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Productivity Gains and Work Conditions in Coercive Labor Markets: Experimental Evidence from the Bangladesh Brick Sector

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ABSTRACT

Productivity growth in competitive labor markets can improve worker welfare over time through higher wages or better conditions, but it is unclear if productivity gains benefit workers in coercive labor markets (where force or threats shape employment). We examine this issue in the Bangladesh brick sector using a randomized trial that introduced a more efficient production method. Despite large productivity improvements, we find no reduction in (high) rates of labor trafficking or child labor. These findings suggest that in the short-term, productivity growth alone may be insufficient to improve work conditions in coercive settings.

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1 Introduction

Productivity growth is central to theories of economic development (Solow 1956; Romer 1990; Lucas 1988; Acemoglu 2009; Jones et al. 2013). In these accounts, higher productivity improves worker welfare, in part through improvements in wages and other aspects of work. Such reasoning is compelling in settings with competitive labor markets—firms face incentives to share gains with workers through higher wages or better conditions. However, improvements in productivity may not improve worker welfare in non-competitive labor markets, such as those with coercive labor practices.

Coercive labor (including labor trafficking[1] and forced labor) as well as child labor are prevalent world-wide, particularly in lower-income countries. Obtaining accurate numbers of these often hidden phenomena is difficult, but at least 27 million people around the world are thought to be victims of forced labor (International Labour Organization 2022; Walk Free 2023), and more than 137 million children are engaged in child labor, with 54 million of them working under hazardous conditions (International Labor Organization and UNICEF 2025). A better understanding of whether or not productivity gains improve work conditions in coercive labor markets is critical for public policy in environments with limited state capacity to enforce labor regulations. However, theoretical models are ambiguous—productivity improvements could decrease or increase coercive labor, underscoring an important role for empirical analyses (Acemoglu et al. 2011; Ashraf et al. 2024; Domar 1970).[2] Moreover, empirical studies of the effects of productivity improvements on coercive labor are rare and based on observational, typically historical, analyses (Naidu et al. 2013; Ashraf et al. 2024; Sharma et al. 2024).[3]

[1] As defined in international law, labor trafficking (a form of human trafficking) generally occurs when a victim is compelled to provide labor through the use of force, fraud, or coercion, which can be subtle or overt, physical or psychological (United Nations 2000).

[2] If productivity raises the return to worker effort relative to the marginal cost of coercion, employers may increase coercion. Alternatively, productivity increases may decrease coercion by improving workers' outside options (Acemoglu et al. 2011; Ashraf et al. 2024; Domar 1970).

[3] Naidu et al. 2013 show that in 19th century Britain, the introduction of more productive technology sometimes increased coercive contract enforcement (to ensure stable labor supply during periods of peak demand). Ashraf et al. 2024 show that during Prussian industrialization, counties with greater elite-owned physical capital experienced faster serf emancipation. In recent experimental work (an exception in the literature). Sharma et al. 2024 show that

In this project, we experimentally test if a productivity-enhancing technology affects short-term work conditions in a setting with high rates of coercive labor and child labor—brick kilns in Bangladesh. Coercive labor is pervasive in global brick production (US Department of Labor 2022) and has been documented extensively in Bangladesh.[4] More generally, work at brick kilns across South Asia is often characterized by debt bondage, excessive work hours (12-16 hour work days), and hazardous or degrading work conditions (including lack of personal protective equipment (PPE) and exposure to toxic chemicals) (International Labour Organization 2017). Many workers are seasonal migrants, often bringing their families with them to kilns, leading to substantial child labor as well (Van de Glind 2010; Larmar et al. 2017; Daly et al. 2020; Ahad et al. 2021).[5]

Our specific context is a large-scale effort to introduce a more productive and energy efficient brick production method across six districts in Bangladesh (Brooks et al. 2025). Through relatively modest changes to coal feeding and brick stacking practices, the improved method reduces spending on coal and increases quality-adjusted output (by increasing the fraction of high-quality bricks, which command a higher price) (Brooks et al. 2025). Building on this work originally designed to study productivity improvements and emissions, we extended our experiment to also study if this more productive manufacturing method influences coercive labor and child labor practices. The trial had three arms: (1) a measurement-only control group (in which we only collected data), (2) a technical intervention group, and (3) a technical+incentive information group. The technical intervention focused on improving productivity, providing information, training, and technical support to kiln owners (along with their managers and workers) to adopt a package of improved operational practices. Because these changes to kiln operations also required important changes in worker routines, the technical+incentive information arm also provided explicit information to kiln owners

alleviating liquidity constraints for micro-contractors in the Indian construction sector did not reduce forced labor.

[4]Global prevalence of coercive labor in brick production is difficult to estimate, but some estimate prevalence rates of bonded labor of 60% or higher (Kara 2014). Within Bangladesh, see Das et al. 2017 for information on work conditions at brick kilns.

[5]Bangladesh's Labour Act of 2006 formally outlawed labor for children under the age of 14 and hazardous labor (which can include work at brick kilns) for children under 18. However, due to the informal nature of most brick production, this law is not strongly enforced at brick kilns (Ministry of Labor and Employment 2010).

about positively incentivizing workers for better adoption of these operational improvements—information which could also improve work conditions independent of any productivity gains.

We study the short-term impact of these interventions on both adult labor trafficking and child labor (as well as work conditions generally) through privately conducted surveys with kiln workers.[6] We measure work conditions and labor trafficking indicators based on U.S. Department of State Office to Monitor and Combat Trafficking in Persons (TIP Office) criteria, several of which were explicitly addressed by the incentive information (*Trafficking Victims Protection Act* 2000; Okech et al. 2020; Okech et al. 2025). Importantly, these also include outcomes which can change within a single brick-firing season.[7] Although we did not interview children directly, we collected information about child labor as well from adult workers at each kiln.[8]

Despite significant productivity gains, we do not find corresponding short-term improvements in work conditions (including the prevalence of labor trafficking and child labor as well as other measures of welfare like wages and health). Taken together, our results suggest that in coercive labor markets, productivity growth alone may be insufficient to improve worker welfare, at least in the short-run.

2 Context, Data, and Methods

2.1 Context

Bangladesh is the fourth-largest producer of bricks globally, with high demand for fired clay bricks driven by rapid urbanization and infrastructure investment (Wescott 2009). Almost 8,000 traditional informal "zigzag" brick kilns operate across the country, supplying more than 90% of

[6]Our study is partial equilibrium in nature, examining short-term effects. Therefore, it does not provide evidence on potential longer-term or general equilibrium effects that might originate through labor market-wide changes in wages, mobility, or outside options.

[7]Workers are often paid advances at the recruitment stage, but they are also paid in cash (including discretionary bonuses) during the season as well. Both pay, and a wide range of amenities that are central to work conditions, can reasonably be changed (based on managerial discretion) mid-season.

[8]Child labor is defined as any work by a child under the age of 18 which is hazardous, dangerous, or interferes with education. It also includes any child working under the age of 14, regardless of job (International Labour Organization 1973; International Labour Organization 1999).

domestic consumption (Eil et al. 2020a). We conducted our study in Bangladesh's Khulna Division, which contains about 700 zigzag kilns operating across 10 districts (according to government data) and 532 zigzag kilns in the 6 districts where we worked. The Bangladesh Brick Manufacturers Owners Association (BBMOA) provided us with a list of 410 kilns from these districts, implying that the 246 kilns in our study (see Section 2.2) account for nearly half of all zigzag kilns in study districts. Kilns generally draw workers from nearby–in our data, about 50% of workers were recruited from the surrounding 10 km, and more than two-thirds were recruited from the surrounding 50 km (see Appendix Figure A2).

Work at brick kilns in Bangladesh and across South Asia is characterized by debt bondage, excessive hours, and hazardous conditions (International Labour Organization 2017). Labor arrangements are facilitated by the *sardar* system, with labor recruiters (*sardars*) also acting as on-site supervisors and intermediaries between kiln owners and workers. *Sardars* often recruit workers seasonally from their same home communities and use advance payments and informal enforcement to create debt bondage and limit worker mobility (Guérin et al. 2007; Ercelawn et al. 2004; Gupta 2003). These arrangements severely constrain workers' ability to seek alternative employment or negotiate better terms once a brick production season begins. The ability of kilns to replace workers mid-season varies by worker type and specialization (see Appendix Section A5 for more detail on worker roles).

Although public perceptions of human trafficking (including labor trafficking) are often shaped by media depictions of its most egregious forms, potentially creating the impression that human trafficking only occurs in instances of physical violence and restraint, a wider range of conditions meet the formal definition of trafficking (*Trafficking Victims Protection Act* 2000). Qualitatively, as we found in our initial planning work, typical cases of labor trafficking in our context involve workers taking advance payments from *sardars* to secure employment for a season. Once onsite, workers find conditions harsh (sometimes harsher than expected or different than disclosed in advance), wages withheld to repay debt from advances, and freedom to leave worksites constrained by credible threats of retaliation (including against workers' families). Workers are effectively

trapped by debt bondage, and in more extreme circumstances, physical restraint also occurs. Our measures of labor trafficking are designed to capture the entire spectrum of coercive conditions.

2.2 Experimental Design

We conducted our study in six districts of the Khulna Division of Bangladesh (Chuadanga, Jashore, Jhenaidah, Khulna, Kushtia, and Narail Districts—see Appendix Figure A1). To identify kilns for inclusion, we first contacted the Brick Manufacturing Owners Association in each district, compiling a list of 410 zigzag kilns (ZZK)[9] from which we aimed to enroll 300 kilns in the trial (based on power calculations and logistical considerations). We collected baseline data from an initial sample of 328 kilns. Due to high coal prices in 2022, some kilns in our initial sample switched to exclusive firewood use, a fuel source for which our technical intervention is not suitable, and some kilns also did not operate during that season. We therefore also enrolled an additional 29 kilns in Jashore District, resulting in a total initial sample of 357 kilns.

We randomly assigned study kilns to experimental arms, stratifying assignment both by district and by quality of bricks—a summary proxy measure of kiln productivity—produced during the previous season (above or below median share of the highest quality ("class 1") bricks).[10] Using this approach, we generated 1,000 random allocation sets, and for actual treatment assignment, we chose the allocation that maximized the sum of the p-values of the t-tests for kiln characteristics and for which none of the individual t-tests between arms was statistically significant at the 5% level (Kasy 2016).[11] After randomization, we discovered that 63 kilns were ineligible for treatment (due

[9] Zigzag kilns are a type of traditional coal-fired brick kiln prevalent in the informal sector in Bangladesh. They are considered "environmentally friendly" by the government and represent 70% of all kilns in the country (Brooks et al. 2024)

[10] "Class 1" bricks must have a "minimum compressive strength of 3,000 pounds per square inch, maximum water absorption of 20% dry weight after five hours of soaking in water, minimum weight of 3.5 kg per brick and the dimensions of 240 mm x 115 mm x 70 mm ... uniformly burnt, homogeneous in texture, uniform in color, free from cracks, nodules of free lime and other flaws, have plane rectangular faces with parallel sides and sharp straight right-angled edges" (Eil et al. 2020b). "Class 2" bricks and lower relate to bricks that are of non-uniform colors, less uniformly burnt, and with deformed shapes or surface cracks (Eil et al. 2020b).

[11] Specifically, t-tests were done using the following variables: owner experience, owner education, existence of additional owners, knowledge of pilot intervention in Jashore, personal interaction with pilot kilns in Jashore, year of ZZK adoption, location, proximity to water, number of bricks fired in previous year, percent Class 1 bricks in the preceding year, production costs per thousand bricks, number of workers in each kiln job, and average weight of

either to exclusive firewood combustion or non-operation during 2022). Some kilns were also no longer operating or did not participate in the survey when endline surveys were collected, yielding a final sample of 246 kilns.[12] Our final sample was powered to detect changes of 18% with 80% power (at the 5% significance level) in counts of labor trafficking indicators. Appendix Table A2 shows evidence of balance on observable baseline kiln characteristics in this final study sample, consistent with attrition uncorrelated with treatment assignment.

Our three randomly assigned study arms include: (1) a measurement-only control group, (2) a technical intervention group focused on improving kiln productivity, and (3) a technical+incentive information group receiving both the technical intervention and information about positive worker incentives to encourage adoption of the technical intervention.

Kilns assigned to the technical intervention arm received information, training, and technical support for making technical and operational improvements to their ZZKs.[13] The technical intervention also highlighted the financial benefits of these improvements, directly addressing kiln owners' uncertainty about economic returns. Because the intervention decreased coal use and costs, and increased brick quality and estimated revenue (Brooks et al. 2025), we explicitly test if these improvements in productivity led to improved work conditions (a form of worker compensation, broadly defined).

Because the technical intervention required changes in worker routines, the technical+incentive information arm also provided guidance to kiln owners on using positive incentives to encourage adoption.[14] We shared strategies to motivate workers including financial incentives (wages,

fired bricks.

[12] Among these kilns, 3 declined to participate in the study, 9 were closed by the government, and 36 ceased production early because of Ramadan (and so were not surveyed). See Appendix Figure A3 for more information. We note that this sample differs from the 276 in Brooks et al. 2025 due to the timing of the worker survey and the kilns which were operating.

[13] These improvements included: changing brick stacking patterns (air flows in a "zig-zag" pattern when bricks are stacked less densely) to improve airflow and combustion; more frequent coal feeding with smaller quantities of coal to improve combustion; closing kiln gates to reduce heat loss; creating a thicker ash layer to improve insulation; and using sawdust or other biomass in front chambers to increase combustion efficiency (see Appendix Section A3 and Brooks et al. 2025). Training also included separate sessions for firing and loading *sardars* followed by on-site assistance.

[14] Literature on the impact of anti-trafficking information campaigns is largely limited to campaigns targeting high-risk workers and the general public and focused on knowledge outcomes (see Henderson et al. 2024; Tjaden et al. 2021; Zimmerman et al. 2021). Boittin et al. 2025 evaluate the impact of informational interventions targeting both, finding

bonuses, return bonuses) and non-financial amenities (better work conditions, improved housing, protective equipment, school facilities for children), see Appendix A4 for details.[15] These examples were directly informed by the experience of other kiln owners successfully operating ZZKs, our own pilot study in Jashore district (Brooks et al. 2024), and the management literature (Atkin et al. 2017)—including evidence from brick kilns in Nepal (Bajracharya et al. 2022) and garment factories in Bangladesh (Saha et al. 2015).[16] We conducted two follow-up visits with technical+incentive information arm kilns to reinforce this information. This intervention tests if, in addition to the technical intervention and any gains in kiln productivity, providing information about the ability of positive worker incentives to increase worker productivity (and hence profitability) leads owners to improve work conditions.

Appendix Figure A4 shows the timeline of our study activities during the 2022-2023 brick production season.

2.3 Data Collection, Measurement, and Balance

To measure work conditions, we conducted a detailed survey in private with workers at brick kilns between March and May 2023.[17] In accordance with local IRB guidelines, research staff

that while knowledge in the general public improved, it did not among targeted migrant domestic workers.

[15] "Bonus" refers to any money paid over the agreed upon piece rate or salary, often at or near the end of the season. These are often conditional on reaching some quantity or quality of bricks produced. On the other hand, "Return bonus" refers to bonuses paid to workers who return to the same kiln in the following season.

[16] Other examples include: Liu et al. 2019, who show that Bangladeshi garment factories with better work conditions are considered more trustworthy by retailers; Luken et al. 2005, who show that targeted policies to meet corporate social responsibility requirements can improve short term profitability and long-term competitiveness; Adhvaryu et al. 2020, who show that improving work conditions (with more efficient lights that decrease indoor temperature on hot days) led to sizable energy savings and productivity gains; Harrison et al. 2010, who show that anti-sweatshop activism increased wages for workers, although these effects may have been offset by lower profits and greater risk of plant closure; and Verhoogen 2008, who shows that in Mexico's manufacturing sector, more productive firms can produce higher quality goods, and in turn pay higher wages to retain a high quality workforce.

