

	Men		Women	
	manual work	agriculture	sales	working
	(1)	(2)	(3)	(4)
Panel A: All countries				
Suitable × peak, 2012–14	2.65** (1.28)	−6.39*** (2.12)	4.13*** (1.24)	−2.43 (1.90)
After minus peak	−3.11*** (1.15)	6.12*** (1.92)	−3.13*** (1.18)	1.07 (1.68)
Second rise minus after, all surveys	1.67 (1.33)	−1.55 (1.88)	1.61 (1.11)	−3.66** (1.65)
Countries	32	32	33	33
Panel B: Second rise minus after, ten rise countries, by cell				
Conflict events in 2019–24	1.03 (2.63)	2.55 (4.13)	−3.22 (2.77)	
No conflict events in 2019–24	−1.01 (2.27)	2.91 (2.89)	1.71 (1.37)	
Mapped mine in the cell	9.08 (7.75)	−12.10 (7.64)	1.64 (3.24)	
No mapped mine	−0.22 (1.69)	2.55 (2.31)	−0.16 (1.37)	

Notes: Each entry reports equation (2) for the respondent's own occupation or current work, in percentage points, relative to 2000–05. Panel A uses every country: the first two rows use surveys to 2018 with the controls of Appendix Table B1; the third row uses all surveys with age controls, as in Appendix Table B2. Panel B repeats Appendix Table B2, column 1, in the ten countries surveyed both in 2015–18 and in 2019–24, for cells with and without a UCDP conflict event in 2019–24 (Sundberg and Melander, 2013) and with and without a mine on the satellite map of Tang and Werner (2023); cells with a mapped mine hold 6 percent of respondents. All regressions have cell and country-by-year effects. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B6—Statistics cited in the text

	Men		Women	
	manual work	agriculture	sales	working
Panel A: Change per unit of the price index at the interview dates, eight countries				
Boom: peak relative to 2000–05	6.4	−18.5	6.3	−9.3
Fall: peak minus after	20.8	−40.7	17.2	−8.9
p, fall equals boom	[0.01]	[0.02]	[0.07]	[0.95]
Panel B: Second rise minus after, ten countries				
Estimate	−0.2	2.2	−0.4	−1.1
Implied by the response during the boom	2.5	−6.2	2.6	−2.6
p, estimate equals it	[0.12]	[<0.01]	[0.03]	[0.44]
p, with the real price	[0.23]	[<0.01]	[0.08]	[0.65]
Implied by the response after the peak	9.3	−14.6	5.3	−2.8
p, estimate equals it	[<0.01]	[<0.01]	[<0.01]	[0.39]
Panel C: Inference for peak / after minus peak, eight countries				
Conley *p*, 100 km	[<0.01] [0.01]	[<0.01] [<0.01]	[0.03] [0.05]	[0.03] [0.40]
Conley *p*, 500 km	[<0.01] [0.01]	[<0.01] [<0.01]	[<0.01] [0.13]	[0.01] [0.37]
Shifted-map placebo *p*	[0.13] [0.17]	[0.05] [0.07]	[0.18] [0.32]	[0.25] [0.68]
Holm *p* across 24 cycle statistics	[0.02] [0.01]	[<0.01] [<0.01]	[0.10] [0.08]	[0.03] [1.00]
Panel D: Five countries in both comparisons (Mali, Nigeria, Rwanda, Senegal, Zambia)				
Peak	4.0	−19.5	7.6	
After minus peak	−5.8	9.2	−4.0	
Second rise minus after	−1.0	3.6	0.3	
Implied by the response after the peak	9.8	−14.7	6.3	
Panel E: Fieldwork timing and the local-currency real price, eight countries				
Windows by survey: peak / after minus peak	6.0 / −5.7	−16.5 / 11.0	5.5 / −4.2	−6.4 / 0.4
Country-year-month effects: peak / after minus peak	4.6 / −2.5	−12.5 / 8.1	5.6 / −2.7	−7.0 / 4.1
Local real price: boom / fall per unit	7.7 / 29.9	−22.2 / −58.5	7.5 / 23.9	−11.1 / −12.4
p, fall equals boom	[<0.01]	[0.01]	[0.05]	[0.90]
Second rise: implied by the boom in local prices	1.9	−4.7	1.9	−2.0
p, estimate equals it	[0.24]	[<0.01]	[0.09]	[0.67]
Ten countries: suitable × price / × price after 2019	9.3 / −1.4	−17.2 / 5.8	7.2 / −2.6	−4.3 / 2.3
Panel F: Men's manual work in the seven countries whose surveys code extraction				
Peak / after minus peak	6.9 / −5.3			

