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Addressing social desirability bias in child labor measurement : an application to cocoa farms in Côte d'Ivoire

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Abstract

This paper proposes new estimates of the prevalence of child labor in Côte d'Ivoire's cocoa farms that are certified free of child labor. We rely on list experiments to avoid issues of social desirability bias associated with measuring sensitive issues, that we implement on a sample of 4 458 Ivorian cocoa farmers. We find that 24% of them were helped by a child under 16 for harvesting and breaking the cocoa pods during the past 12 months, 21% for preparing their farm, and 25% employed and paid a child to perform any task on their cocoa farm. These results are twice as high as those declared by farmers when directly questioning them on their child labour use. Last, we show that the prevalence of child labor is higher for farms that are more remote, in line with limited school opportunities for children, lower adult labor supply, and weaker law enforcement capacity related to the reliance on children for farm activities. While child labor has been given considerable attention over recent years by most actors of the cocoa value chain, this paper shows that further progress can still be accomplished, particularly amongst the most remote farming communities.

Keywords: List experiment, social desirability bias, child labor, certification schemes

JEL: C83, J23, J43, J81

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1 Introduction

With an estimated 790 000 children between 5 and 17 years laboring on cocoa farms in 2019 (NORC, 2020), the Ivorian cocoa sector is still struggling with child labor. The sector remains under pressure from national and international regulators, as children working on cocoa farms are widely exposed to hazardous work, one of the worst forms of child labor according to the International Labour Organization (ILO). In Côte d'Ivoire, 97% of children working on cocoa farms are estimated to be involved in such hazardous work (NORC, 2020). The ILO defines the latter as "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" (Article 3 of ILO's Convention No. 182). Pressure from various civil society stakeholders to reduce child labor in cocoa has in part been fueled by a growing body of research related to the negative effects of child labor on children's physical and mental health (Guarcello et al., 2004; Fekadu et al., 2006; Roggero et al., 2007; Trinh, 2020) or education (Udry, 2006; Beegle et al., 2009; Putnick and Bornstein, 2015) since the early 2000s.

Since the late 2000s, traders and manufacturers have been using independent certification labels to meet growing consumer demand for ethical and sustainable cocoa[1]. These labels reward cocoa farmers with the legal price[2] and a certification premium, the latter rewarding a more sustainable cocoa production, without deforestation and free of child labor. Farmers that are members of certified cooperatives also benefit from various training and are sensitized to the negative consequences of child labor on children's well-being. Certified cooperatives are annually audited by third-party auditors to ensure that their affiliated farmers comply with their social and environmental requirements. Certification labels and the services that they provide to farmers have gradually attracted the attention of researchers in the past few years, mainly focusing on assessing the impact of certification on farmers' incomes. As far as we know, no studies have investigated if child labor remains prevalent in the specific context of certified cocoa value chains.

Investigating child labor issues in certified value chains implies addressing methodological challenges to correctly measure this complex and sensitive phenomenon. The issue of child labor measurement has recently been highlighted by Guarcello et al. (2012), who find that child labor prevalence in several countries fluctuates from one year to another, calling into question the way in which it is measured. The subsequent literature on the measurement of adult and child labor has identified various factors that may influence the accuracy of labor measurement. Dillon (2010) highlighted that responses regarding child labor vary substantially depending on the type of respondent, whether adult or child. Beegle et al. (2012) found that the choice of recall period affects responses regarding adult labor, which might also be the case for child labor. The type of survey and its design were also found to have an impact on child labor measurement (Dillon et al., 2012). Often prohibited by law or prone to negative social perceptions, child labor is also a sensitive issue and questioning individuals about it is challenging. It is now acknowledged that when people are asked about sensitive subjects, they are likely to lie to avoid negative consequences, either legal or social, or to be seen in a favorable light by the interviewer (Tourangeau and Yan, 2007). To our knowledge, this social desirability bias has not received much attention in the measurement of child labor, and has never been considered in any report assessing the prevalence of child labor in the cocoa industry. The latter, using a direct measure of child labor, estimates that the proportion of children working on cocoa farms and living in cocoa households has recently increased from 37% in 2013-2014 to 45% in 2018-2019 (NORC, 2020). These figures are however likely underestimated as they do not account for social desirability bias.