[17] Our team addressed the complex issue of referring individuals (both children and adults) who are, or might be, suffering from harm to appropriate services in an environment in which trustworthy and reliable service providers are scarce. To develop our approach, we sought guidance from other researchers, non-governmental organizations (NGOs), and funding bodies involved in anti-trafficking work who have grappled with these challenges. This included qualitative interviews with workers, owners, and key informants in the area. The consensus from our planning work was that there is no universally recognized protocol for referrals and support, especially in the context of work at brick kilns which employ many seasonal migrant workers (the International Labor Organization (ILO) is currently developing guidelines for such circumstances). Given a lack of reliable support services in our study area, we decided to provide participants in our study with information about government hotlines, specifically advising about

first secured verbal permission from kiln owners, managers, and sardars before approaching brick workers at kilns for participation. Eligible workers were then informed about the purpose of the survey, what participation involved, the voluntary nature of participation, and their right to decline or withdraw at any time. Consent was obtained before survey administration, using approved consent forms available in Bangla. At each study kiln, we interviewed 6 individuals (5 workers and 1 *sardar*, or recruiter and on-site supervisor who act as an intermediary between kiln owners and workers), focusing on four types of workers: brick molders (who shape clay to form "green" bricks before they are fired), brick loaders (who load "green" bricks into kilns), brick unloaders (who remove fired bricks from kilns), and firemen (who feed coal into kilns to bake bricks).[18] Through these surveys, we collected detailed information about wages, work conditions, migration status, occupational hazards, and the age range of workers at kilns.

Our survey instrument also included a multi-indicator human trafficking measurement tool developed by the U.S. Department of State through its Prevalence Reduction Innovation Forum (PRIF) (Okech et al. 2020; Okech et al. 2025).[19] This measurement tool consists of 39 indicators of human trafficking across seven domains (recruitment, employment practices, control over personal life and property, degrading conditions, freedom of movement, debt and dependency, and violence, see Appendix Table A1). Following Okech et al. 2025, we classify indicators by strength as either "strong" (14 indicators) or "medium" (21 indicators). Additionally, we refer to 4 other strong indicators in Okech et al. 2025 as "extreme" because, unlike the others, each of these individually constitutes trafficking.[20] As depicted in Figure 1, a worker is determined to be trafficked if the

109 telephone resources, and for rescue from worksites or other emergencies, 999 telephone resources. During our interviews with workers, we received no direct requests for assistance.

[18]Because we conducted our worker surveys near the end of the firing season, some brick molders had already left kilns for the season (molding bricks out of clay is the first step in the brick production process). To account for this, we developed a secondary sampling method. See Appendix Section A2 for more information about this method.

[19]This method draws on the definition of human trafficking adopted by the United Nations Convention against Transnational Organized Crime's Protocol to Prevent, Suppress and Punish Trafficking in Persons Especially Women and Children (Palermo Protocol) as well as the United States' Trafficking Victims Protection Act (*Trafficking Victims Protection Act* 2000). Labor trafficking in particular includes both debt bondage and forced labor. Debt bondage is defined as labor demanded as a means of servicing a loan or debt when the labor is undervalued and the debt is ill-defined or ever-increasing such that an individual cannot reasonably "repay" the debt. Forced labor is defined as labor coerced by means of violence or the threat of violence, restricted movement or confinement, or threats of punishment (*Trafficking Victims Protection Act* 2000).

[20]Following survey pre-testing and qualitative work, our team determined that a subset of indicators were both un-

combination of indicators they experience meets one of three thresholds: 1) Threshold 1 is met if any one of four extreme indicators are experienced (no freedom of movement/communication, hereditary bonded labor, being sold for labor or sex, or being made to work in commercial sex); 2) Threshold 2 is met if two or more strong indicators from two different domains are experienced (e.g., coercive or deceptive recruitment, confiscation of documents or identification, etc.); and 3) Threshold 3 is met if at least one strong and three medium indicators are experienced (e.g., debt imposed without consent along with the absence of a formal contract, wages withheld and not guaranteed, and constant surveillance at work). Throughout the rest of the paper, we define "prevalence" as the occurrence of labor trafficking using this indicator-based definition. Although trafficking indicators are standard measures established by the TIP Office, subjective judgment is required to measure some indicators. Because we are not aware of guidance for these cases, we present results using a more "conservative" coding, but the Appendix also shows equivalent results using a more "liberal" coding.[21] Appendix Section A1 gives a complete description of our human trafficking classification methodology.

The sensitive nature of the indicators suggests that misreporting could also be a concern.[22] To the extent that any misreporting is independent of treatment assignment (which is plausible), its impact on our treatment effect estimates depends on the nature of the outcome variable. For a continuously distributed outcome (with unbounded support), our estimates would be consistent and unbiased, but estimated with reduced precision. Alternatively, for a binary dependent variable (with limited misclassification), treatment effects estimated using Ordinary Least Squares (OLS)

likely to be observed in our target population and were also likely to cause discomfort among respondents (for example, questions about sexual violence and hereditary slavery). These indicators were excluded from the survey; see Appendix Section A1 and Appendix Table A1 for a complete list of indicators and clarification of the ones we collected.

[21] For example, for degrading conditions, indicator 4 (see Appendix Section A1), the liberal coding requires that the housing provided at the kiln site harms health (no sanitation, etc.), while the conservative coding also requires that the individual was forced to live in employer-provided housing.

[22] Workers fearing retaliation may be reluctant to report adverse conditions, and thus under-report exploitative conditions. Under-reporting is generally the central concern in measuring coercive labor at brick kilns in a variety of countries (International Labour Organization 2012; International Labour Organization 2017). However, if workers perceived the presence of enumerators as an opportunity to advocate for improvements in work conditions, they could also potentially over-report exploitative conditions as well.

would be attenuated toward zero.[23]

Our analysis has four pre-specified primary outcomes. The first outcome is a weighted count of labor trafficking indicators at the kiln level. To account for differences in severity among medium, strong, and extreme indicators (as specified by TIP Office guidelines), we assign medium indicators two-thirds of the weight of strong and extreme indicators (as stated in our pre-analysis plan). Second, again at the kiln level, we code a count of the number of individual trafficking indicators that were explicitly linked to the incentive information intervention (there are three in total).[24] Third, we code prevalence of labor trafficking at the kiln level using combinations of indicators that constitute trafficking according to guidelines established by the TIP Office (Okech et al. 2020; Okech et al. 2025). Fourth, we measure child labor at the kiln level using reports by surveyed adult workers, each of whom was asked about the presence of children working at kilns (and these children's approximate ages). We consider any child under age 14 who was working and any child age 17 or younger who was working under hazardous conditions (conditions at brick kilns are generally hazardous) to be child labor.[25] To better distinguish between the presence of these practices at a kiln and the extent (or prevalence) of these practices, we analyze outcomes at both the kiln level (whether or not a practice occurred at a kiln) and the worker level (how many workers interviewed at a kiln reported a practice).

We use October 2022 baseline data collected on kilns to demonstrate balance on observable kiln characteristics (given that we did not conduct a baseline worker survey) (Appendix Table A2), and we also demonstrate balance using time-invariant worker characteristics (Appendix Table A3).

[23] See Hausman 2001 for a general discussion of estimation with measurement error in the dependent variable.

[24] Specifically, these are: being made to be available day and night without adequate compensation outside of the scope of the work agreement; performing hazardous and/or arduous services without proper protective gear; and living in degrading conditions (e.g. housing or shelter is unclean, provides no privacy, or is otherwise insufficient in a way that harms health).

[25] We use the definition of hazardous conditions from the Worst Forms of Child Labor Convention of 1999: "Work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of children." Survey respondents are coded as observing child labor if they report that their own child works at the kiln or that at least one child under 18 works on their team at the kiln. Although the definition of child labor that we adopt requires that children ages 15-17 be working under "hazardous" conditions, given the universal lack of personal protective equipment (PPE) that we find among surveyed workers at study kilns along with prior research on children in brick kilns Joshi et al. 2013; Zakar et al. 2015; Larmar et al. 2017, we consider all jobs at study kilns to qualify as "hazardous." This definition of child labor is also generally consistent with the Government of Bangladesh's definition.

Appendix Table A4 presents descriptive statistics from our worker survey.

2.4 Estimation

We estimate Intention-to-Treat (ITT) effects of the interventions on our four primary outcomes. Specifically, we estimate ITT effects for each treatment arm using the following basic framework:

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 I_i + \gamma_s + \epsilon_i \tag{1}$$

where Y_i is an outcome of interest for kiln (or worker) i, T_i is a binary indicator for assignment to the technical intervention arm, I_i is a binary indicator for assignment to the technical+incentive information intervention arm, and γ_s are randomization strata fixed effects. The coefficients for each treatment indicator (β_1 and β_2) capture the ITT effect of assignment to the treatment arms on each of the outcomes relative to the control arm. For worker-level outcomes, we compute heteroskedasticity-robust standard errors clustered at the kiln level, and for kiln-level outcomes, we compute heteroskedasticity-robust standard errors. If either of our randomized interventions improves the productivity of brick kilns, this ITT estimation framework then allows us to study how they also directly lead to changes in labor conditions as well.[26]

3 Results

In this section, we present results that analyze the impact of our interventions on coercive labor practices, child labor, and other work conditions. We report detailed estimates of the impact of the technical intervention elsewhere (Brooks et al. 2025) and include key findings on adoption of the technical intervention, fuel use and spending, brick quality, and other input costs in Appendix Tables A6-A7. For context, the technical intervention decreased fuel costs by 9.6% and increased

[26] We note that we prespecified an IV analysis, in which we use random assignment as an instrument for kilns adopting the technical intervention and estimate it using two-stage least squares. This prespecified IV analysis was intended for the kiln efficiency outcomes and the results are presented in Brooks et al. 2025. This analysis is not included here because the exclusion restriction may not hold in the case of the trafficking outcomes. In fact, the incentive information treatment may affect them directly, independent of adoption of the technical intervention.

brick quality by 8.1% relative to the control group. These effects did not differ significantly between the two treatment groups and there were no significant changes in kiln costs.

3.1 Prevalence of Trafficking Indicators, Labor Trafficking, and Child Labor

Figure 2 shows the prevalence of individual trafficking indicators at study kilns. Overwhelmingly, workers report a lack of PPE. A large majority of workers (70%) do so using a conservative coding (and all workers (100%) do so using a liberal coding, as shown in Appendix Figure A5). Lack of PPE at brick kilns commonly leads to burns, head injuries, eye irritation, and smoke inhalation (Shaikh et al. 2012; Sanjel et al. 2016; Das et al. 2017). 71% of workers also report that they do not have a formal labor contract.[27] 42% of workers say that they have limited freedom of movement or communication, conditions often implying inability to leave a worksite voluntarily (and 5% report that they have no freedom of movement or communication). Other trafficking indicators reported less commonly by workers include wages or benefit withholding (11.8%), deceptive or coercive recruitment (6.4% and 2.8%, respectively), constant surveillance of personal space (3.7%), and violence against other workers or people about whom they care (7.0% and 1.9%, respectively). Appendix Figures A6-A8 show the corresponding distributions of trafficking indicators by study arm.[28]

We next apply PRIF definitions to work conditions to measure the prevalence of labor trafficking (Okech et al. 2025). Figure 3 shows the share of study kilns by number of surveyed workers (out of 6) who were classified as trafficked (and Appendix Figure A9 shows this using both liberal and conservative codings). At half of kilns (49.6%), at least 1 worker out of 6 meets the definition of labor trafficking. Across all surveyed workers, the average number of trafficked workers per

[27] Although measurement differences prevent direct comparisons, the Bangladesh Labor Force Survey reports the share of workers across all sectors in Bangladesh lacking formal labor contracts to be 84.9% in 2022 (Bangladesh Bureau of Statistics 2023).

[28] We note that although a majority of surveyed workers were in debt to their employers (70.3%), few workers described the debt in a way consistent with trafficking indicators. Only 0.5% report that they had not agreed to the debt and 0.1% considered their debt to be 'high or increasing.'

kiln (out of 6 workers) is about 1.1 worker per kiln—a trafficking rate of roughly 20%.

Figure 4 presents results for the prevalence of any child labor (shown in blue), showing that more than 70% of kilns in our sample use child labor according to reports by adult workers. The average number of workers per kiln reporting child labor is about 1.6 (out of 5). We present results for the youngest group of children (under age 14) in orange on Figure 4. In about 20% of kilns, at least one worker reported seeing children under the age of 14 working, and the average number of workers per kiln reporting child labor under age 14 is about 0.3 (a prevalence rate of about 5%). Taken together, Figure 4 implies that most of the child labor that we observe is concentrated among children ages 14-17.

3.2 Experimental ITT Estimates for Labor Trafficking, Child Labor, and Incentivized Work Conditions

3.2.a Labor Trafficking Indicators and Prevalence

Columns 1-4 in Table 1 show ITT estimates from Equation 1 for the effect of the technical and technical+incentive information interventions on the number of all trafficking indicators and also the number of indicators targeted by the incentive information intervention, using conservative codings. We measure these outcomes both at the worker level (the number of indicators each individual worker experiences) and at the kiln level (the number of indicators experienced by at least one surveyed worker at the kiln). See Columns 1-4 in Appendix Table A5 for results using liberal codings and Appendix Figure A10 for results using a range of alternative weights for the medium indicators. Our results are generally insensitive to these choices. As the table shows, neither intervention significantly reduced the number of trafficking indicators, either at the worker or at the kiln level. We also conducted equivalence tests using a Two One-Sided t-Tests (TOST) procedure (Lakens 2017), finding that we can rule out reductions in labor trafficking indicator counts of 16-17% ($p < 0.05$), or standardized effect sizes of 0.25-0.27.

Columns 5 and 6 in Table 1 repeat this analysis for prevalence of labor trafficking. This out-

come is also measured at the worker level (whether or not a given individual is classified as trafficked) and at the kiln (whether or not *any* worker at the kiln is classified as trafficked). We find little evidence of statistically significant reductions, both at the worker and kiln level, using conservative coding (see Appendix Table A5 Columns 5-6 for the comparable results using liberal coding).

Overall, there is little evidence that our interventions reduced either the number of trafficking indicators that workers experienced or the share of workers meeting the trafficking threshold. ITT estimates for both of our interventions are statistically insignificant for the outcomes that we study, and they are sufficiently precise to rule out socially meaningful effects.[29] Although our study focuses on short-run partial equilibrium effects, these results stand in contrast to the common empirical finding in non-coercive labor markets that productivity gains translate into gains in worker welfare through higher wages and better living standards (as implied by standard growth models Lucas 1988; Romer 1990).

3.2.b Child Labor Prevalence

We also examine how our experimental interventions influenced child labor at brick kilns. Table 2 reports ITT estimates from Equation 1 for three distinct outcomes. First, we measure its presence at a kiln using a kiln-level indicator for whether or not any surveyed worker reported observing child labor at a given kiln. Second, to measure its prevalence, we use two individual-level outcomes: a binary variable for whether or not a worker personally observed child labor, and a continuous measure reflecting the share of children on that worker's team.[30] The first row of the table shows that we find no evidence that the technical intervention alone reduced child labor, either among younger children (under age 14) or all children present at kilns. By contrast, the second row shows some suggestive evidence that the technical+incentive information intervention may have reduced work among all children at kilns. However, after implementing our pre-specified

[29] Although our pre-analysis plan includes a correction for multiple hypothesis testing following Anderson 2008 and using the Benjamini-Krieger-Yekutieli (Benjamini et al. 2006) sharpened two-stage procedure, we do not make this correction for labor trafficking indicators or cases given that the uncorrected estimates are statistically insignificant.

[30] The share of child workers in each respondent's team was not a pre-specified outcome

multiple hypothesis test adjustments, the resulting adjusted p-values (shown in square brackets) are statistically insignificant at conventional levels.[31] We therefore do not strongly interpret these results to provide clear evidence of a meaningful decline in child labor.

3.2.c Other Work Conditions

Although not pre-specified, we also study how work conditions more broadly (beyond labor trafficking and child labor) may have changed in response to productivity gains. Focusing on specific worker amenities explicitly highlighted as part of the technical+incentive information arm script (see Appendix Section A4), Figure 5 shows ITT estimates for individual amenities from Equation 1. In general, these estimates are statistically indistinguishable from zero, and they are also similar in both the technical and technical+incentive information groups as well. Overall, they suggest little improvement across a wide range of amenities, consistent with what owners also reported (Brooks et al. 2025).