Notes: Percentage points in a fully gold-suitable cell. Panel A divides the peak coefficient of Appendix Table B1 by the change in the mean lagged price index at the interview dates from 2000–05 to the peak, and the change after the peak by the fall in that index from the peak to 2015–18; the *p*-value tests the difference with cell-clustered standard errors. Panel B compares the estimate of Appendix Table B2 with the change implied by scaling each response by the rise in the index from 2015–18 to 2019–24, in nominal dollars and deflated by US consumer prices. Panel C reports *p*-values for the peak and for after minus peak, separated by a space: Conley standard errors with a uniform kernel; the share of about 320 shifts of the suitability map by at least two degrees that give an estimate as large as the actual one; and Holm-adjusted *p*-values across the 24 cycle statistics of Appendix Table B1. Panels D and F use the specification of Appendix Table B1 in the samples named. In Panel E, windows by survey assign each respondent to the window of the first interview year of the survey; country-year-month effects replace the country-by-year effects and add the suitable share times calendar-month indicators; the local real price is the dollar gold price times the official exchange rate, divided by the consumer price index (World Bank), indexed to 2013 within each country and lagged one year; the last row uses the ten rise countries, all surveys, with the suitable share times a linear trend. *p*-values in brackets.

Table B7—Who is surveyed over the gold price cycle

	1990s (1)	Rise 2006–11 (2)	Peak 2012–14 (3)	After minus peak (4)	Mean (5)	Observations (6)
Household size	1.39***	0.63**	0.40	−0.04	5.85	387,424
	(0.35)	(0.28)	(0.27)	(0.10)		
Men 15–29 (% of members)	−0.2	0.9	1.0	0.4	12.6	387,424
	(0.9)	(0.7)	(0.7)	(0.5)		
Female (% of members)	0.5	−2.0**	−0.8	−0.1	50.1	387,424
	(0.8)	(0.8)	(0.7)	(0.5)		
Head with no schooling (%)	−2.1	−1.3	−3.3*	1.8	47.0	387,410
	(2.7)	(2.2)	(1.9)	(1.3)		
Women arrived <5 years ago (%)	5.7***	−0.1	−1.5	6.5**	19.5	256,459
	(2.2)	(2.8)	(3.7)	(3.0)		

Notes: Each row reports equation (2) in the eight countries surveyed both at the peak and after it, surveys to 2018, with cell and country-by-year effects and no controls. The first four rows use households from the household rosters; the last uses women aged 15 to 49, with an indicator equal to 100 if the woman has lived in the place for less than five years. Coefficients are the change in a fully gold-suitable cell relative to 2000 to 2005. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table B8—Child mortality in towns that predate the boom

	Lit at night in 1992–99				Urban cluster before 2006			
	Towns		Other cells		Towns		Other cells	
	Under five (1)	Infant (2)	Under five (3)	Infant (4)	Under five (5)	Infant (6)	Under five (7)	Infant (8)
Rise, 2006–11	−0.05	−0.27	−0.75	−0.74	0.25	0.06	−0.52	−0.69**
	(0.30)	(0.26)	(0.62)	(0.56)	(0.38)	(0.32)	(0.37)	(0.33)
Peak, 2012–14	0.70	0.32	−0.45	−0.39	1.03**	0.58	−0.03	−0.18
	(0.43)	(0.37)	(0.91)	(0.77)	(0.52)	(0.44)	(0.56)	(0.47)
After, 2015–18	1.01**	0.64	−1.07	−0.25	1.20**	0.78	0.01	0.15
	(0.46)	(0.41)	(1.04)	(0.85)	(0.61)	(0.55)	(0.60)	(0.50)
After minus peak	0.31	0.31	−0.62	0.15	0.18	0.20	0.04	0.34
	(0.36)	(0.31)	(0.79)	(0.59)	(0.48)	(0.44)	(0.45)	(0.35)
Mean	11.0	6.7	12.9	7.7	10.5	6.5	12.1	7.3
Births	1,608,991	1,608,991	339,165	339,165	1,013,257	1,013,257	934,899	934,899
Cells	2,573	2,573	1,899	1,899	858	858	3,614	3,614