In this paper, we rely on the list experiment approach, an indirect questioning method, to measure the proportion of certified cocoa farmers in Côte d'Ivoire who use child labor to perform hazardous work on their farm. This method, by hiding the respondent's answer to the sensitive question among other answers to innocuous questions, is expected to reduce social desirability bias (Imai, 2011). We also perform a multivariate analysis to determine the main factors influencing the probability that a certified farmer will use child labor. Specifically, respondents were asked about whether they had been helped by a child under 16 to perform

[1] UTZ and Rainforest Alliance for sustainable development labels, Fairtrade International (Max Havelaar) for fair trade label, or Organic for cocoa that follows organic production methods. All sustainable development programs set up by chocolate producers themselves (e.g. Cocoa Life for Mondelez) are excluded here.

[2] In Côte d'Ivoire, the cocoa farmgate price is set at the beginning of each season by the Conseil Café Cacao (CCC). During the survey period, the farmgate price per kilo of cocoa was set at 825 CFA (1.48 dollars).

dangerous work on their farm, or whether they had employed and paid a child for any work on their farm. Our study covers 4 458 cocoa farmers certified by the UTZ and RA labels, surveyed between December 2019 and March 2020.

We find strong evidence that certified cocoa farmers exhibit a social desirability bias when asked about their use of child labor on their cocoa farms. The prevalence of child labor use estimated using the indirect measure is twice as large as the one from direct questioning. Using list experiments, we find that 24% of certified cocoa farmers were helped by a child under 16 for harvesting and breaking cocoa pods during the past 12 months, 21% for preparing their farm, and 25% employed and paid a child to perform any task on their cocoa farm. We further provide insights on the persistence of child labor on cocoa farms certified free of child labor using multivariate analyses. We find that household cocoa production, which determines the labor needs of the farmer, as well as community and infrastructural characteristics, are the main determinants of the use of child labor. Our results show that the prevalence of child labor is higher for farms that are more remote, in line with limited school opportunities for children, lower adult labor supply, and weaker law enforcement capacity related to the reliance on children for farm activities. These estimates are likely lower bound when one considers the cocoa sector altogether (certified and non-certified). In fact, although we do not measure the impact of certification on child labor, it is likely that the use of child labor among certified cocoa farmers remains significantly lower than among non-certified farmers, given the ongoing efforts of the private sector and certification bodies regarding training and awareness-raising campaigns addressing child labor issue.

Our paper contributes to the literature on child labor in two ways. First, unlike other studies that attempt to measure child labor, we use an indirect method of questioning to reduce the social desirability bias among respondents and obtain a more accurate measure of child labor. Our results support the existence of a social desirability bias and question the relevance of using direct measurement in this context, which can contribute to the design of poorly targeted private and public policies. Second, to the best of our knowledge, this is the first study to focus on measuring hazardous child labor in certified cocoa value chains. Our findings, which support the existence of child labor even in these presumed child labor free value chains, are explained by two main reasons. First, because important determinants of the use of child labor, both community-based and structural, are beyond the expertise of certification bodies. Second, the remoteness of cocoa farms makes it difficult for certification bodies to properly monitor them, decreasing the incentive for farmers to actually comply with child-labor restriction rules.

The remainder of this article is organized as follows. In Section II, we discuss the challenges associated with measuring child labor in certified cocoa value chains. Section III presents the data, the list experiment method, its design, and the empirical strategy. The results are discussed in section IV and section V concludes.

2 Assessing child labor in certified cocoa value chains

2.1 Cocoa sustainability standards and child labor

Child labor has become a major issue in the cocoa sector since the early 2000s, when the cocoa industry committed to reduce the worst forms of child labor by 70% by 2020[3]. Despite ongoing efforts to achieve this goal by both governments and cocoa companies, the sector has failed to meet its commitment. Indeed, many children continue to work on cocoa farms in West Africa, some of them performing dangerous tasks that may threaten their health, such as land clearing, felling trees, burning plots, stump grubbing, pruning, pod-breaking with a sharp tool, harvesting with a machete, and manipulating agrochemicals. In the case of Côte d'Ivoire, all these activities are prohibited for children under the age of 18[4] and recognized as hazardous

[3] In September 2001, several companies from the cocoa industry further signed the Harkin-Engel Protocol, an international public-private partnership aimed at eradicating the worst forms of child labor in cocoa value chains in West Africa.

[4] Dangerous work can be allowed from the age of 16 provided that children have received specific instruction or vocational training.

under Ivorian legislation. In response to growing international demand for sustainable cocoa, as well as increasing legal requirements in both importing and producing countries, cocoa traders are constantly trying to improve the detection and remediation of child labor in their supply chains.