Table 3 shows estimates for worker wages and health outcomes. It suggests that wages paid to kiln workers did not rise despite an increase in the return to worker effort (an implied increase in the marginal revenue product of labor). It also reports results for respiratory health, workplace injuries, and mental health conditions (anxiety and depression, measured using clinically-validated GAD-7 and PHQ-9 questionnaires), showing that although respiratory symptoms, workplace injuries, anxiety, and depression are highly prevalent, none declined significantly as a result of our interventions.[32]

[31] In our pre-analysis plan, we pre-specified evaluating four outcomes jointly following Anderson 2008 and the Benjamini-Krieger-Yekutieli (Benjamini et al. 2006) sharpened two-stage procedure: a binary outcome for labor trafficking at the kiln level, a binary outcome for child labor at the kiln level, a weighted count of indicators present at kilns, and a measure of the indicators targeted by the technical+incentive information arm at the kiln level. In our final analysis, we evaluate all outcomes both at the kiln level and at the worker level.

[32] The only respiratory health outcome with an unadjusted statistically significant estimate is constant cough among workers in the technical-only arm ($p = 0.026$). However, this increase is insignificant after applying the Benjamini-Krieger-Yekutieli (Benjamini et al. 2006) sharpened two-stage procedure, which accounts for multiple respiratory-related outcomes.

4 Conclusion

In this paper, we use a randomized controlled trial to study how a new, more efficient method of manufacturing bricks—and information about improving work conditions to incentivize adoption—influence coercive labor (including forced labor and labor trafficking), child labor, and work conditions in Bangladesh. Our setting provides an important test case for at least two reasons. First, coercive labor and child labor are thought to be pervasive in brick production in many countries (US Department of Labor 2022). However, past studies documenting high prevalence rates at brick kilns in South Asia are generally based on small case studies of individual kilns (Bhukuth et al. 2006; Guérin et al. 2007; Muhammad et al. 2010; Larmar et al. 2017; Shah et al. 2020; Gul et al. 2022). Among our study kilns, 50% of kilns had trafficked labor (and roughly 20% of workers were trafficked), and about 70% of kilns had child labor. Our analyses contribute important quantitative empirical evidence on the pervasiveness of labor exploitation in the brick sector in Bangladesh. Second, effective strategies to reduce coercive labor and child labor in environments with weak regulatory enforcement and state capacity like ours may require approaches that are aligned with the incentives of private business owners. However, we find little evidence that a profitable private sector innovation which improves kiln productivity/efficiency within a single brick season (or information about better work conditions to enhance its adoption) is sufficient to reduce labor trafficking or child labor in such settings.

Our findings that productivity gains did not improve short-term labor conditions in a coercive market (conditions which can feasibly change within a single brick season) also do not appear to be fully explained by unique market features of the brick sector in Bangladesh. Although we cannot be definitive about the reason for this lack of improvement in work conditions, a key factor that could help to explain these results in coercive labor markets is the exercise of monopsony power through the *sardar* system. Qualitative interviews that we conducted suggest that there is some degree of competition in brick labor markets—for example, workers are generally aware of work conditions and terms at nearby kilns, and alternative types of jobs are also available to

kiln workers, including farming, fishing, operating rickshaws, masonry, and selling vegetables and goods in the informal sector. However, once workers arrive at kilns and begin the season, they face severe constraints to their ability to seek alternative employment or negotiate better terms, and they are typically working to pay debts owed to the *sardar* due to advance payment (*sardars* often come from the same villages as workers, creating informal enforcement mechanisms).[33] Our data show that 42.4% of workers experienced limited freedom of movement or communication (see Figure 2)–meaning that owners and *sardars* limit and/or supervise their movements and their communication. This lack of freedom creates a situation in which, conditional on workers agreeing to work at a kiln for a brick season, kiln owners exercise strong control over working conditions, effectively wielding monopsony power during the season.[34] Under these conditions, even when worker productivity increases, owners appear largely able to capture the resulting surplus because, in practice, workers have no outside option or bargaining power during the season.

Overall, our findings suggest that productivity gains alone may be insufficient to improve work conditions in coercive labor markets, at least over shorter time horizons—and that absent more focused interventions, technological progress and productivity gains may do little to directly reduce labor exploitation in poorly regulated markets. Similarly, "light touch" strategies such as providing information to business owners about the benefits of positively incentivizing workers may also do little to improve labor standards. More generally, there is limited quantitative evidence on the factors responsible for coercive labor, including labor trafficking, as well as on strategies for effectively addressing them (Sharma et al. 2024). This is a critical area for new empirical research.

[33] Such constraints have been documented in the kiln industry elsewhere in South Asia as well, see e.g., Guérin et al. 2007; Ercelawn et al. 2004; Gupta 2003.

[34] The ability of kilns to replace workers mid-season varies to some extent by worker type. For more specialized workers such as firemen, it can be difficult for a kiln owner to replace a worker mid-season, while for less-skilled workers such as brick loaders or unloaders, it is relatively easier for kiln owners to find replacements during a season.

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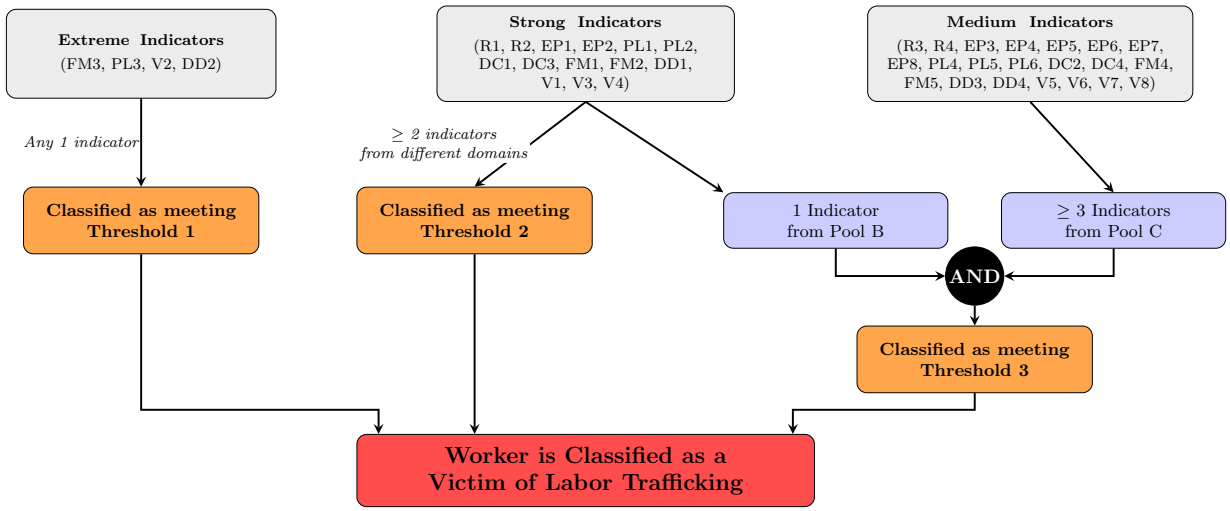
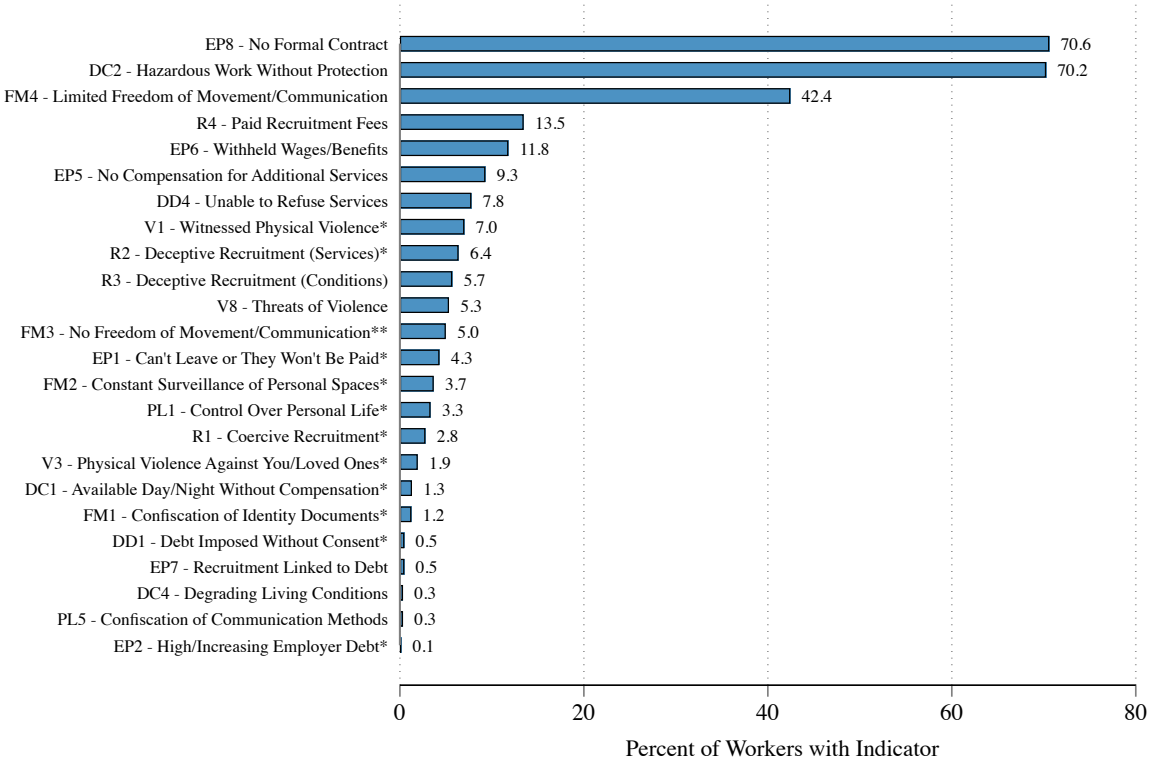
Figure 1: Labor Trafficking Classification Flowchart



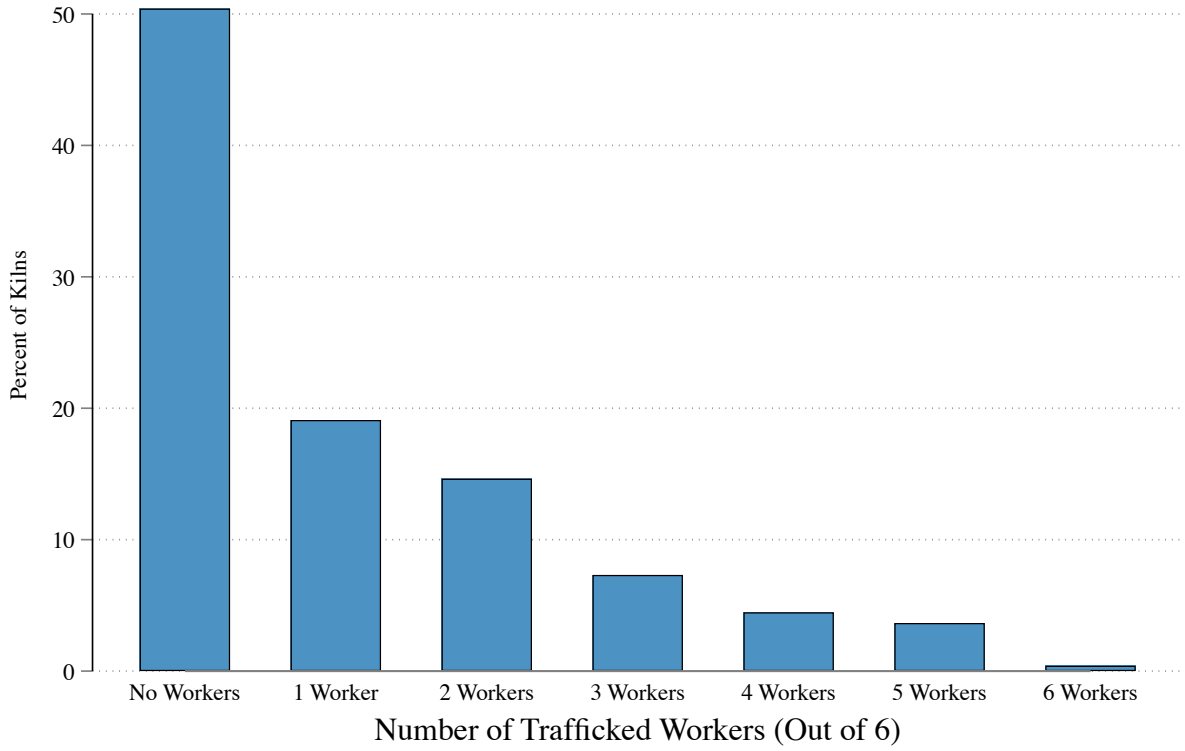
Notes: This flowchart illustrates the three thresholds used to classify a worker as a victim of labor trafficking, following the framework of Okech et al. 2025. This framework encompasses all forms of human trafficking, and we list all indicators included in Okech et al. 2025 for completeness. However, this paper only measured, and studies, labor trafficking (not sex trafficking and other forms of human trafficking) – see Appendix Table A1 for the subset of indicators collected. A worker is classified if they meet the criteria for Threshold 1, Threshold 2, OR Threshold 3. The codes (e.g., FM3, R1) correspond to specific trafficking indicators as listed in Appendix Section 1.

Figure 2: Prevalence of Labor Trafficking Indicators at Study Kilns



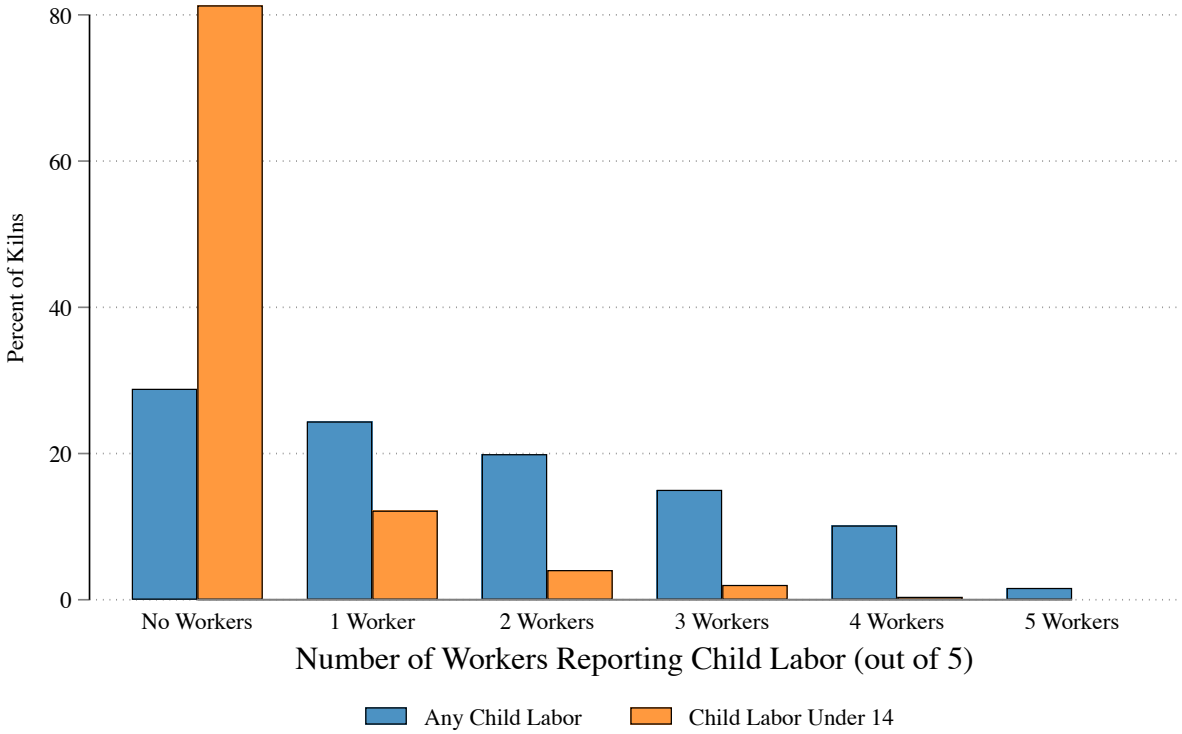
Notes: Sample includes data from 246 brick kilns, with a total of 1442 workers interviewed. All indicators come from Okech et al. 2025. Note that not all indicators mentioned in Okech et al. 2025 are included here, because our survey does not ask about sex trafficking or sexual violence. See Appendix Section A1 for more information on trafficking indicators. * = Strong Indicator. ** = Extreme Indicator.