Notes: Each column reports equation (2), suitable × window, for an indicator equal to 100 if the child died before age five (under five) or age one (infant), by year of birth, for births in the 15 years before interview and at least 60 months before it, in all countries, with cell-by-survey and country-by-birth-year effects and controls for the mother's age at birth and its square, the child's sex and twin birth. Columns 1 to 4 define towns as cells with positive mean harmonised night lights in 1992 to 1999; columns 5 to 8 as cells with at least one urban DHS cluster in a survey fielded before 2006. The mean is deaths per 100 births. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Online Appendix

OA1 The Survey File of Girard et al. (2025)

The survey file of Girard et al. (2025) covers 189 survey-years. Of these, 145 are in this build; the other 44, which hold 15 percent of the women in their file, are mostly malaria and AIDS indicator surveys, which this build excludes. In the shared survey-years, I match 97.6 percent of their women one to one on survey, year and month of interview, age and cell, and across surveys the number of women per cell correlates at a median of 0.994.

In Table OA1, I re-estimate their specification for the measure that counts the woman's or her partner's occupation. On the new build and their survey-years, manual work rises by 3.8 points per unit of the price index, against 2.8 on their file, extraction by 1.1 on both, and agriculture falls by 2.5 against 2.8 (rows 1 and 2). Services differ, at 0.8 against 3.0 points. The new build holds more women in the same survey-years, 1,154,443 against 869,054, and keeping one woman per household brings the count to 824,370 and the estimate for services to 1.4 points (row 3). Adding the surveys to 2018 that their file does not contain leaves the estimates close to row 2 (row 4).

Table OA1—Reproducing Girard et al. (2025) on the new survey build

	Manual (1)	Extraction (2)	Agriculture (3)	Services (4)	Women
Girard et al. file	2.84**	1.06	−2.77	3.02**	869,054
	(1.18)	(0.73)	(1.71)	(1.39)	
Same survey-years	3.82***	1.09**	−2.49	0.76	1,154,443
	(1.12)	(0.44)	(1.84)	(1.50)	
One woman per household	4.12***	1.16**	−2.55	1.42	824,370
	(1.24)	(0.47)	(1.85)	(1.56)	
All surveys to 2018	3.88***	1.08**	−2.48	1.18	1,177,619
	(1.09)	(0.43)	(1.83)	(1.49)	

Notes: Each entry is the coefficient on the suitable share times the lagged gold price index (2013 equal to one) for an indicator equal to 100 if the woman or her partner works in the sector, the outcome of Girard et al. (2025), in their specification: cell and country-by-year effects, temperature, crop suitability times crop prices, industrial gold times price, age and age squared, surveys to 2018. Sectors follow the DHS occupation groups of the woman's (v717) and her partner's (v705) occupation; extraction is manual work whose occupation label names mining or quarrying, in the surveys whose labels code it. The first row uses their survey file; rows 2 to 4 use the survey files assembled for this paper. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

OA2 Exposure within 10 km of Gold-Suitable Land

In Table OA2, I re-estimate Table 2 and Appendix Table B1 with exposure measured as the share of the cell within 10 km of gold-suitable land (see also Ghazarian and Khan,

2025). Across all countries, agriculture falls by 5.2 points per unit of the price index, against 4.9 in Table 2, and women's sales rise by 4.1 points, against 3.8. In the eight countries surveyed on both sides of the peak, men's manual work rises by 4.8 points at the peak and gives up 4.3 after it, men's farming falls by 12.5 points and recovers 8.6, and women's sales rise by 6.1 points and fall by 3.7.