Since the late 2010s, the various independent cocoa certification labels (UTZ, Fairtrade, and RA) represent one of the potential tools for reducing child labor, now covering nearly 60% of the country's cocoa farmers (The World Bank, 2019). These labels allow certified farmers to obtain an additional premium and to benefit from various trainings, related to good agricultural and social practices. In return, farmers must comply with social and environmental requirements, including non-reliance on child labor on their farms. This ban is associated with awareness campaigns to inform certified cocoa farmers about the harmful effects of child labor, the benefits of schooling for children, and the legal minimum age at which children can start working. Certified cocoa cooperatives must also put in place systems to prevent, monitor, and address child labor at the community level. Similarly, the great majority of cocoa buying companies implement their own child labor monitoring system[5]. These requirements associated with certification schemes are supposed to help reduce child labor on cocoa farms.

The impact of these certification schemes on farmers has received attention from researchers in recent years. Mainly studied in the coffee sector, the economic effects are mixed and differ according to countries, types of certification, and context (de Janvry et al., 2015; Oya et al., 2018; Meemken, 2020). In the cocoa sector, studies assessing the impact of certification on cocoa farmers show a positive effect on cocoa productivity, income, and consumption (Astrid Fenger et al., 2017; Ingram et al., 2018; Knößlsdorfer et al., 2021). Nevertheless, these positive results seem conditioned by the quality of the services and the supervision that farmers receive from the cooperative to which they are affiliated. Recently, Sellare et al. (2020) confirmed the importance of accounting for the heterogeneity of cocoa cooperatives to improve the evaluation of certification schemes in Côte d'Ivoire. Mainly focused on the impacts of certification on farmers' income or productivity, the literature has surprisingly paid little attention to other outcomes likely to be impacted by the participation of farmers in a certification program (Chen et al., 2017). Child labor, which is prohibited by all cocoa certification schemes in Côte d'Ivoire, is one of those topics neglected by prior research. More than a lack of interest, it can be argued that previous research has not focused on child labor for two main reasons: 1) the effect of certification on child labor is probably not direct but goes through intermediate channels (i.e. income), and 2) certification schemes prohibit child labor, increasing the challenges associated with the measurement of child labor itself.

2.2 Challenges of child labor statistics

Providing accurate child labor statistics has been recognized as a complicated task. One of the first steps for a researcher designing a child labor survey is to decide which member of the household is most likely to accurately answer these specific questions. Often embedded in a broader household survey, questions on child labor are usually asked to the head of the household (or another proxy respondent) to keep the survey short. Looking at the allocation of children's time between school, work, and leisure in Mali, Dillon (2010) find that children reported longer working hours than household head proxy respondents. However, based on two different methods of questioning, the study cannot differentiate between effects related to the type of respondent and those related to the questioning method. Nevertheless, it certainly did pave the way for further research on this finding, and subsequent studies support the hypothesis of underreporting in child labor questions by household head or proxy respondents (Galdo et al., 2018; Janzen, 2018). Recently, a study conducted in Mali in the coffee sector (Galdo et al., 2020) suggests that the existence of discrepancies between the responses of the child and the proxy respondent depends on whether the child is a boy or a girl. Whether children are best able to provide accurate answers is however uncertain. Different theories of children's cognitive development provide evidence that their answers are generally accurate but that they forget information, and that they may be subject to as much bias as adults (Borgers et al., 2000; Fuchs, 2008).

[5] Usually based on the Child Labour Monitoring and Remediation Systems (CLMRS) developed by the International Cocoa Initiative (ICI).

Recall bias is one of the labor survey biases that has attracted the most attention from researchers. Indeed, it can be difficult for respondents to recall accurately and over long periods of time the amount of labor used, or even their own working time. This is particularly the case in the context of the informal agricultural sector, where time use is not fixed and depends on many external factors. Several studies have confirmed the existence of such bias in labor surveys in the context of developing countries. Beegle et al. (2012) investigate the impact of time between survey and harvest on responses related to adult labor used for harvest in Malawi, Kenya, and Rwanda. While they did find a recall bias for Malawi and Kenya, this bias does not operate in the same direction: a longer recall period increases the probability of reporting hired labor in Kenya, while it decreases the probability in Malawi. The opposite direction of bias in different contexts can be explained by the fact that biases arise from several factors, such as memory bias, which involves forgetting certain events, or incorrectly estimating the date of an event, being subject to telescoping[6] (Thompson et al., 1988). When asked about quantitative questions, it has also been shown that not all respondents use the same cognitive processes, leading to significantly different outcomes (Bradburn et al., 1987). In 2016, Arthi et al. confirmed the existence of such recall bias among Tanzanian farmers. They found that Tanzanian farmers surveyed at the end of the season tend to overestimate the working time of their household members on their plots by a factor up to 3.7 when compared to farmers surveyed weekly, and underestimate the number of plots on which family workers worked by about 50%. Gaddis et al. (2020) found the same tendency among Ghanaian farmers. All these findings tend to suggest that the choice of recall period (seasonal, monthly, weekly) sometimes underestimates or overestimates labor use or working time depending on the context.