Figure 3: Share of Study Kilns by Number of Workers who are Trafficked (out of 6)



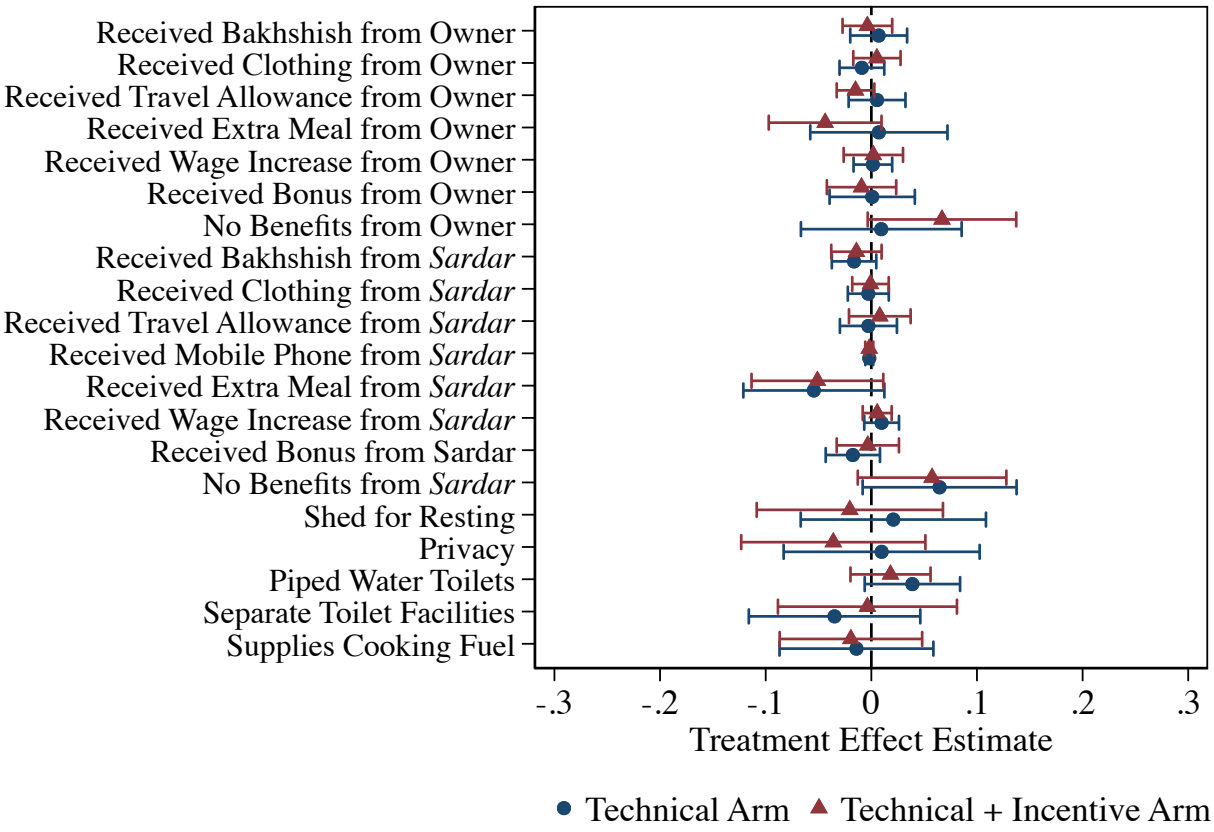
Notes: Sample includes data from 246 brick kilns, with a total of 1442 workers interviewed. Trafficking classifications follow Okech et al. 2025. See Figure 1, Appendix Section A1 and Appendix Table A1 for more information on trafficking classification.

Figure 4: Share of Study Kilns by Number of Workers (Out of 5) Who Report Seeing Child Labor.



Notes: Sample includes data from 245 brick kilns, with a total of 1198 workers interviewed. This differs from the Trafficking Indicators sample because *sardars* were not asked about children working at the kiln. In one kiln, only a *sardar* was interviewed, so the observation is lost. Respondents are classified as having seen child labor if they either have their own child work at the kiln with them or if they report that at least one member of their team is under-age. The blue bars show results for all children (17 years old or younger). The orange bars show results for children under 14. Note that we were unable to directly interview children at study kilns.

Figure 5: ITT Estimates for Individual Incentivized Work Conditions.



Notes: Sample: 246 kilns (1442 workers) surveyed in both the worker survey as well as kiln performance monitoring. Graphs show the OLS estimates and 95% confidence intervals generated from regressing an indicator for each amenity on treatment arm dummy variables with randomization strata fixed effects. Bahkshish is a term often used in South Asia to describe small informal payments made to individuals (similar to a tip), while bonuses are typically more formal and given at the conclusion of a service. Bonuses often are predetermined, while bahkshish amounts may be declared at the time of giving.

Table 1: ITT Estimates for Labor Trafficking by Study Arm

	Weighted Count of Indicators				Trafficking Prevalence	
Treatment Arm	(1)	(2)	(3)	(4)	(5)	(6)
Technical Only	0.097	-0.021	0.206	-0.022	0.029	0.071
	(0.131)	(0.026)	(0.341)	(0.054)	(0.037)	(0.078)
Technical+Incentive	0.088	-0.010	0.510	0.008	0.005	-0.037
	(0.121)	(0.021)	(0.364)	(0.042)	(0.037)	(0.078)
Control Mean	1.858	0.488	3.988	0.703	0.177	0.482
Kiln or Worker Level?	Worker	Worker	Kiln	Kiln	Worker	Kiln
All or Target?	All	Target	All	Target	-	-
Observations	1442	1442	246	246	1442	246

Standard errors in parentheses. All standard errors are clustered at the kiln level for worker level analyses and are heteroskedasticity-robust for kiln level analyses. Columns 1-4: The dependent variable is a weighted count of the trafficking indicators observed; medium indicators receive 2/3rds the weight of strong and extreme indicators. Estimates are OLS estimates generated from regressing the weighted count of trafficking indicators on treatment arm dummy variables, with fixed effects for randomization strata. Columns 1-2 show regression results for the worker-level weighted count of indicators. Columns 3-4 show results for the weighted count of unique indicators in each kiln. Target indicators use the same weighting and include indicators that are most closely related to the incentives: DC1 (Made to be available day and night without adequate compensation outside of the scope of the contract); DC2 (Made to complete hazardous and/or arduous services without proper protective gear); and DC4 (Made to live in degrading conditions). Columns 5-6: Estimates are OLS estimates generated from regressing an indicator for trafficking on treatment arm dummy variables, with fixed effects for randomization strata. To generate kiln-level data, we code kilns as having trafficking if any of the workers interviewed at that kiln met the definition for trafficking.

$^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table 2: ITT Estimates for Child Labor by Study Arm

	Observed Child Labor		Share of Child Workers		Any Child Labor at Kiln	
Treatment Arm	(1)	(2)	(3)	(4)	(5)	(6)
Technical Only	-0.006	-0.030	-0.007	-0.002	0.022	-0.104
	(0.041)	(0.022)	(0.007)	(0.002)	(0.069)	(0.064)
Technical+Incentive	-0.073*	-0.027	-0.009	-0.002	-0.079	-0.100
	(0.040)	(0.020)	(0.007)	(0.002)	(0.072)	(0.061)
	[0.346]					
Control Mean	0.353	0.078	0.048	0.007	0.735	0.265
Kiln or Worker Level?	Worker	Worker	Worker	Worker	Kiln	Kiln
All Child Labor or Under 14?	All	Under 14	All	Under 14	All	Under 14
Observations	1198	1198	1198	1198	245	245

Standard errors in parentheses and q-values in square brackets. All standard errors are clustered at the kiln level for worker level analyses and are heteroskedasticity-robust for kiln level analyses. Q-values are calculated using the Benjamini-Krieger-Yekutieli (Benjamini et al. 2006) sharpened two-stage procedure. Estimates are OLS estimates generated from regressing child labor outcomes on treatment arm dummy variables, with fixed effects for randomization strata. Columns 1-2: binary indicator for whether a worker personally observed child labor. Columns 3-4: the share of workers in the respondent's team who are children. Columns 5-6: kiln-level indicator for whether any surveyed worker reported observing child labor. For all columns, child labor is defined as workers under the age of 18 (columns 1, 3, 5) or under the age of 14 (columns 2, 4, 6). A test of equality between the treatment arm estimates in column 1 has a p-value of 0.102, for column 3 the p-value is 0.772, and for column 5 the p-value is 0.159. Sample includes data from 245 brick kilns, with a total of 1198 workers interviewed. This differs from the Trafficking Indicators sample because *sardars* were not asked about children working at the kiln. In one kiln, only a *sardar* was interviewed, so the observation is lost.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: ITT Estimates for Worker Wages and Health Outcomes

	Wages	Respiratory Health					Other Physical Health		Mental Health	
	Weekly Wages	Any Symptoms	Respiratory Problems	Constant Cough	Difficulty Breathing	Wheezing/ Asthma	Work Injury	Any Physical Symptoms	Anxiety (GAD-7)	Depression (PHQ-9)
Technical Only	-29.47	0.032	-0.000	0.038**	-0.004	-0.012	-0.010	0.038	0.093	0.013
	(88.68)	(0.022)	(0.007)	(0.017)	(0.016)	(0.012)	(0.035)	(0.030)	(0.266)	(0.262)
				[0.179]						
Technical+Incentive	-27.17	-0.006	-0.001	0.006	-0.013	-0.007	0.011	0.017	-0.038	-0.104
	(85.59)	(0.021)	(0.007)	(0.014)	(0.014)	(0.012)	(0.033)	(0.029)	(0.250)	(0.256)
Control Mean	3811.08	0.112	0.014	0.045	0.053	0.043	0.293	0.230	4.350	4.688
Observations	1198	1442	1442	1442	1442	1442	1442	1442	1442	1442

Standard errors in parentheses, clustered at the kiln level. Q-values shown in square brackets are calculated using the Benjamini-Krieger-Yekutieli (Benjamini et al. 2006) sharpened two-stage procedure. Estimates are OLS estimates from regressions of each outcome on treatment arm dummy variables, with fixed effects for randomization strata. Weekly Wages are measured in Bangladeshi Taka (BDT). Any Respiratory Symptoms equals 1 if the respondent reported any respiratory issue (either work-related respiratory problems or any of the three respiratory symptoms). Respiratory Problems equals 1 if respiratory problems were reported in the work injury module. Constant Cough, Difficulty Breathing, and Wheezing/Asthma are indicators for specific respiratory symptoms reported in the physical health module. Work Injury equals 1 if any work-related injury was reported. Any Physical Symptoms equals 1 if any physical health symptom was reported. Anxiety is an integer score (0-21) based on the GAD-7 anxiety scale. Depression is an integer score (0-27) based on the PHQ-9 depression scale. The sample in the first column includes data from 245 brick kilns, with a total of 1198 workers interviewed. This differs from the other outcomes' sample because *sardars* were not asked about children working at the kiln.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix:
"Productivity Gains and Work Conditions in Coercive Labor Markets: Experimental Evidence from the Bangladesh Brick Sector"

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Section A.1: Labor Trafficking Classification (Okech et al. 2025)

Following the framework developed by Okech et al. (2020) and Okech et al. (2025), we classify workers as victims of labor trafficking if they meet one of three thresholds. Note that this framework encompasses all forms of human trafficking, and we list all indicators included in Okech et al. (2025) for completeness. However, this paper only measures and studies labor trafficking (not sex trafficking and other forms of human trafficking). Table A1 shows these indicators, noting which were collected in our survey and which have liberal and conservative codings (note that liberal and conservative codings are ours, not from Okech et al. (2025)).

- **Threshold 1**
  - Worker subject to any **ONE** of the following *extreme* indicators:
    - No freedom of movement or communication (FM3)
    - Made to work in commercial sex to repay debt or wage advance (PL3)
    - Ever been sold for labor or commercial sex work (V2)
    - Tradition or birth into slavery or bondage (DD2)
- **Threshold 2**
  - Worker is subject to *strong* type conditions from at least **TWO** of the following seven domains:
    1. **Recruitment:** Coercive (R1) or deceptive recruitment regarding nature of services (R2).
    2. **Employment Practices:** Had pay withheld and if worker quits they will not receive wages (EP1), or worker had high debt related to employment (EP2).
    3. **Personal Life:** Employer has control (PL1) or transferred control over a meaningful part of the worker's personal life (PL2).
    4. **Degrading Conditions:** Made to engage in illicit activities (DC3), or made to be available day and night without adequate compensation (DC1).
       - Conservative Coding (DC1): Worker is always required to work overtime and never receives compensation for it.
       - Liberal Coding (DC1): Worker is always or sometimes required to work overtime and never or sometimes receives compensation for it.
    5. **Freedom of Movement:** Constant surveillance of personal space (FM2) or confiscation of documents/identification papers (FM1).
       - Conservative Coding (FM1): Employer often confiscates documents.
       - Liberal Coding (FM1): Employer often or sometimes confiscates documents.
    6. **Debt & Dependency:** Debt was imposed on the worker without their consent (DD1).
    7. **Violence:** Worker witnessed physical violence against another worker (V1) or experienced physical (V3) or sexual violence (V4) against themselves or someone they care about.

- **Threshold 3**
  - Worker subject to **ONE** *strong* type condition from the above seven domains from Threshold 2

  AND

  - Worker subject to any **THREE** of the following *medium* type conditions:
    - Recruiter deceptive about living or working conditions (R3)
    - Paid recruitment fees (R4)
    - High or increasing debt from recruitment (EP3)
    - Made to work overtime beyond legal limits (EP4)
    - Absence of a formal contract (EP8)
    - Ever not received wages or had wages withheld (EP6)
    - Made to perform additional services outside contract or work overtime beyond legal limits (EP5)
      - Conservative Coding: Worker never receives overtime compensation
      - Liberal Coding: Worker sometimes or never receives overtime compensation
    - Confiscation of mobile phones as a means of control (PL4)
    - Confiscation of mobile phones as a means of control (PL5)
      - Conservative Coding: Employer often confiscates communication devices
      - Liberal Coding: Employer often or sometimes confiscates communication devices
    - Confiscation of mobile phones as a means of control (PL5)
    - Hazardous labor without protective equipment (DC2)
      - Conservative Coding: No PPE provided and respondent said that they were exposed to dangerous work
      - Liberal Coding: Respondent stated they did not receive PPE, or did not receive gloves, safety shoes, and goggles (the three most important PPE items for work at brick kilns)
    - Made to live in degrading or inhumane conditions (DC4)
      - Conservative Coding: Housing does not have toilet, electricity, or privacy, and the respondent is forced to live in employer-supplied housing
      - Liberal Coding: Housing does not have toilet, electricity, or privacy
    - Limited freedom of movement or communication (FM4)
    - Constant surveillance at work (FM5)
    - Unable to refuse to provide services (DD4)
    - Threat of reporting to authorities or reputational harm (V7)
    - Emotional or psychological abuse (V6)
    - Threat of violence against you or someone you care deeply about (V8)

These thresholds are also represented graphically in Figure 1 in the main text.

Section A.2: Worker Sample Replacement

In our study protocol, we planned to randomly sample and survey six workers at each kiln (one sardar, one firemen, one brick molder, two brick loaders, and one brick unloader). However, given differences in their responsibilities, different types of workers at kilns are present at different times during the brick production process. At the time of our survey, some brick molders (the most common job in brick kilns, and generally the first to finish their work during a season) had already left kilns for the season. Additionally, some kilns closed early due to the timing of the end of Ramadan and the celebration of Eid al-Fitr. We therefore developed a replacement protocol for sampling workers when it was not possible to follow our original protocol. Specifically, if the planned number of brick molders, loaders, or unloaders could not be surveyed, we instructed enumerators to replace them with a different type of worker (excluding firemen) under a different sardar. Alternatively, if the planned number of firemen could not be surveyed, we instructed enumerators to replace them with any other type of worker.

Section A.3: Technical Intervention Details

Less dense brick stacking with multiple (two or three) zigzag air paths
The technical intervention introduced less dense brick stacking with multiple zigzag air paths, where existing practice was to densely pack bricks with only a single zigzag path for air to travel. This change allows for better distribution of air flow, leading to uniform distribution of heat and combustion of coal, therefore decreasing pollutant emissions from coal combustion. Additionally, this change also better maintains pressure, meaning that less energy is required to operate the fan blowing air through the kiln.