Table OA2—Work with exposure within 10 km of gold-suitable land

	Working (1)	Manual (2)	Extraction (3)	Agriculture (4)	Sales (5)	Services (6)
Panel A: All adults						
Exposure × price, all countries	−2.27*	0.89	−0.04	−5.24***	3.06***	−0.94**
	(1.16)	(0.69)	(0.30)	(1.42)	(0.86)	(0.40)
Exposure × peak, fall countries	−6.16***	2.24**	0.77	−11.77***	4.93***	−1.45**
	(1.89)	(1.00)	(0.49)	(2.16)	(1.31)	(0.66)
After minus peak, fall countries	0.71	−2.10***	−0.81**	4.77***	−2.87***	0.00
	(1.38)	(0.77)	(0.38)	(1.67)	(0.97)	(0.70)
Mean of outcome, all countries	61.0	10.3	0.9	31.1	14.0	4.2
Mean of outcome, fall countries	63.6	10.1	0.9	29.6	19.7	4.2
Observations, all countries	1,691,736	1,657,666	1,116,355	1,657,666	1,657,666	1,657,666
Observations, fall countries	637,014	620,509	408,237	620,509	620,509	620,509
Panel B: Men						
Exposure × price, all countries	−1.23	1.13	−0.12	−5.11***	0.54	−0.39
	(1.42)	(0.95)	(0.53)	(1.53)	(0.65)	(0.53)
Exposure × peak, fall countries	−2.49	4.82***	0.99**	−12.50***	1.89	−0.44
	(2.76)	(1.50)	(0.41)	(3.01)	(1.21)	(0.67)
After minus peak, fall countries	−2.10	−4.26***	−0.60	8.64***	−1.08	−1.64**
	(1.70)	(1.22)	(0.47)	(1.96)	(0.75)	(0.68)
Mean of outcome, all countries	77.3	18.4	1.9	41.2	7.6	5.2
Mean of outcome, fall countries	79.0	19.0	1.3	40.8	10.0	4.6
Observations, all countries	474,271	475,389	344,150	475,389	475,389	475,389
Observations, fall countries	181,812	185,152	133,282	185,152	185,152	185,152
Panel C: Women						
Exposure × price, all countries	−2.65*	1.10	0.18	−5.22***	4.13***	−1.17**
	(1.42)	(0.77)	(0.31)	(1.64)	(1.14)	(0.48)
Exposure × peak, fall countries	−7.13***	1.17	0.75	−10.86***	6.12***	−1.86**
	(2.09)	(1.12)	(0.63)	(2.39)	(1.71)	(0.81)
After minus peak, fall countries	1.57	−0.79	−0.94*	2.57	−3.75***	0.82
	(1.64)	(0.92)	(0.51)	(1.87)	(1.35)	(0.87)
Mean of outcome, all countries	54.7	7.0	0.5	27.0	16.5	3.8
Mean of outcome, fall countries	57.4	6.3	0.7	24.8	23.8	4.0
Observations, all countries	1,217,450	1,182,257	772,198	1,182,257	1,182,257	1,182,257
Observations, fall countries	455,201	435,356	274,954	435,356	435,356	435,356

Notes: The first row of each panel reports equation (1) and the next two rows equation (2), with exposure equal to the share of the cell within 10 km of gold-suitable land in place of the suitable share. The first row uses all countries; the other two use the eight countries surveyed both at the peak and after it. Surveys to 2018, own occupations and current work from the men's and women's interviews, indicators equal to 100 or 0. All regressions control for temperature, the crop-price index, age and age squared, with cell and country-by-year effects; Panel A also controls for sex. Standard errors clustered by cell in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

OA3 Employment by Sector in the Censuses

In Table OA3, I estimate equation (1) on the IPUMS-International censuses (Minnesota Population Center, 2026), with the suitable share of each census unit in place of the cell's. No country has a census both at the peak and after it, so the censuses cannot follow the cycle. Thirteen countries have at least two rounds from 1985, in 1,097 districts or regions. Men's employment in mining rises by 0.8 points per unit of the price index, on a mean share of 1.8 percent, in line with the rise of extraction in the surveys. Agriculture does not fall: its share of workers rises by 2.8 points, and that of services falls by 3.7, and with country clusters neither estimate is statistically significant. The censuses classify workers by industry, not by occupation, and over districts and regions much larger than a cell, and a digger who also farms may be counted in agriculture.

Table OA3—Artisanal gold and employment by sector in the censuses

	Agriculture (1)	Mining (2)	Manufacturing (3)	Services (4)
All workers: suitable × price	2.82*	0.46	−0.18	−3.69**
	(1.50)	(0.29)	(0.49)	(1.44)
p, country clusters	[0.12]	[0.33]	[0.75]	[0.17]
Mean share (%)	45.2	1.3	8.6	44.3
Men: suitable × price	1.32	0.84**	−0.14	−3.18**
	(1.53)	(0.37)	(0.45)	(1.36)
p, country clusters	[0.46]	[0.28]	[0.77]	[0.27]
Mean share (%)	41.5	1.8	10.3	45.8
Women: suitable × price	3.67**	0.02	−0.03	−3.87**
	(1.69)	(0.22)	(0.67)	(1.55)
p, country clusters	[0.03]	[0.88]	[0.98]	[0.07]
Mean share (%)	51.6	0.5	5.8	41.8
Unit-rounds, all workers	3,115	3,115	3,115	3,115
Units	1,097	1,097	1,097	1,097
Countries	13	13	13	13