It is also likely that, depending on the type of child labor concerned, national legislation, and social standards, a social desirability bias arises when individuals are asked about child labor. This means that farmers may not answer child labor questions honestly in order to provide socially desirable answers, and not be subject to criticism or sanctions. This behavior is common when respondents are questioned about sensitive topics, both from a personal or societal perspective (Tourangeau and Yan, 2007), such as politics (Çarkoğlu and Aytaç, 2015), health (De Cao and Lutz, 2018; Moseson et al., 2015) or intimate partner violence (Cullen, 2020). To our knowledge, no previous studies on the measurement of child labor has addressed the presence of this potential social desirability bias. Yet, estimates of the prevalence of child labor obtained through a direct questioning method could significantly underestimate the phenomenon in the case of a proven social desirability bias.

2.3 Social desirability bias in certified cocoa value chains

Even though child labor is prohibited by both national legislation and certification bodies in the context of certified cocoa value chains, child labor may nevertheless be used by certified cocoa farmers.

Indeed, the use of child labor may be the only available option for some agricultural households. The poorest among them may not be able to afford adult labor, and others need the additional wage earned by their children to reach a decent level of income (Basu and Van, 1998). The idea that the use of child labor is rooted in household poverty has shown to be relevant in the context of cocoa households in Côte d'Ivoire (Nkamleu and Kielland, 2006). But child labor does not only occur in the poorest households. Land-rich agricultural households are also likely to use child labor (Bhalotra and Heady, 2003), as each additional hectare of land increases the household's need for labor. This wealth-paradox has been nuanced by Basu et al. (2010) and requalified as an inverted U-shaped relationship between land-wealth and child labor. While several studies highlight the positive impact of certification on cocoa farmers' income (Astrid Fenger et al., 2017; Ingram et al., 2018), the literature on child labor suggests that the relationship between income and child labor is still unclear and depends on many other factors. In fact, the wealth paradox may be partly explained by a combination of market failures, particularly in rural areas of developing countries (Dumas, 2013).

In Côte d'Ivoire, cocoa-producing households are likely to face challenges in finding available adult labor to work on their farms for several reasons. Cocoa-related activities are not mechanized and are thus labor-intensive. Therefore, a higher cocoa production necessarily implies a higher need for labor. While some studies

[6] Backward telescoping occurs when the respondent considers recent events to be more remote than they are. When the misperception goes in the opposite direction, the respondent experiences forward telescoping.

have found a positive impact of certification on cocoa productivity (Ingram et al., 2018), it may nonetheless put upward pressure on farmers' need for labor, and potentially encourage them to use child labor. Moreover, while cocoa is a year-round labor-intensive activity, the labor demand of cocoa households peaks during the main cocoa season, when cocoa production is most intensive. Cocoa farmers are however usually clustered in cocoa growing communities, which means that during peak season, farmers from the same community seek additional labor for their farm at the same time. Access to external labor force remains limited given the landlocked nature of the cocoa communities. All these factors increase the likelihood that a cocoa-producing household will face difficulties in finding adult labor available in a tight labor market[7]. Likewise, transaction and contract enforcement costs can discourage even the most well-off households from using adult labor.

The disadvantages arising from a labor market that does not function properly could however be mitigated by an efficient land-market. A farmer who could not hire an adult worker could sell or rent the part of his farm that he cannot take care of. However, farmers in Côte d'Ivoire continue to hold customary land titles despite successive policy attempts to facilitate the official registration of property rights. Land exchanges are therefore limited because they are fraught with uncertainty. The imperfection of the land market directly impacts the credit market, since land is generally a collateral required by banks to grant credit to farmers. Without enough collateral, farmers therefore have difficulty obtaining credit from financial institutions, as the latter face significant information asymmetries. Yet, access to credit could allow households to smooth their income, and thus avoid taking their children out of school for financial reasons, and/or to make them work to increase household income (Guarcello et al., 2009). Finally, the lack of school infrastructure at the community level or within a reasonable distance may lead parents to take their children with them on cocoa farms as a possible alternative to school.