Single fireman continuous fuel feeding
In brick kilns, coal is fed through feed holes on the kiln's roof by firemen. The prevailing method of coal feeding is for three to four firemen to feed the kiln at intermittent intervals (feeding interval of 10-15 minutes, followed by a non-feeding interval of 15-20 minutes). This method leads to accumulation of fuel in the kiln, hampering complete combustion of the coal. In addition to incomplete combustion, accumulation of coal also leads to higher particulate emissions.

The technical intervention changes this method so that a single fireman continuously feeds the kiln for 30 minutes, after which the fireman stops and switches with his partner. With this method, fuel is fed in smaller quantities, allowing for adequate air and complete combustion. This allows for less wasted fuel and lower pollutant emissions. It also causes more uniform heat distribution across the kiln (and more consistent brick quality).

These first two interventions are the most important for improving operation of a kiln. Kilns observed adopting both practices were coded as adopters of the technical intervention.

Thicker ash layer on the kiln top
The layer of ash on the top of the kiln serves as a roof, providing insulation against heat loss. The prevailing practice is to have this 6-inch ash layers, but the technical intervention advocated increase the thickness ash layers to 9 inches or more. This improvement in insulation reduces the fuel needed to fire bricks and increases the temperature among bricks on the top layer, increasing

the share of Class-1 bricks (i.e., the best quality bricks).

Closing kiln entry gates with an ash-filled cavity wall
Kiln gates allow workers to enter the kiln to stack "green bricks" and remove fired ones. When the bricks are being fired, these gates are closed and sealed, and the prevailing practice is to build a temporary wall one brick thick (roughly 10 inches). The intervention encouraged kilns to increase the thickness of this wall to 30 inches, including an inner wall of 15 inches, a 5-inchlayer of ash for insulation, and an outer wall 10 inches thick. This new method increases insulation, decreases fuel requirements, and allows bricks stacked near kiln gates to reach high temperatures, increasing the share of Class-1 bricks.

Use of powdered biomass fuel in the newly inducted chamber in the fuel-feeding zone
In a zigzag kiln, fire moves through the kiln's firing chamber. As the fire moves, a new chamber enters the fuel-feeding zone every 8-12 hours. The temperature of a newly-inducted chamber is initially lower ($<500^{\circ}$C). By prevailing practice, coal is fed into the newly-inducted chamber, but because the newly-inducted chamber has a low temperature, this coal does not burn completely, increasing pollutant emissions. The intervention encouraged kilns to feed sawdust and other powdery biomass with high concentrations of volatile matter and low ignition temperatures into the newly-inducted chamber. Because these fuels burn completely at lower temperatures, they increase a new chamber's temperature until it reaches 700°C, when coal is added.

Section A.4: Incentive Information Given to Kiln Owners

Kilns that were randomized into the technical+incentive arm received a detailed information session along with the hands-on training provided with the technical intervention. In these information sessions, our team described how our pilot work increased brick quality while decreasing fuel use, and that achieving these benefits depends on the ability to align worker incentives with the new production method, providing evidence that pilot firms that improved work conditions (either through higher wages or bonuses, or in-kind transfers) experienced greater benefits. The complete script is as follows:

[Begin Script]

I'm here to talk to you about how you can get more profit in this year's brick production. We are glad you are working with us to implement the new practices, but their success depends on every worker on your kiln. Our team is here to help with technical training and assistance to make sure your workers have the proper skills to implement everything correctly. **If everyone on your kiln works together and follows the instructions, you will use less coal and increase your production of Class-1 bricks. As a result, these new practices will increase your profit and your kiln will be more successful.**

How do we know this?

Our team worked with similar brick kilns in Jashore, and a 14% increase in the percentage of Class-1 bricks and a 20% reduction in coal spending per brick in kilns that successfully followed the recommended practices of single fireman continuous coal feeding and double zigzag brick setting owners saw, compared to kilns using traditional methods.

What's more interesting is that the owners from Jashore that provided more incentives and benefits to their workers had even higher Class-1 bricks (on average, 5 percentage points higher) and lower coal spending (on average, 0.42 Taka less per brick) compared to kilns that did not offer additional incentives.

How can you reap the same benefits?

The workers on your kiln are crucial for the success of this new practice. They have to learn the new practices and at first they may not want to change from the old way of doing things. If your workers invest the time to master the new skills it will lead to huge benefits for you . Now, you can imagine when they are learning the new practices they might more slowly which might reduce their pay. If they do not feel motivated to adopt the new practices, they may take shortcuts or not learn it properly unless you find a way to include them in the success you will have from these new practices.

You may also consider the time and effort you are putting in to having your workers trained on these new practices. They are learning many new skills which will make your kiln successful. You will benefit if you can use the same workers next season, because they will already have the experience and training on these new practices. If you can encourage workers to return, it will be very beneficial to your kiln operation and production.

Because all workers on your kiln must be successfully adopt these practices and work together to increase your production and profit, we recommend any incentives or extra bonus be offered to all workers.

We have some suggestions that other kiln owners like you have used and found to be successful at increasing their kiln performance, getting better performance from workers, and commitments from workers to return to the same kiln:

1. Providing some extra monetary incentives to the workers to motivate them to follow this new practice properly. This will be easily covered by your increased profit /production soon. Because all workers on your kiln must be successfully adopt these practices and work together to increase your production and profit, we recommend incentives be offered to all workers. Successful kiln owners have used incentives differently for different categories of workers, for example, firing workers are given lump sum bonuses after a circuit, whereas unloaders and loaders are given bonuses in terms of 1000 bricks.

2. There are easy improvements you can make for your workers to make them happier and healthier to motivate them be more productive. If your kiln gets a reputation for being a good place to work, where workers are well-taken care of, your workers are more likely to return next season and more workers will want to work for you.

How can you make incentives and benefits work for you?

When offering these incentives, it is very important that the workers themselves receive the benefit. Otherwise, they will not be motivated to adopt the new practices, trust will be lost, and your kiln will not benefit. You may encourage the Sardars to provide these benefits to workers so that the workers will adopt the practices. Some owners provide benefits directly to the workers to make sure they receive them. A common practice of successful owners is to announce a particular day and time and request all workers and sardars be present, then owners hand over bonuses/bakhshish by themselves. This practice is successful because everyone will give credit to the owner for the extra benefits.

It is also important that you provide the incentives and benefits in a timely manner and early in the season. If it is too late, the workers may not be encouraged to follow the new practices and you will not see the benefit in time.

[Ask: Any questions on what we have talked about so far?]

What are examples of monetary incentives and good working conditions that you can provide?

We have put together a list of suggestions from successful kiln owners for you to think about:

Monetary incentives:

1. You may offer a 'Bakhshish' from the higher earnings that you will get by adopting our suggested practices. For example, you can offer a Bakhshish to your workers such as 5-10%, which can be shared across all the workers. One successful kiln owner has provided 10000 Tk to the loading Sardar for adopting the new system and he committed to providing it subsequently in the next rounds of brick stacking. If you inform them at the beginning of each circuit about the Bakhshish and the importance of following the new practices to achieve a higher amount, it will motivate their performance during the circuit.

2. You may offer a bonus (onudan) to the workers if your kiln achieves a certain level of class-1 bricks in each circuit. We have provided a guideline for the bonuses depending on the share of class-1 bricks. For example, you may offer BDT 5000 if your kiln achieves 80-85% class-1 bricks in a cycle, BDT 6000 if you achieve 85-90% class-1 bricks, and BDT 7000 if you achieve $>$90% class-1 bricks. You can adjust the schedule given your kiln's performance. We suggest you inform workers at the beginning of the circuit about the bonus to motivate their performance and deliver the payment at the end of the circuit once the brick quality has been assessed.

3. You can also provide 'Bakhshish' of extra Taka 50 per 1000 bricks if your kiln achieves 80-85% class-1 bricks, extra Taka 100 per 1000 bricks if your kiln achieves 85-90% class-1 bricks, or extra Taka 150 per 1000 bricks if your kiln achieves $>$90% class-1 bricks.

4. Some of the recommended practices will require more time involvement for the workers. For example, in the new method, workers need to increase the ash layers by 9-12 inches from the previous setting. In the new method, fire travels faster and more loading of bricks is necessary to keep up the fire travel in a circuit. In both cases, you can consider increasing the wages of the workers by Taka 10-50 per 1000 bricks to account for the changes.

5. You may offer a return bonus if workers return to your kiln the next season. Inform them of the bonus offer before the end of the current season, so that it can encourage them to return the next year. For example, some kiln owners have offered a bonus equal to 20% of the workers current wages if they return the following season, which will be paid only after they return.

6. You might see that some of your workers want to leave for other working options during the firing season, especially on agricultural fields. To prevent workers who have been trained on these new and improved practices from leaving in the middle of an active season, kiln owners have provided instant bonuses in cash. By making your kiln a more desirable and better paying place to work, the workers will not want to leave for other options.

7. Many kiln owners have successfully retained a higher presence of workers by offering 'attendance bonuses.' You can offer some bonuses for the top 5 workers who are most regular in your kilns to motivate all the workers to avoid shirking.

Working conditions:

You will know best what type of working conditions are the most important for your workers, but we have put together a list of suggestions from successful kiln owners for you to think about:

1. You can provide shaded/resting areas for your workers. If workers rest in their free time, this can improve their productivity during the rest of the day.

2. You can provide accommodation for your workers. As you know, many of your workers have migrated from other places to work here. Providing accommodation facilities (spacious room, individual beds, windows, ventilation, hygienic toilets, electricity, and cooling/ceiling fan) would benefit the workers and increase their productivity.

3. Successful kiln owners in Jashore have offered improved meals like chicken or beef to their workers if they achieve good performance of class-1 bricks or without any condition.

4. Some kiln owners provide new clothing to their workers during religious festivals like Eid or Pahela Baisakh or during the winter season.

5. Workers' health is one of the most important aspects of worker productivity and success that you can improve as a motivated kiln owner. Workers especially firemen may be provided with saline to help them from dehydration. You can help workers to go to the nearest community clinics, and union and upazila health complexes if they have any medical needs.

6. To help prevent against injuries and accidents that will harm your workers and your production, it is important that workers have proper protective equipment. We suggest heat protective boots, masks, gloves and if possible, movable shed for firemen, masks and customized helmet for unloaders, masks for the brick loaders and ash layer providers. Providing such protective equipment will make workers feel protected and cared for and will motivate their production.

7. Workers may be concerned about their children's schooling while the kiln season is in progress. Bangladesh government has made primary schooling free to access. You can encourage and help workers to get their children admitted to the nearest government school. Also, if NGO schools (i.e. BRAC) are nearby, you can also encourage workers to send their kids to those schools.

8. Bangladesh government has recently reduced the price of the LPG cylinder gas. If your kiln does not have a pipeline gas connection, then you can provide LPG cylinder gas to the workers to facilitate cooking.

9. As many workers, especially firemen come from an outside district and they stay at the kiln throughout the season apart from their families. Offering a monthly/quarterly leave to these workers can be helpful to meet with their families for refreshment and they will return to your kiln happy and motivated.

Which one of these do you think is feasible for you to do?
[Ask: owners to raise hands for different options and note their answers]
How can we help you think through it?

Closing pitch: Remember, by adopting these new practices your kiln will use less coal and produce more class 1 bricks, but their success depends on every worker on your kiln. By offering extra incentives or improved working conditions to your workers will encourage quicker learning and successful adoption of the new practices. This will not only increase your profit this season, but it may also help you retain your experienced workers for next year. For the incentives to successfully motivate workers and improve their performance, it is very important that you provide them to all workers and you offer them in a timely manner. If they follow the new practices, it means more profit for you, and everyone will benefit.

[End Script]

Section A.5: Responsibilities of Workers By Type

A.5.1: Brick Molder

Brick molders' main job is to shape clay into the molds of bricks, termed "green bricks." Due to the limited skill requirements, as well as lower levels of risk, this is the job most commonly held by women and children in the kilns. Additionally, the molder's role is mainly done at the beginning of the season, after which many will return home. They are also the majority of workers at a kiln (see Table A4).

A.5.2: Brick Loaders

Once molding is completed, the next task is to load the "green bricks" into the kiln. The brick loaders take the "green bricks" from the field and then load them into the kilns in a specific pattern. In our intervention, loaders played an important role as they had to follow a double/triple zig-zag structure to load the bricks. After brick molders, brick loaders constitute the highest number of workers in the kiln.

A.5.3: Firemen

Firemen are the workers with the most technical skills in a brick kiln. They normally get paid the highest (after sardars). Typically there are ten firemen in a kiln and they are always men. Firemen are responsible for feeding coals into the kiln system. This process is critical as the quality of the bricks mostly depends on how the fire is traveling in a kiln and how the temperature is distributed. In our intervention, one major component was to use single-fireman continuous feeding. The success of our technical intervention in part depended on the efficiency of the firemen's work.

A.5.4: Brick Unloaders

Once the bricks baking is done, a group of workers known as brick unloaders take the bricks out of the kiln and put them in a separate place to cool down. This process requires intense physical labor to carry heavy bricks out of the kiln. Brick unloading is mostly done at the end of every production cycle. Unloading is important to maintain the quality of the bricks as sometimes while unloading many of the bricks lose their intended shapes, lessening their value.

A.5.5: Managers

Managers are the most powerful individuals at the kiln after the owner. They oversee the entire production process, but do not engage in any labor with any particular team. They work directly with the owners and in the absence of the owners, they make executive decisions. The owners pay them either monthly or by the season. Typically there would be at least one manager, but it could go up to four or five in different kilns.

A.5.6: Sardars

Sardars are team leaders for each of the main teams at a kiln (i.e., Brick Loaders, Brick Unloaders, Firemen, and Molders). They help the team work efficiently and distribute payments from the owner to workers.

A.5.7: Other Jobs at the Kiln

Although the aforementioned jobs are the most common at kilns, there are many additional jobs that workers can also perform at the kiln. These include coal crushers, electricians, carpenters, and night guards. Kilns will also often have 10-12 daily laborers. These workers have a very loosely defined job, often including cleaning, meal preparation, and covering any needs in the production process.