Notes: Stars use the unit-clustered standard errors in parentheses; the country-clustered p-values in brackets are larger and are the more conservative guide. Each entry reports equation (1) for the share of workers in the sector, in percent, in census units (districts where the census identifies them, otherwise regions) of the IPUMS-International censuses from 1985, in countries with at least two rounds. Exposure is the suitable share of the unit times the lagged gold price index (2013 equal to one). Services include trade. Unit and country-by-year effects, weighted by the number of workers. Standard errors clustered by unit in parentheses; p-values from country clusters with $t(G-1)$ critical values in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, from unit clusters.

OA4 Imports of Mining Machines and Mercury

In Figure OA1, I plot the window specification of equation (2) across African countries, and Table OA4 reports the estimates with bootstrap p-values. The outcome is the loga-

Table OA4—Imports of mining machines and mercury by country gold exposure

	Excavators (1)	Crushers (2)	Screens (3)	Loaders (4)	Mercury (5)	Road rollers (6)
1995–99	0.34	−1.11	−0.55	−0.84	0.30	0.51
	(0.86)	(0.83)	(0.68)	(0.74)	(0.50)	(0.83)
Rise, 2006–11	1.71***	0.51	−0.61	−0.19	1.30**	−0.36
	(0.63)	(0.46)	(0.77)	(0.63)	(0.53)	(0.81)
Peak, 2012–14	2.11**	1.33	0.19	−0.19	1.85**	0.06
	(1.02)	(1.10)	(1.19)	(0.96)	(0.91)	(1.05)
p, bootstrap	[0.04]	[0.23]	[0.87]	[0.87]	[0.04]	[0.95]
After, 2015–18	2.91**	1.98*	0.83	0.35	1.17	1.13
	(1.16)	(1.10)	(1.20)	(0.94)	(0.87)	(1.22)
Second rise, 2019–24	3.24***	2.25**	0.75	0.32	0.62	0.84
	(1.02)	(1.08)	(1.13)	(0.89)	(0.85)	(1.02)
After minus peak	0.80	0.65	0.63	0.53	−0.68	1.07*
	(0.85)	(0.75)	(0.56)	(0.50)	(0.78)	(0.63)
p, bootstrap	[0.33]	[0.42]	[0.27]	[0.31]	[0.36]	[0.11]
Second rise minus after	0.33	0.27	−0.08	−0.03	−0.54	−0.29
	(0.71)	(0.63)	(0.61)	(0.45)	(0.56)	(0.75)
p, bootstrap	[0.66]	[0.67]	[0.90]	[0.95]	[0.33]	[0.70]
Mean of outcome	7.48	6.96	5.96	7.95	1.17	6.78
Country-years	1,578	1,578	1,578	1,578	1,578	1,578
Countries	54	54	54	54	54	54

Notes: Each column regresses the logarithm of one plus the value of imports (thousand current USD) by African country and year, 1995 to 2024, from CEPII BACI (Gaulier and Zignago, 2010), on the country's gold-suitable share (the area-weighted mean of the cell share of equation (1), from 0 to 0.74) times indicators for the windows of equation (2), relative to 2000 to 2005, with country and year effects and the logarithm of total imports. HS 1992 codes: excavators with a revolving superstructure 842952; crushing and grinding machines 847420; sorting, screening, separating and washing machines 847410; front-end loaders 842951; mercury 280540; tamping machines and road rollers 842940. Standard errors clustered by country in parentheses; wild cluster restricted bootstrap *p*-values (999 Rademacher draws) in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$, from country-clustered standard errors.

rithm of one plus the value of the country's imports of each product in each year, 1995 to 2024, from CEPII BACI (Gaulier and Zignago, 2010), which reconciles the reports of importers and exporters. Exposure is the gold-suitable share of the country, the area-weighted mean of the cell shares, which ranges from 0 to 0.74 and is 0.42 in Ghana. The regressions include country and year effects and the logarithm of total imports; standard errors are clustered by country, for 54 countries. Excavators rise during the rise and at the peak and do not fall afterwards (column 1); a coefficient of 2.11 at the peak implies that a country at Ghana's share imported 2.4 times its imports of 2000 to 2005, relative to a country without gold-suitable land. Crushing machines follow the same path, imprecisely (column 2), while screening and washing machines and loaders do not respond (columns 3 and 4). Mercury rises during the rise and at the peak and falls back afterwards (column 5); exporter bans from 2011 and the Minamata Convention, in force from 2017, push the recorded trade down after the peak as well. Road rollers do not respond at the peak but rise after it (column 6). The estimates change little without South Africa, with quantities in place of values, or with exposure above the median as a binary indicator; without the control for total imports, road rollers rise at the peak as