All these market failures are present in both non-certified and certified cocoa value chains, suggesting that despite some directly observable income and productivity benefits of certification for cocoa farmers, they are likely to use child labor like any other non-certified farmer. Beyond economic factors explaining the persistent use of child labor, the monitoring difficulties might also play against the ban. Cocoa farms are often isolated and difficult to reach, making the monitoring process more costly and less effective[8]. Enforcement of the ban, which relies in part on the awareness, involvement, and cooperation of farmers and various stakeholders at the community level, is likely to be limited. Indeed, the very definition of a child, and therefore of child labor, established by the international community is not consistent with that of Ivorian cocoa communities. The latter does not assign tasks to children according to their age, but rather to their physical capacities, which they are able to appreciate (Buono and Babo, 2013). At the community level, it is therefore unlikely that the ILO standard would be the one to prevail, as it sometimes conflicts with the social traditions of Ivorian cocoa households. The efficiency of community-based systems aimed at detecting and monitoring child labor is thus probably undermined by the inadequacy between standards. Yet, previous literature on child labor has shown that the ability to enforce a policy is a key factor for its success. Consequently, where enforcement is low, policies to reduce child labor are shown to have little or no effect (Edmonds and Shrestha, 2012; Bargain and Boutin, 2021).

3 Research design

3.1 The data

We use data from a socioeconomic survey, designed by ourselves and carried out by an international cocoa trading company, among Ivorian certified cocoa households that are part of its supply chain. We use two versions of the questionnaire to implement the list experiment (see below). Randomization of the survey version among farmers was also carried out and monitored by ourselves. The survey is divided into two complementary questionnaires : (i) A household level questionnaire, which collects household characteristics such as size, composition, and basic characteristics of its members, along with information on banking,

[7] The difficulty in finding adult labor was also discussed in the 2020 Cocoa Barometer.

[8] Audits performed by certification bodies have recently been declared ineffective in addressing child labor (Fountain and Hütz-Adams, 2020)

savings and credit practices, and wealth. (ii) A farm-level questionnaire which covers issues such as farm size, farm age, pesticide use, the incidence of pests and diseases, use of family and hired labor, and cocoa-related income. The survey is only addressed to the certified cocoa farmer. No other respondents, such as other household members, were surveyed. Data collection officially started during the main cropping season in December 2019 and stopped mid-March 2020. The enumerators collected information in several cocoa-growing areas in the regions of Agnéby-Tiassa, Cavally, Grands Ponts, Guémon, Gôh, Lôh-Djiboua, Nawa, and Tonkpi.

The final sample consisted of 4 458 UTZ (88%) and RA (12%) certified cocoa farmers[9]. The great majority of them are Ivorian (74%) or Burkinabe (24.5%), and almost all of the farmers are men (95%) (table A1). Cocoa farmers are on average 42 years old, they are generally married (89%) and live in a household with at least one child (90%). The level of education of the farmers remains relatively low : 57% of them never attended school and only 17% of them have reached secondary school or higher education. The median size of the cocoa farm is 2.09 ha, but cocoa farmers grow other crops on their farm in 51% of cases.

We combine the survey data with four other sources of information. Data on population density was obtained from the General Census of Population and Housing (RGPH 2014) of Côte d'Ivoire. Road infrastructure and protected areas data were respectively obtained through Open Street Map and the World Database on Protected Areas (WDPA). Finally, the 2019 Ivorian school map was used to obtain information on the location of primary schools.

3.2 The list experiment

To overcome issues of social desirability bias when asking respondents about sensitive topics, several alternative methods of indirect questioning have been proposed. The list experiment[10] is one of the main methods used as an alternative to direct questioning. It consists of showing participants a list of statements (usually 4 or 5) and asking how many of them apply to their case. Since the answer provided by the respondent is a global response, the enumerator has no way of knowing precisely which statements apply to the respondent's case, which gives the latter total confidentiality and should encourage him to respond more honestly. In the simplest version of the list experiment, respondents are randomly divided into two groups. The control group receives a list of n non-sensitive items, and the treatment group receives a list with the exact same n sensitive items as the control group, plus one sensitive item. The proportion of the sample engaging in sensitive behavior is then estimated by a simple difference in mean responses between the two groups.