Figure A1: Map of Study Kiln Locations (Khulna Division)

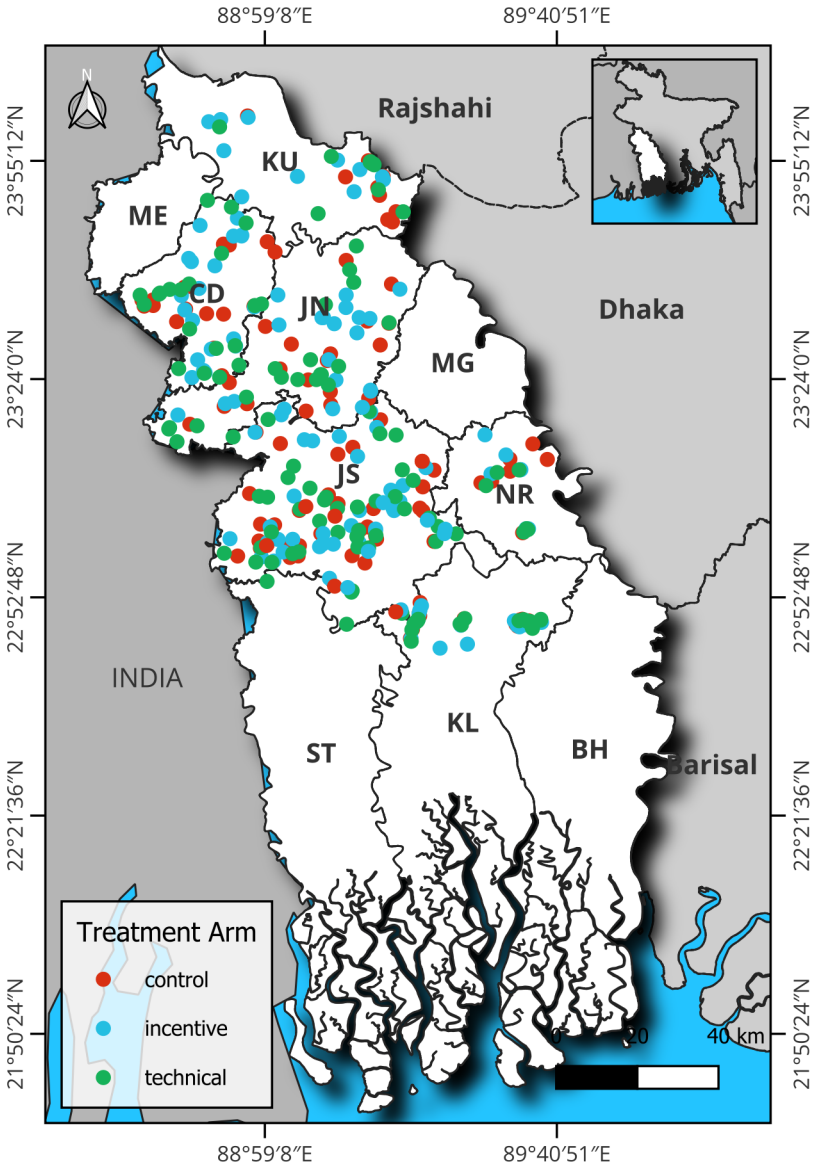


Figure A2: Kilometers Traveled by Workers

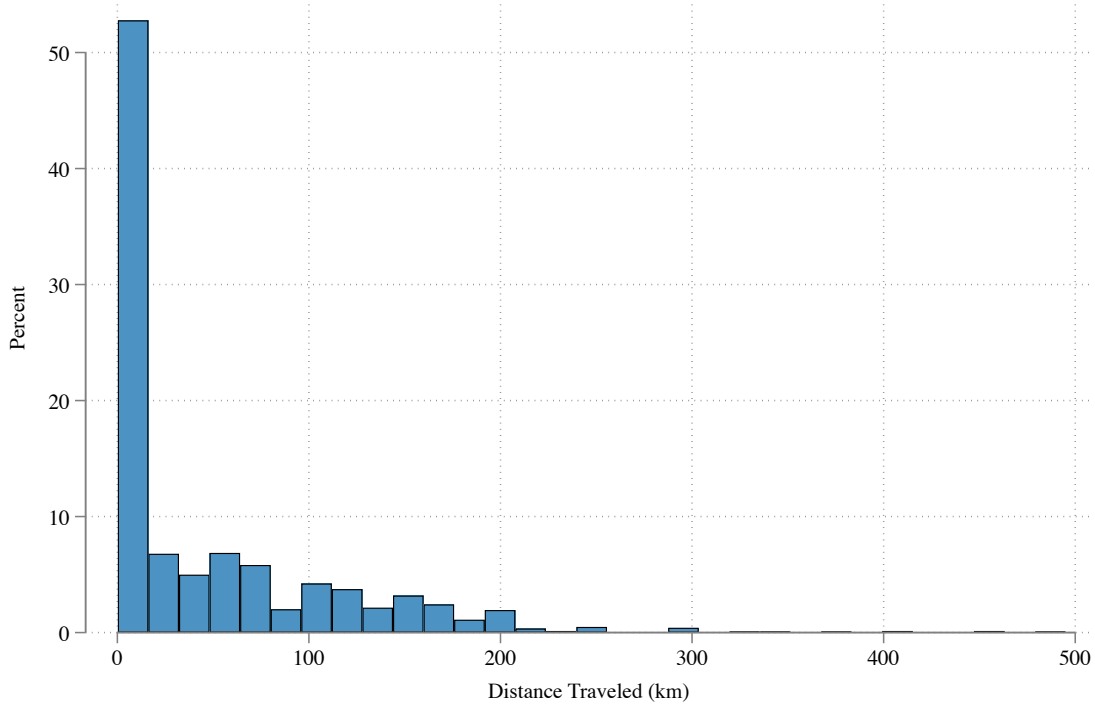


Figure A3: Sample Selection Flow Chart

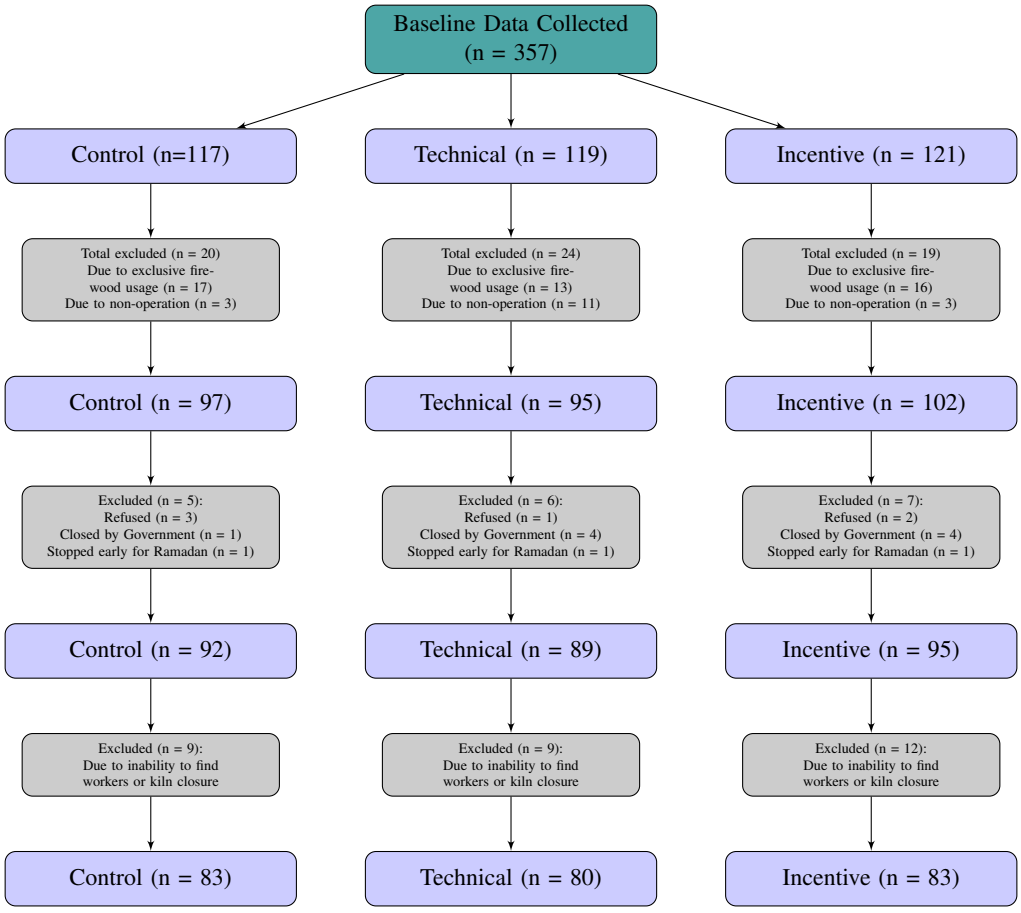


Figure A4: Study Timeline

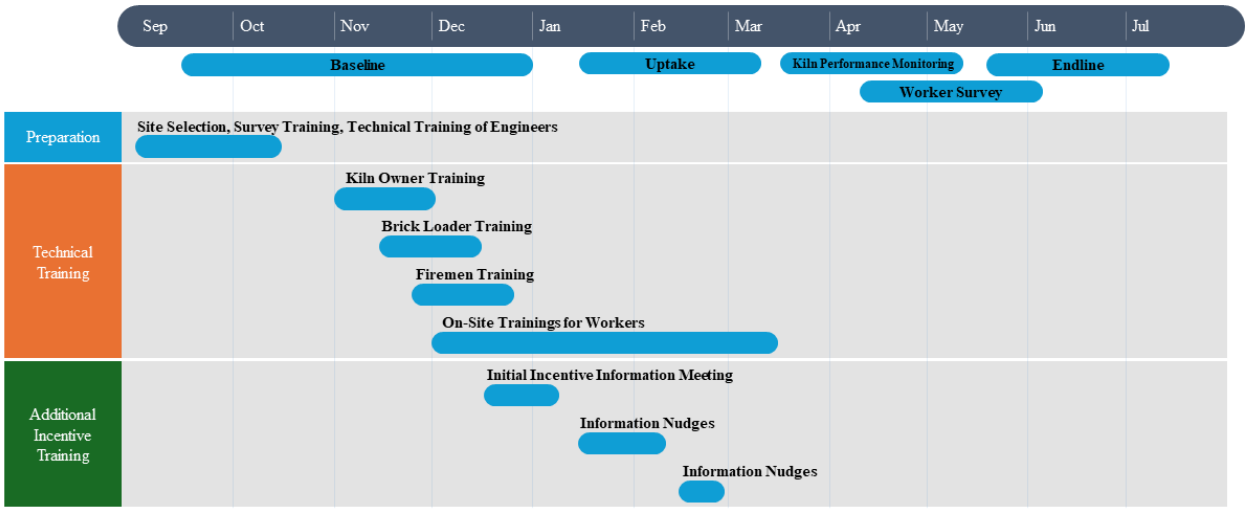
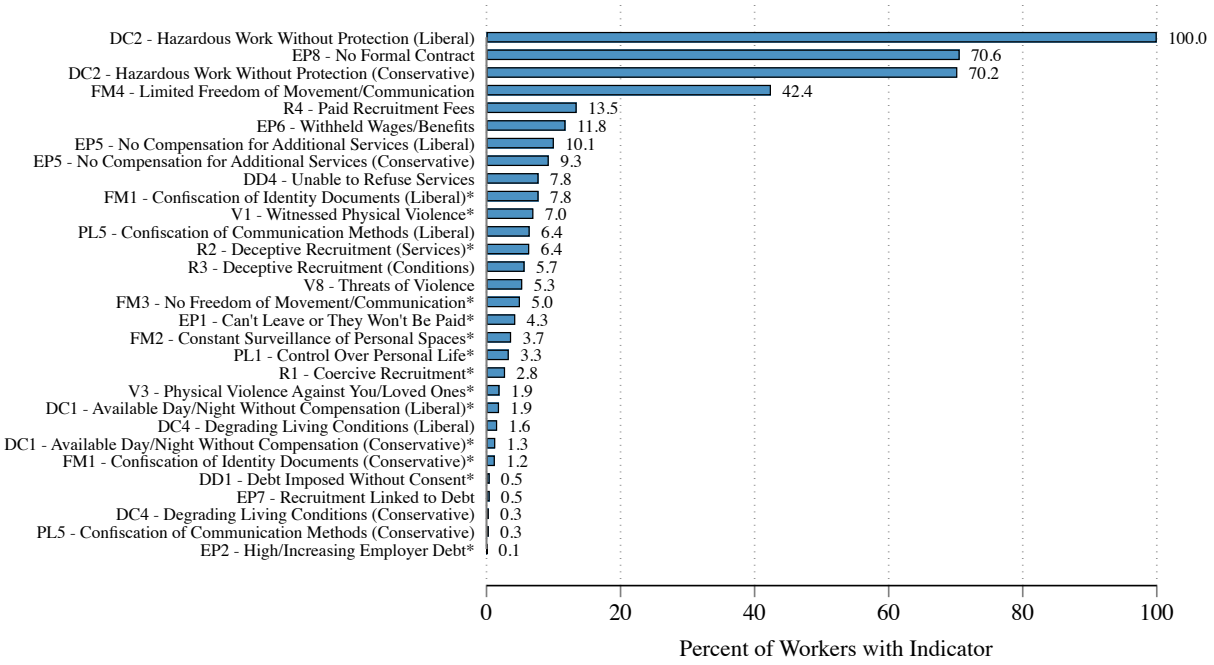
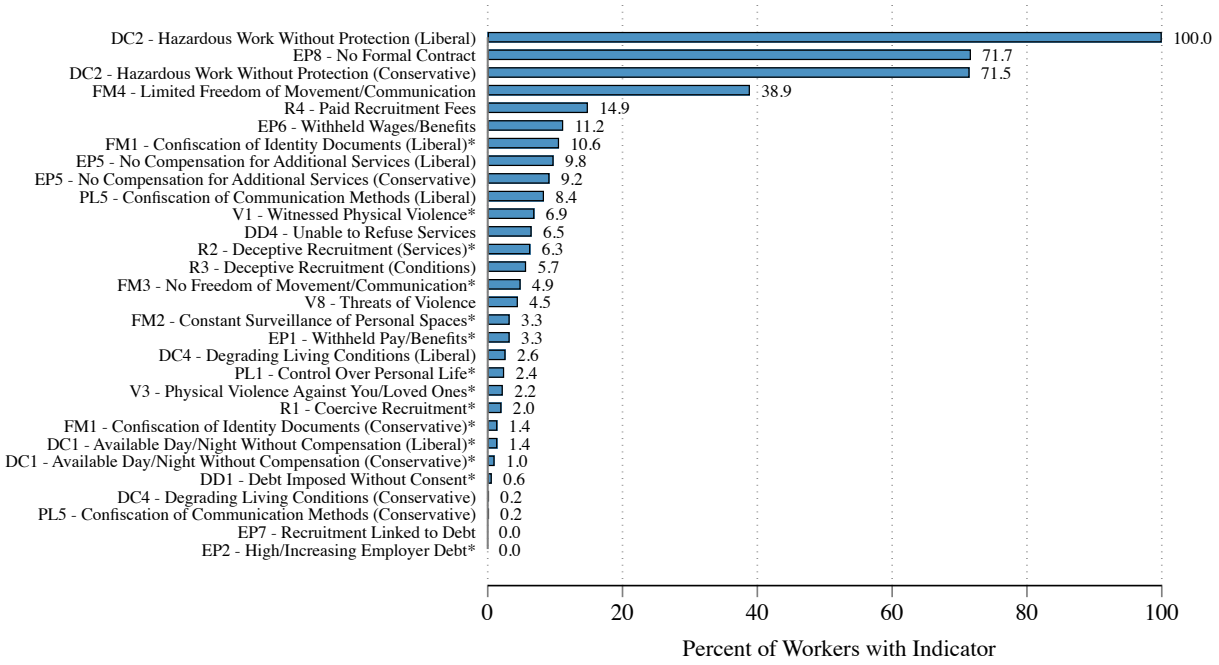


Figure A5: Prevalence of Labor Trafficking Indicators at Study Kilns (Including "Liberal" Codings)



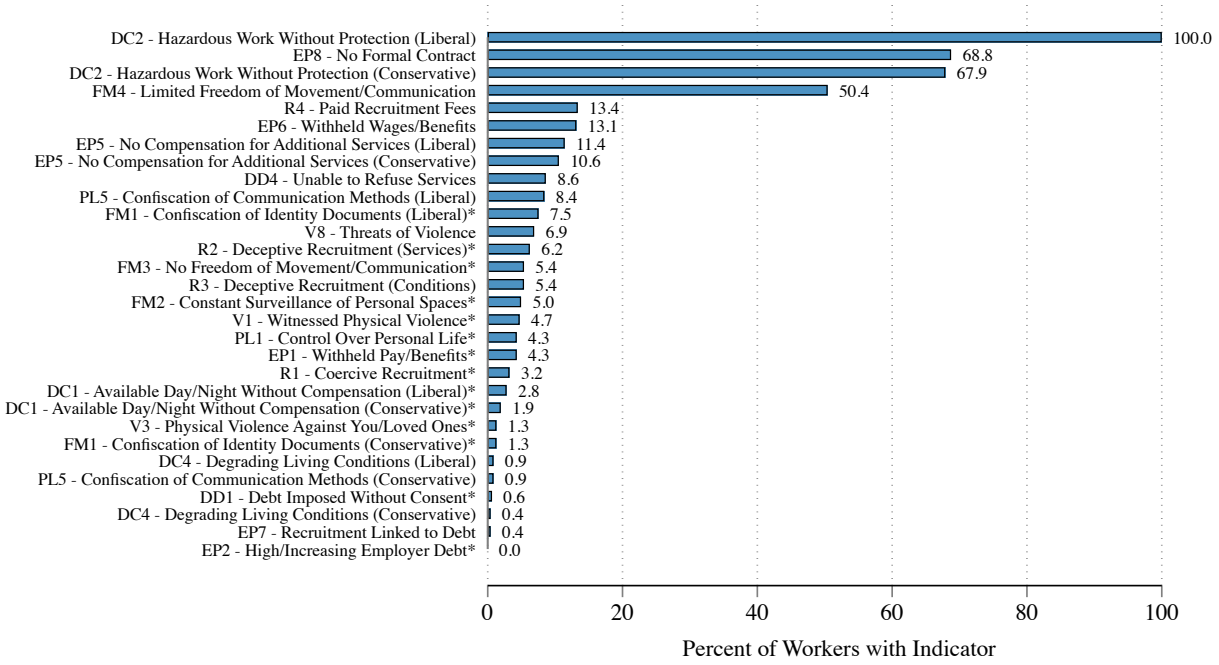
* = Strong Indicator. Sample includes data from 246 brick kilns, with a total of 1442 workers interviewed. All indicators come from Okech et al. (2020). Note that not all indicators mentioned in Okech et al. (2020) are included here, because our survey does not ask about sex trafficking or sexual violence. The graph shows both the conservative and the liberal coding of indicators requiring subjective judgment. See Appendix Section A1 for more information on trafficking