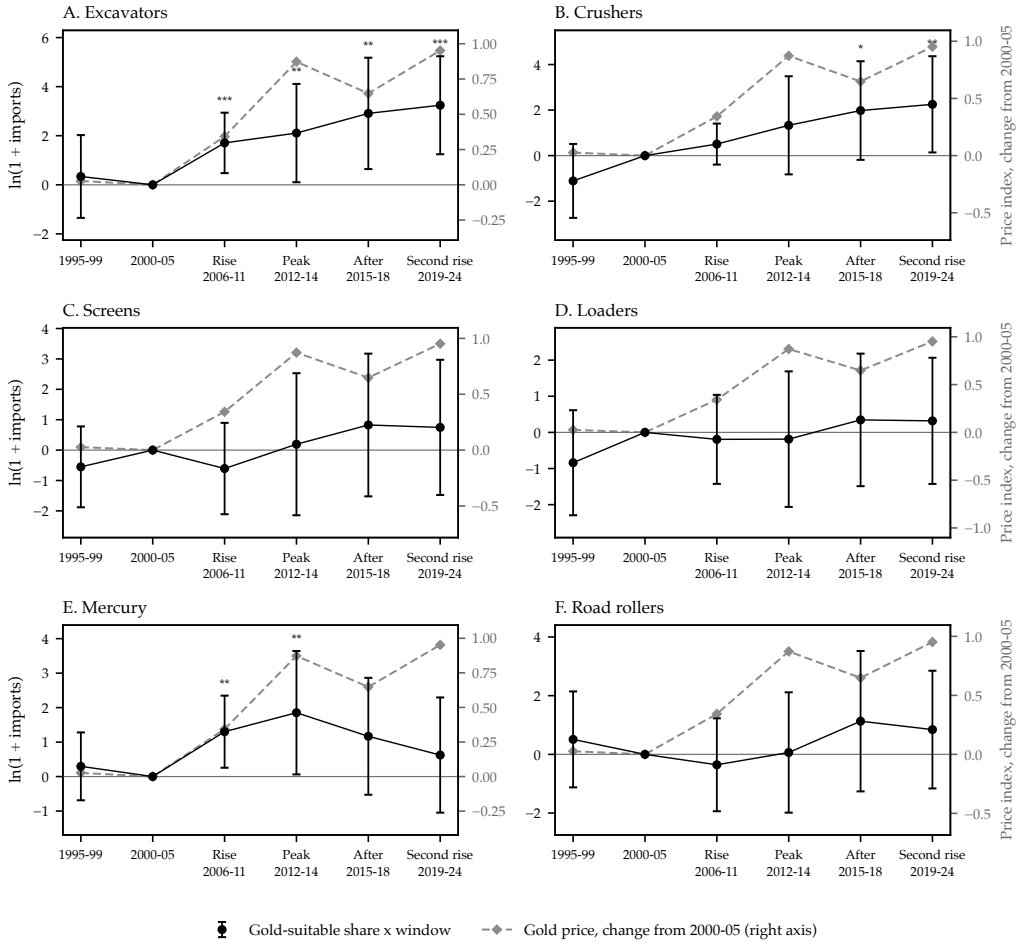


Figure OA1—Imports of mining machines and mercury by country gold exposure

Notes: Coefficients of the window specification of equation (2) across African countries, relative to 2000 to 2005: the logarithm of one plus the value of the country's imports of each product in each year, 1995 to 2024, from CEPII BACI (Gaulier and Zignago, 2010), on the country's gold-suitable share times indicators for each window, with country and year effects and the logarithm of total imports, for 54 countries; Table OA4 reports the estimates, bootstrap p-values and the HS codes. The dashed line (right axis) is the mean lagged gold price index in each window minus its mean in 2000 to 2005 (2013 equal to one): 0.03 in 1995 to 1999, 0.34 during the rise, 0.87 at the peak, 0.65 after it and 0.95 in the second rise. Bars are 95 percent confidence intervals from standard errors clustered by country. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

well.