Initially proposed by Raghavarao and Federer (1979) in a slightly different version, the list experiment has since been used in many areas to study various topics such as politics (Çarkoğlu and Aytaç, 2015; Comşa and Postelnicu, 2013; Corstange, 2010; Holbrook and Krosnick, 2010), health (Lépine et al., 2020; Moseson et al., 2015), homophobia (Lax et al., 2016; Co Man et al., 2017), intimate partner violence (Cullen, 2020) or food security (Tadesse et al., 2020) among others. The use of the list experiment has revealed the existence of a social desirability bias for some sensitive topics, invalidating previous estimates obtained via direct questioning. As an example, Gonzalez-Ocantos et al. (2012) found that 24% of Nicaraguan voters exchanged their vote for a gift or service using the list experiment, compared to only 2% when asked directly. Similarly, Co Man et al. (2017) found a 67% increase in the proportion of homophobic sentiment in the workplace through the list experiment in an online survey compared to the direct question. The better performance of the list experiment compared to other methods of questioning (direct and indirect) has been highlighted by several other empirical studies (Çarkoğlu and Aytaç, 2015; Holbrook and Krosnick, 2010; Moseson et al., 2015; Wolter and Laier, 2014). Yet, the list experiment sometimes leads to insignificant results or of the same magnitude as those obtained via the direct question (Arentoft et al., 2016; Krebs et al., 2011; Lax et al., 2016). This type of results may occur when the sample is not large enough or the social desirability bias is too small

[9] Farmers in our sample benefited from several awareness sessions on the negative effects of child labor. Each cocoa farmer and their household are individually sensitized to child labor when they start working for the cooperative. A second awareness session, this time at the community level, is repeated every year.

[10] Also known as the Unmatched Count Technique or the Item Count Technique.

to be detected by the list experiment, which produces estimates with relatively high variance due to the non-sensitive items. Recently, Chuang et al. (2021) also showed that the design of the list experiment, especially the choice of non-sensitive items, could also influence respondent compliance and the results obtained with the list experiment. Lack of difference between the list experiment and direct question may also reveal the absence of social desirability bias, contrary to the researchers' initial assumptions (Blair et al., 2020).

Although used in many research settings, the list experiment has, to our knowledge, not yet been used to measure child labor.

3.3 Design of the list experiment

We are interested in three different categories of work performed by children under 16 on cocoa farms. First, we want to estimate the proportion of cocoa farmers being helped by a child for tasks classified as hazardous by the ILO. We distinguish between hazardous work related to farm preparation (applying pesticides, clearing, tree felling, burning plots), and harvesting and pod breaking. We are also interested in estimating the proportion of cocoa farmers who hire and pay a child to perform any task(s) on their farm. We are not concerned with the light work performed by children on the cocoa farms, as this is not harmful to the child and commonly encouraged by their family. Those tasks, tolerated by the ILO, are generally perceived by cocoa farming households as an integral part of the child's education and personal development (Buono and Babo, 2013). We also choose to restrict the scope of the study to children under 16, to be in line with Ivorian legislation which, under certain conditions, allows children between 16 and 18 to perform hazardous work.

Three list experiments were proposed to cocoa farmers, one for each of the aforementioned categories of work:

List 1 – During the last campaign, for harvesting and breaking the pods :
1) No woman over 16 helped me.
2) At least one member of my family helped me.
3) One or more people under 16 helped me.
4) A group of communal laborers helped me.
In total, how many statements apply to your case ?

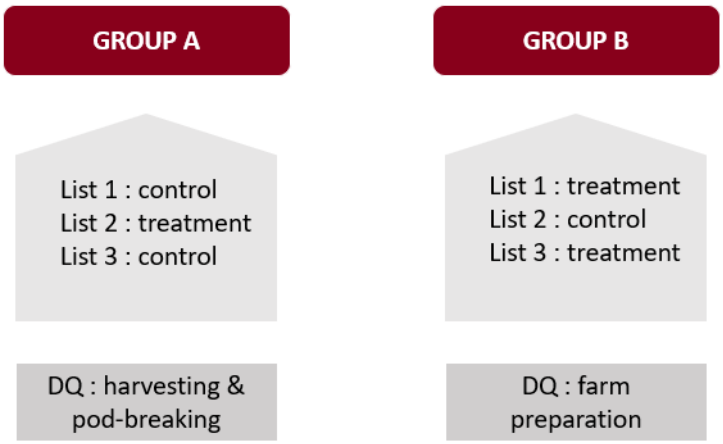
List 2 - During the last campaign, to prepare my plot (applying pesticides, clearing, felling of trees, burning of plots) :
1) No woman over 16 helped me.
2) At least one member of my family helped me.
3) One or more people under 16 helped me.
4) A group of communal laborers helped me.
In total, how many statements apply to your case ?

List 3 – During the last campaign, to do some work on my farm (for all types of activities):
1) I have not employed any woman over 16.
2) At least one member of my family helped me.
3) I have employed and paid one or more people under 16 who are not members of my family.
4) I employed a group of communal laborers.
In total, how many statements apply to your case ?