Figure A6: Prevalence of Labor Trafficking Indicators at Study Kilns - Control Arm (Including "Liberal" Codings)



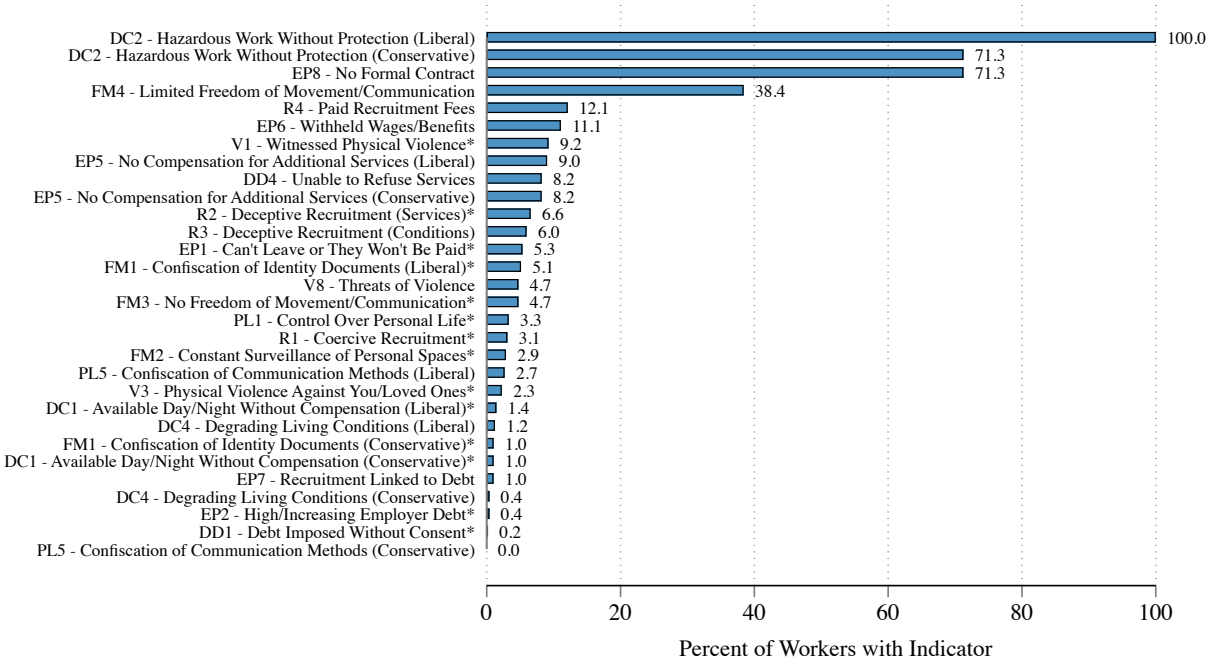
* = Strong Indicator. Control kiln sample includes data from 83 brick kilns, with a total of 490 workers interviewed. Note that not all indicators mentioned in Okech et al. (2020) are included here, because our survey does not ask about sex trafficking or sexual violence. The graph shows both the conservative and the liberal coding of indicators requiring subjective judgment. See Appendix Section A1 for more information on trafficking indicators.

Figure A7: Prevalence of Labor Trafficking Indicators at Study Kilns - Technical Arm (Including "Liberal" Codings)



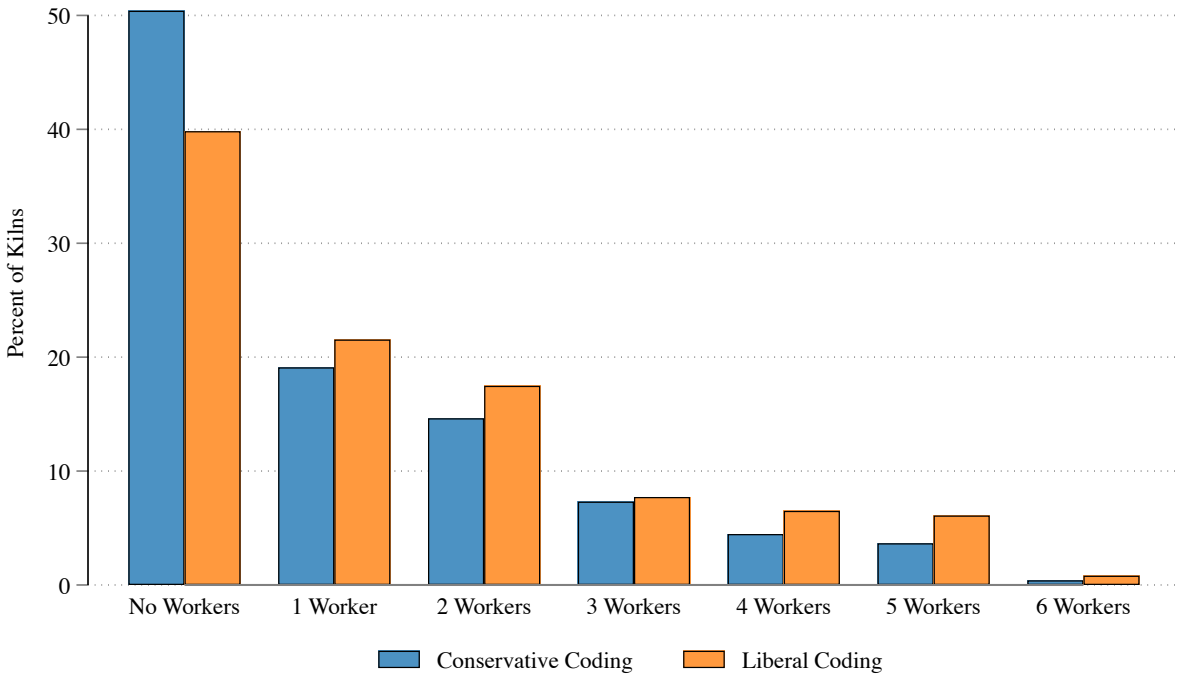
* = Strong Indicator. Technical kiln sample includes data from 81 brick kilns, with a total of 465 workers interviewed. Note that not all indicators mentioned in Okech et al. (2020) are included here, because our survey does not ask about sex trafficking or sexual violence. The graph shows both the conservative and the liberal coding of indicators requiring subjective judgment. See Appendix Section A1 for more information on trafficking indicators.

Figure A8: Prevalence of Labor Trafficking Indicators at Study Kilns - Incentive Arm (Including "Liberal" Codings)



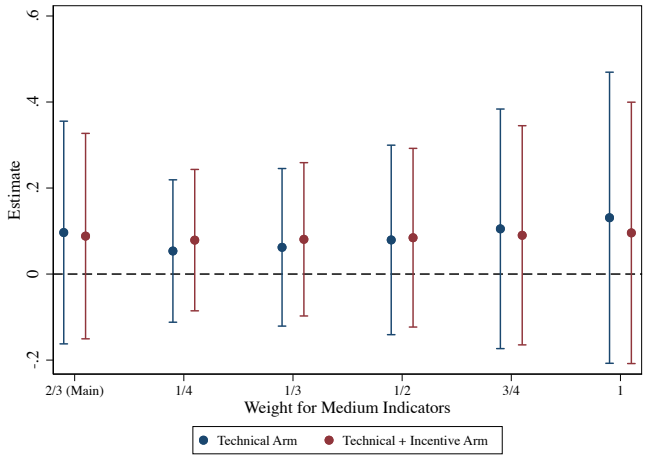
* = Strong Indicator. Technical+incentive kiln sample includes data from 82 brick kilns, with a total of 487 workers interviewed. Note that not all indicators mentioned in Okech et al. (2020) are included here, because our survey does not ask about sex trafficking or sexual violence. The graph shows both the conservative and the liberal coding of indicators requiring subjective judgment. See Appendix Section A1 for more information on trafficking indicators.

Figure A9: Share of Study Kilns by Number of Workers (Out of 6) Classified as Trafficked (Including "Liberal" Codings)

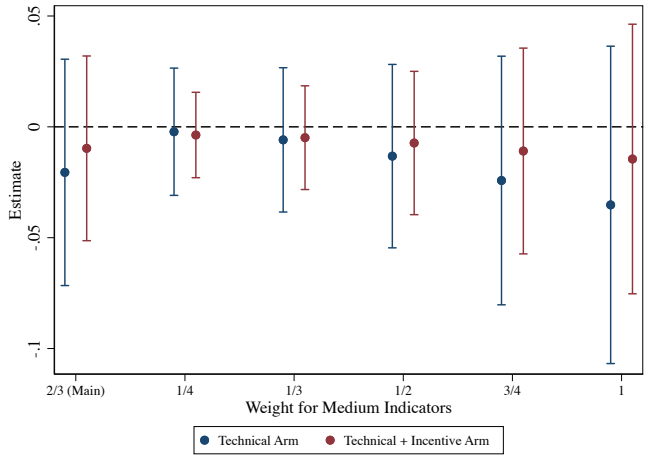


Sample includes data from 246 brick kilns, with a total of 1442 workers interviewed. Trafficking classifications follow Okech et al. (2020). See Appendix Section A1 for more information on trafficking classifications. 'Conservative Coding' places stricter requirements on indicators which have a degree of subjectivity, while 'Liberal Coding' places weaker requirements.

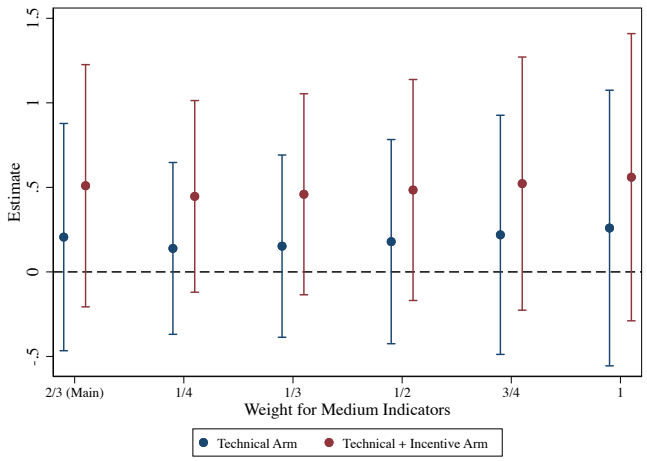
Figure A10: Robustness to Alternative Medium Indicators Weighting



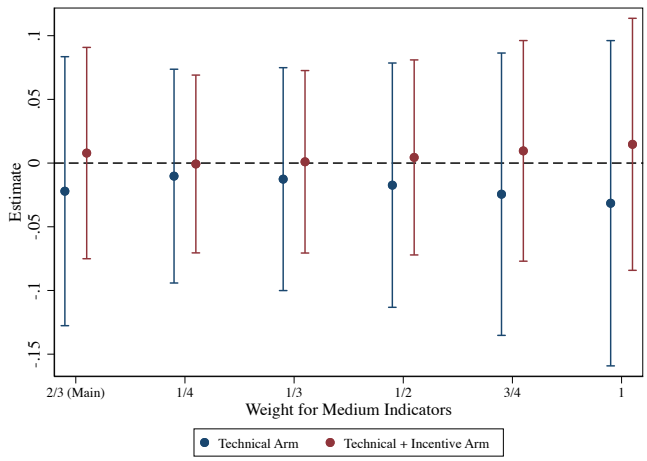
(a) All Indicators (Worker)



(b) Target Indicators (Worker)



(c) All Indicators (Kiln)



(d) Target Indicators (Kiln)

Notes: Sample: 246 kilns (1442 workers) surveyed in both the worker survey as well as kiln performance monitoring. Graphs show the OLS estimates and 95% confidence intervals generated from regressing the first four outcomes in Table 1 on treatment arm dummy variables with randomization strata fixed effects.

Table A1: Labor Trafficking Indicators based on Okech et al. (2025), with Survey Collection Status and Coding Variants

Code	Type	Indicator Description	Collected in Survey?	Has Coding Variants? (Conservative and Liberal)
Recruitment				
R1	Strong	Coercive recruitment (abduction, confinement during the recruitment process)	Yes	No
R2	Strong	Deceptive recruitment (nature of services or responsibilities required)	Yes	No
R3	Medium	Deceptive recruitment (regarding working conditions, content or legality of relevant contract, housing and living conditions, legal documentation or acquisition of legal status, location or employer, compensation/benefits, promise of marriage/love)	Yes	No
R4	Medium	Paid recruitment fees	Yes	No
Employment Practices & Penalties				
EP1	Strong	Had your pay, other promised compensation and/or benefits withheld and if you leave you will not get them	Yes	No
EP2	Strong	High or increasing debt related to an employer or other person who controls earnings (by falsification of accounts, inflated prices for goods/services purchased, reduced value of goods/services produced, excessive interest rate on loans, etc.)	Yes	No

Continued on next page

Table A1 – continued from previous page

Code	Type	Indicator Description	Collected in Survey?	Has Coding Variants? (Conservative and Liberal)
EP3	Medium	High or increasing debt related to a recruiter, intermediary or other individual (by falsification of accounts, etc.)	No	N/A
EP4	Medium	Made to work overtime beyond legal limits	No	N/A
EP5	Medium	Made to perform additional services or responsibilities (beyond what was agreed) without due compensation	Yes	Yes
EP6	Medium	Ever not received or had withheld promised wages, benefits, or other compensation.	Yes	No
EP7	Medium	Recruitment linked to debt (advance or loan)	No	N/A
EP8	Medium	Absence of a formal contract	Yes	No
Personal Life & Properties				
PL1	Strong	Another individual has control over any meaningful part of your personal life (i.e. blackmail, religious retribution, or exclusion from future employment, community, personal or social life, etc.)	Yes	No
PL2	Strong	Another individual has transferred control over any meaningful part of your personal life.	No	N/A
PL3	Extreme	Made to work or engage in commercial sex for in order to repay outstanding debt or wage advance	No	N/A

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Table A1 – continued from previous page

Code	Type	Indicator Description	Collected in Survey?	Has Coding Variants? (Conservative and Liberal)
PL4	Medium	Made to work or engage in commercial sex for employer's private home or family	No	N/A
PL5	Medium	Confiscation of mobile phones or other communication methods as a way to have control over you.	Yes	Yes
PL6	Medium	Confiscation of other valuables as a way to have control over you.	No	N/A
Degrading Conditions				
DC1	Strong	Made to be available day and night without adequate compensation outside of the scope of the contract	Yes	Yes
DC2	Medium	Made to complete hazardous and/or arduous services without proper protective gear	Yes	Yes
DC3	Strong	Made to engage in illicit activities	No	N/A
DC4	Medium	Made to live in degrading conditions e.g. housing or shelter is unclean, provides no privacy, or is otherwise insufficient in a way that harms your health	Yes	Yes
Freedom of Movement				
FM1	Strong	Confiscation of or loss of access to identity papers or travel documents	Yes	Yes
FM2	Strong	Constant surveillance of personal spaces by employer, recruiter, or other individuals	Yes	No

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Table A1 – continued from previous page

Code	Type	Indicator Description	Collected in Survey?	Has Coding Variants? (Conservative and Liberal)
FM3	Extreme	No freedom of movement or communication	Yes	No
FM4	Medium	Limited freedom of movement or communication i.e. supervised communication, movement restricted or surveilled during off-hours.	Yes	No
FM5	Medium	Constant surveillance of place of work	No	N/A
Debt or Dependency				
DD1	Strong	Had a debt imposed on you without your consent	Yes	No
DD2	Extreme	Tradition, birth/descent into hereditary slavery or bonded status	No	N/A
DD3	Medium	Pre-existence of an intimate or dependent relationship such as romantic or familial relationship	No	N/A
DD4	Medium	Unable to refuse to provide services	Yes	No
Violence & Threats of Violence				
V1	Strong	Physical violence inflicted in front of you on other individuals	Yes	No
V2	Extreme	Ever been sold or witness ownership of another person in your situation being sold for labor or for sex	No	N/A
V3	Strong	Physical violence against you or someone you care deeply about	Yes	No
V4	Strong	Sexual violence against you or someone you care deeply about	No	N/A

Continued on next page

Table A1 – continued from previous page

Code	Type	Indicator Description	Collected in Survey?	Has Coding Variants? (Conservative and Liberal)
V5	Medium	Threat of denunciation to authorities against you or someone you care deeply about	No	N/A
V6	Medium	Emotional/psychological abuse against you or someone you care deeply about	No	N/A
V7	Medium	Threat of harm to your personal or professional reputation	No	N/A
V8	Medium	Threats of violence against you or someone you care deeply about	Yes	No

Notes: This table lists all labor trafficking indicators from Okech et al. (2025). Note that this framework encompasses all forms of human trafficking, and we list all indicators included in Okech et al. (2025) for completeness. However, this paper only measures and studies labor trafficking (not sex trafficking and other forms of human trafficking). "Collected in Survey" notes whether an indicator was collected in our survey. "Type" refers to the strength of the indicator (Extreme, Strong or Medium) used in the classification thresholds shown in Figure 1 in the main text. Note that Okech et al. (2025) only distinguish between Strong and Medium indicators, while we categorize as Extreme those indicators that individually make a worker classified as trafficked (Threshold 1). "Coding Variants" indicates whether the indicator has both conservative and liberal coding in our analysis. Conservative codings use stricter criteria (e.g., "often" confiscates documents), while liberal codings use more inclusive criteria (e.g., "often or sometimes" confiscates documents). See Appendix Section A1 for more details.