The third item in each of these lists is the sensitive one, which is only asked to one of the two randomly defined groups.

Before proceeding with the list experiment, each enumerator explained to the respondent how this particular question worked, as follows: “Please put your hand behind your back. I’m going to read 3 or 4 statements about the labor used on your cocoa farm in the last 12 months. If the statement read is true, and applies to you, lift a finger behind your back. If the statement is not true, do not lift a finger. After I read you all the statements, show me your hand and the number of fingers you raised. I don’t want to know which statements apply to you, only the number of statements that are true for you. Please do not answer ”yes” or ”no” when I read statements to you. Your answers must remain confidential.” Enumerators were further encouraged to provide an example to the farmer in case he seemed confused about the wording of the question. The proposed example was a simple one, using familiar terms and representing a common situation for farmers.

Fig. 1: Design of the list experiment and direct question



Note : DQ = direct question. Farmers in group A are asked about the three list experiments. Since they belong to the control group for list 1 and list 3, these two lists do not contain the sensitive item. They are asked directly about child labor for harvesting and breaking the pods.

Cocoa farmers were randomly assigned to two groups (Figure 1). Group A serves as a control group for list experiments 1 and 3, i.e. farmers in group A are not exposed to the sensitive item in list 1 and list 3; and as a treatment group for list 2. The inverse is true for group B, which serves as a control group for list experiment 2, and as a treatment group for list experiments 1 and 3. The list experiments were always administered to respondents in the same order, regardless of the respondent group. To avoid any order effect, we were careful with the design and the sequence of our list experiments. Hence, the first list experiment to which the cocoa farmers are exposed relates to tasks that are *a priori* often performed by children on cocoa farms. The last list experiment asks about the most sensitive practice. This sequence was designed to avoid offending the respondent by asking a question on the most sensitive topic first. The statements of our list experiments were neutral and did not contain any judgments or terms that could offend the farmers. We do not use the term ”children” and do not describe the tasks we are interested in as ”dangerous”. Despite these precautions an order effect may persist, but we believe that this possibility is limited. We argue that it is unlikely that the cocoa farmers in group A will experience an order effect, as they are exposed to only one list experiment including a sensitive item. If the order effect occurred, it would likely be among farmers belonging to Group B, who act as treatment groups twice, and could thus be subject to a sensitive item twice. Indeed, the fact that they have already been exposed to a sensitive item during the first list experiment could increase their mistrust, and influence their response downwards in the second list experiment for which they serve as a treatment group. Acknowledging the possibility that an ordering effect may exist, we consider that the mean of items obtained in the treatment group concerning the employment of children (list 3) is probably a lower bound.

In addition to the list experiments, farmers from group A were asked directly about the use of child labor for harvesting and pod breaking, and farmers from group B were asked directly about their child labor use for plot preparation. To be able to compare the answers given to the list experiment and the direct

question, the wording of the direct questions was identical to that of the corresponding list experiment[11]. We decided to ask only one direct question to farmers in each group as asking several sensitive questions directly could raise suspicion or offend farmers, which could bias the answers to the second direct question. No direct question were asked about employed child labor. During our fieldwork, we found that this issue was far too sensitive and could have caused farmers to refuse to continue the survey, as the employment of children is sometimes associated with child trafficking and forced labor.

3.4 Estimation strategy

We rely on two related estimation strategies. First, we use simple difference-in-means to assess the overall level of child labor. Second, we rely on a series of multivariate analyses to identify correlates of child labor prevalence. We detail the assumption underlying each approach below.

3.4.1 The difference-in-means estimator

We use the difference-in-means estimator to obtain the prevalence of the three types of child labor we mentioned above. This estimator is used to obtain the average number of items to which respondents answered yes in both the control and treatment groups. Any difference in means between the treatment group and the control group is attributed to the sensitive item. Using the notation proposed by Blair and Imai (2012), the estimator is defined as follows :

$$\widehat{\tau} = \frac{1}{N_1}\sum_{i=1}^{N} T_i Y_i - \frac{1}{N_0}\sum_{i=1}^{N}(1-T_i)Y_i \tag{1}$$

With T_i taking the value of 0 if the respondent is in the control group, 1 otherwise. Let Y_i be the answer given by the respondent, which can take the value from 0 to J, J being the maximum possible value, *i.e.* the total number of proposed items. N_1 and N_0 correspond to the size of the treatment and control group, respectively. The validity of the difference-in-means estimator relies on three key assumptions (Blair and Imai, 2012) : a random allocation of respondents between the control group and treatment group (1), the assumption of no design effect (2), and the assumption of no liars (3). If these three assumptions are not simultaneously satisfied, the estimator is biased and does not yield valid estimates.