Table A2: Balance Tests of Time-Invariant Kiln Characteristics

	Technical+Incentive Arm		Technical Arm		Control Arm		p-value for Test of Equality		
Balance Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	I vs. C	T vs. C	I vs. T
Owner Experience (Years)	15.602	8.625	17.062	10.247	15.169	9.910	0.849	0.308	0.355
Jashore Pilot Intervention Knowledge	0.361	0.484	0.355	0.482	0.358	0.483	0.825	0.973	0.810
Jashore Owner Interaction	0.455	0.510	0.545	0.510	0.458	0.509	0.798	0.333	0.529
Zigzag Year	2015	4	2014	4	2014	3	0.624	0.360	0.169
Water Adjacent	0.602	0.492	0.625	0.487	0.639	0.483	0.333	0.949	0.313
Bricks Fired (100,000s)	8.079	1.013	7.858	1.192	8.118	1.114	0.485	0.082	0.244
Circuits Completed	6.149	1.512	5.991	1.509	6.119	1.818	0.599	0.711	0.319
Class 1 Production Share (%)	65.193	11.496	67.312	8.380	65.880	10.543	0.946	0.110	0.193
Production Cost BDT (per 1K Bricks)	8869	941	8600	1314	8642	1065	0.077	0.960	0.130
Total Workers	110.133	28.621	111.938	32.697	110.940	35.788	0.903	0.571	0.656
Joint Ownership	0.313	0.467	0.325	0.471	0.398	0.492	0.262	0.264	0.994

All data collected through baseline owner survey. Sample includes 246 kilns with worker surveys and kiln performance monitoring. P-values from regressions with strata fixed effects. See Appendix Figure A2 for more details.

Table A3: Balance Tests of Pre-Existing Worker Characteristics

	Technical+Incentive Arm		Technical Arm		Control Arm		p-value for Test of Equality		
Balance Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	I vs. C	T vs. C	I vs. T
Age	34.632	9.670	34.597	10.076	34.253	9.947	0.720	0.735	0.997
Years of Education	4.540	3.626	4.700	3.517	4.644	3.444	0.870	0.655	0.772
Male	0.910	0.287	0.929	0.257	0.906	0.292	0.932	0.374	0.468
Literacy	0.018	0.135	0.013	0.113	0.010	0.100	0.536	0.837	0.711
Job as Brick Loader	0.386	0.487	0.377	0.485	0.360	0.481	0.368	0.885	0.471
Job as Molder	0.092	0.290	0.106	0.308	0.098	0.297	0.830	0.499	0.397
Job as Fireman	0.226	0.419	0.263	0.441	0.275	0.447	0.111	0.782	0.071
Job as Brick Unloader	0.296	0.457	0.254	0.436	0.267	0.443	0.301	0.341	0.038
Worked at Same Kiln in Previous Season	0.742	0.438	0.705	0.457	0.682	0.466	0.258	0.855	0.272
Worked at Any Kiln in Previous Season	0.946	0.227	0.948	0.222	0.939	0.240	0.715	0.636	0.912
Worked with Same Sardar in Previous Season	0.747	0.435	0.677	0.468	0.629	0.484	0.008	0.290	0.093
Division of Residence (Khulna)	0.930	0.255	0.931	0.254	0.939	0.240	0.349	0.315	0.869
Division of Residence (Rajshahi)	0.049	0.217	0.060	0.238	0.053	0.224	0.803	0.347	0.485
Division of Residence (Rangpur)	0.000	0.000	0.004	0.066	0.002	0.045	0.266	0.504	0.149
Division of Residence (Dhaka)	0.008	0.090	0.002	0.046	0.002	0.045	0.241	0.960	0.269
Division of Residence (Barisal)	0.012	0.110	0.002	0.046	0.004	0.064	0.123	0.831	0.086
Traveled for Work?	0.462	0.499	0.502	0.501	0.509	0.500	0.944	0.674	0.626
Distance Traveled (km)	45.382	63.948	48.567	67.811	49.141	64.770	0.948	0.696	0.660

All data collected through worker survey. Sample includes 1442 workers from 246 kilns with worker surveys and kiln performance monitoring.
P-values from regressions with strata fixed effects and standard errors clustered at kiln level. See Appendix Figure A2 for more details.

Table A4: Summary Statistics

	Mean	Standard Deviation	Minimum	Maximum
Trafficking and Labor Indicators				
R1 - Coercive Recruitment*	0.028	0.164	0	1
R2 - Deceptive Recruitment (Services)*	0.064	0.244	0	1
R3 - Deceptive Recruitment (Conditions)	0.057	0.232	0	1
R4 - Paid Recruitment Fees	0.135	0.341	0	1
EP1 - Can't Leave or They Won't Be Paid*	0.043	0.203	0	1
EP2 - High/Increasing Employer Debt*	0.001	0.037	0	1
EP5 - No Compensation for Additional Services (Liberal)	0.101	0.301	0	1
EP5 - No Compensation for Additional Services (Conservative)	0.093	0.290	0	1
EP6 - Withheld Wages/Benefits	0.118	0.323	0	1
EP7 - Recruitment Linked to Debt	0.005	0.070	0	1
EP8 - No Formal Contract	0.706	0.456	0	1
PL1 - Control Over Personal Life*	0.033	0.179	0	1
PL5 - Confiscation of Communication Methods (Liberal)	0.064	0.246	0	1
PL5 - Confiscation of Communication Methods (Conservative)	0.003	0.059	0	1
DC1 - Available Day/Night Without Compensation (Liberal)*	0.019	0.136	0	1
DC1 - Available Day/Night Without Compensation (Conservative)*	0.013	0.114	0	1
DC2 - Hazardous Work Without Protection (Conservative)	0.702	0.457	0	1
DC2 - Hazardous Work Without Protection (Liberal)	1.000	0.000	1.000	1.000
DC4 - Degrading Living Conditions (Conservative)	0.003	0.059	0	1
DC4 - Degrading Living Conditions (Liberal)	0.016	0.125	0	1
FM1 - Confiscation of Identity Documents (Liberal)*	0.078	0.268	0	1
FM1 - Confiscation of Identity Documents (Conservative)*	0.012	0.111	0	1
FM2 - Constant Surveillance of Personal Spaces*	0.037	0.188	0	1
FM3 - No Freedom of Movement/Communication*	0.050	0.218	0	1
FM4 - Limited Freedom of Movement/Communication	0.424	0.494	0	1
DD1 - Debt Imposed Without Consent*	0.005	0.070	0	1
DD4 - Unable to Refuse Services	0.078	0.268	0	1
V1 - Witnessed Physical Violence*	0.070	0.255	0	1
V3 - Physical Violence Against You/Loved Ones*	0.019	0.138	0	1
V8 - Threats of Violence	0.053	0.225	0	1
Worker is Trafficked (Conservative)	0.186	0.389	0	1
Worker is Trafficked (Liberal)	0.241	0.428	0	1
Weighted Count of Indicators (Conservative)	1.911	1.244	0.000	8.667
Weighted Count of Indicators (Liberal)	2.234	1.322	0.667	9.333
Child Labor				
Child Labor Exists	0.325	0.468	0	1
Child Labor Exists for Children Under 14	0.058	0.233	0	1
Share of Workers Under 18 in Respondent's Team	0.043	0.080	0.000	0.500
Share of Workers Under 14 in Respondent's Team	0.006	0.028	0.000	0.400
Amenities to Workers				
Supplies Cooking Fuel	0.607	0.488	0	1
Separate Toilet Facilities for Men and Women	0.162	0.369	0	1
Piped Water Toilets	0.047	0.212	0	1
Privacy in Dwelling	0.501	0.500	0	1
Shed for Rest During Work	0.477	0.500	0	1
No Benefits from Sardar	0.613	0.487	0	1
Received Bonus from Sardar	0.036	0.187	0	1
Received Wage Increase from Sardar	0.010	0.101	0	1
Received Extra Meals from Sardar	0.147	0.354	0	1
Received Mobile Phone from Sardar	0.001	0.026	0	1
Received Travel Allowance from Sardar	0.022	0.147	0	1
Received Clothing from Sardar	0.012	0.111	0	1
Received Bakhshish from Sardar	0.019	0.136	0	1
Worker-Reported Wages and Health				
Weekly Wages (Worker-Reported)	3784	1110	0	9100
Work-Related Injury	0.287	0.453	0	1
Physical Health Symptoms	0.249	0.433	0	1
Anxiety Score (GAD-7)	4.282	3.320	0.000	21.000
Depression Score (PHQ-9)	4.607	3.334	0.000	27.000
Respiratory Symptoms	0.125	0.331	0	1
Respiratory Problems	0.015	0.120	0	1
Constant Cough	0.061	0.239	0	1
Difficulty Breathing	0.049	0.215	0	1
Wheezing or Panting or Asthma	0.036	0.187	0	1
Owner-Reported Wages				
Molder Wages (Owner-Reported)	1024	123	600	1200
Brick Loader Wages (Owner-Reported)	313	42	200	400
Brick Unloader Wages (Owner-Reported)	207	32	160	310
Firemen Wages (Owner-Reported)	1083610	147867	675000	1400000
Kiln-Level Outcomes				
Trafficked Worker at Kiln (Conservative)	0.496	0.501	0	1
Trafficked Worker at Kiln (Liberal)	0.602	0.491	0	1
Weighted Count of Unique Indicators at Kiln (Conservative)	4.198	2.304	0.667	11.667
Weighted Count of Unique Indicators at Kiln (Liberal)	4.692	2.554	1.333	13.000
Weighted Count of Target Indicators at Kiln (Conservative)	0.706	0.321	0.000	2.333
Weighted Count of Target Indicators at Kiln (Liberal)	0.798	0.340	0.667	2.333
Child Labor Exists at Kiln	0.714	0.453	0	1
Child Labor Exists at Kiln for Children Under 14	0.188	0.391	0	1
N: 1442 individuals; 246 kilns; 1400 owner wage observations.				

* Strong Indicator

Table A5: ITT Estimates for Labor Trafficking by Study Arm (Liberal Coding)

	Weighted Count of Indicators				Trafficking Prevalence	
Treatment Arm	(1)	(2)	(3)	(4)	(5)	(6)
Technical Only	0.093	0.001	0.118	-0.031	0.015	-0.033
	(0.137)	(0.016)	(0.376)	(0.056)	(0.040)	(0.075)
Technical+Incentive	0.019	-0.011	0.280	-0.019	-0.033	-0.112
	(0.125)	(0.012)	(0.402)	(0.053)	(0.038)	(0.074)
Control Mean	2.219	0.699	4.598	0.807	0.253	0.651
Kiln or Worker Level?	Worker	Worker	Kiln	Kiln	Worker	Kiln
All or Target?	All	Target	All	Target	-	-
Observations	1442	1442	246	246	1442	246

Standard errors in parentheses. All standard errors are clustered at the kiln level for worker level analyses and are heteroskedasticity-robust for kiln level analyses. Columns 1-4: The dependent variable is a weighted count of the trafficking indicators observed; medium indicators receive 2/3rds the weight of strong and extreme indicators. Estimates are OLS estimates generated from regressing the weighted count of trafficking indicators on treatment arm dummy variables, with fixed effects for randomization strata. Columns 1-2 show regression results for the worker-level weighted count of indicators. Columns 3-4 show results for the weighted count of unique indicators in each kiln. Target indicators use the same weighting and include indicators that are most closely related to the incentives: DC1 (Made to be available day and night without adequate compensation outside of the scope of the contract); DC2 (Made to complete hazardous and/or arduous services without proper protective gear); and DC4 (Made to live in degrading conditions). Columns 5-6: Estimates are OLS estimates generated from regressing an indicator for trafficking on treatment arm dummy variables, with fixed effects for randomization strata. To generate kiln-level data, we code kilns as having trafficking if any of the workers interviewed at that kiln met the definition for trafficking.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A6: Adoption and Impact of Technical Intervention on Efficiency and Productivity

	Adopted Technical Intervention	Specific Energy Consumption (MJ/kg fired brick)	Specific Fuel Consumption (tons/100,000 bricks)	Fuel Spending (BDT/Brick)	Class 1 Bricks (% of total production)
Technical Only	0.45***	-0.10***	-1.70***	-0.41***	0.06***
	(0.06)	(0.03)	(0.41)	(0.10)	(0.01)
Technical+Incentive	0.44***	-0.12***	-1.91***	-0.31***	0.06***
	(0.06)	(0.03)	(0.44)	(0.09)	(0.01)
Observations	276	276	276	276	276
Control Mean	0.20	1.07	16.07	3.74	0.78

Heteroskedasticity-robust standard errors in parentheses. Estimates are OLS estimates generated from regressing each outcome on treatment arm dummy variables, with fixed effects for randomization strata. Adoption (column 1) is a binary for whether a kiln adopted the improved brick stacking and fuel feeding practices or not. Specific Energy Consumption (column 2) measures megajoules per kilogram of fired brick. Specific Fuel Consumption (column 3) measures tons of coal per 100,000 bricks produced. Fuel Spending (column 4) is measured in Bangladeshi Taka (BDT) per brick. Class 1 Bricks (column 5) represents the percentage of total production meeting Class 1 quality standards.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Impact of Technical Intervention on Owner-Reported Costs

	Soil Cost (BDT per 1000 bricks)	Molding Cost (BDT per 1000 bricks)	Coal Preparation Cost (BDT per season)	Brick Loading Cost (BDT per 1000 bricks)	Brick Unloading Cost (BDT per 1000 bricks)	Firemen Cost (BDT per season)	Total Production Cost (BDT per 1000 bricks)
Technical Only	1.59	6.58	13239.60	5.85	3.35	18452.90	-112.10
	(14.89)	(17.36)	(8852.78)	(5.81)	(4.63)	(22541.56)	(93.07)
Technical+Incentive	22.62	2.30	2502.05	6.27	4.09	22234.53	2.64
	(15.36)	(16.59)	(8255.78)	(5.90)	(4.54)	(22297.62)	(95.72)
Observations	276	276	276	276	276	276	276
Control Mean	902.30	1026.79	214463.91	307.52	204.54	1.07e+06	9234.78

Heteroskedasticity-robust standard errors in parentheses. Estimates are OLS estimates generated from regressing each cost measure on treatment arm dummy variables, with fixed effects for randomization strata. All costs are owner-reported and measured in Bangladeshi Taka (BDT). Columns 1, 2, 4, 5, and 7 show costs per 1,000 bricks. Columns 3 and 6 show total seasonal costs for coal preparation and firemen, respectively. Total Production Cost (column 7) represents the owner's estimate of total cost per 1,000 bricks, including all inputs.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$