Table 1 shows the average characteristics of farmers who received questionnaire A and questionnaire B, and allows us to validate assumption 1 of a successful random allocation of the treatment.

Table 1: Basic characteristics of respondents in groups A and B

	Control	Treatment	(C-T) p-value	Obs.
age	41.99	41.88	0.749	4 458
married	0.89	0.89	0.951	4 458
no education	0.42	0.44	0.289	4 458
ivorian	0.73	0.74	0.947	4 458
number of children	2.62	2.61	0.726	4 458
number of adults	3.29	3.38	0.117	4 458
cocoa income (XOF)	995001	992207	0.913	4 458
yields (kg/ha)	656.57	639.16	0.392	4 458
other crop	0.51	0.51	0.911	4 458

Assumption 2 implies that the inclusion of the sensitive item does not affect the respondents' answers to control items. That is, the treatment group's answers to non-sensitive items should be approximately

[11] The two direct questions were worded as follows: "During the last campaign, for harvesting and breaking the pods, did one or more people under 16 help you ?" and "During the last campaign, to prepare your plot (applying pesticides, clearing, felling of trees, burning of plots), did one or more people under 16 help you ?".

equivalent to those of the control group. Additionally, the average total number of items in the treatment group must be equal to or greater than that of the control group, but at most by one item. This condition corresponds to the null hypothesis of the test proposed by Blair and Imai (2012) to detect the presence of a design effect. Keeping their initial notations, we have :

$$H_0 \begin{cases} Pr(\mathrm{Y}_i \leqslant y \,|\mathrm{T}_i = 0) \geqslant Pr(\mathrm{Y}_i \leqslant y \,|\mathrm{T}_i = 1) & \text{for all } y = 0, ..., J\text{-1 and} \\ Pr(\mathrm{Y}_i \leqslant y \,|\mathrm{T}_i = 1) \geqslant Pr(\mathrm{Y}_i \leqslant y - 1 \,|\mathrm{T}_i = 0) & \text{for all } y = 1, ..., J \end{cases} \tag{2}$$

This test allows to estimate the different proportions of each type of respondent ($\widehat{\pi}_{yz}$), characterized by the total number of affirmative answers to the non-sensitive items (y, which can take a value from 0 to 3) and their answer for the sensitive item (x, which takes the value of 0 for a negative answer, and 1 for a positive answer). If all these proportions are positive, the null hypothesis of no design effect cannot be rejected. This is the case for our three list experiments, as shown in Table 2.

Table 2: Estimated respondent types for each list experiment

	Harvesting & pod-breaking				Farm preparation				Employed child labor			
y value	$\widehat{\pi}_{y0}$	SE	$\widehat{\pi}_{y1}$	SE	$\widehat{\pi}_{y0}$	SE	$\widehat{\pi}_{y1}$	SE	$\widehat{\pi}_{y0}$	SE	$\widehat{\pi}_{y1}$	SE
0	2.57	0.0034	0.33	0.0049	2.93	0.0034	0.25	0.0051	2.93	0.0036	0.37	0.0052
1	25.18	0.0102	4.08	0.0137	27.41	0.0102	3.10	0.0140	25.60	0.0103	0.46	0.0135
2	46.01	0.0131	7.15	0.0115	40.92	0.0136	5.14	0.0125	41.67	0.0136	7.72	0.0129
3	5.22	0.0097	9.45	0.0062	8.88	0.0109	11.38	0.0065	7.13	0.0113	14.13	0.0074

Note : The table shows the estimated proportion of respondents characterized by the total number of affirmative answers to the non-sensitive items and their answer for the sensitive item. *For example* : The value in the third row and fourth column suggest that an estimated 0.33% of farmers answered no to all non-sensitive items but yes to the sensitive item. Standard errors are also provided for each estimated proportion. We use Blair and Imai's (2012) notations.

Finally, the no liars assumption implies that respondents answer honestly to the sensitive item. While there is no statistical test to verify this hypothesis, the essence of the method enhances an honest response from respondents to the sensitive item. Nevertheless, the validity of this assumption may be questioned when the respondent would like to answer yes (ceiling effect) or no (floor effect) to all the items. In this case, the enumerator can infer the respondent's answer to the sensitive item, which removes the private nature of the answer and may encourage respondents to misreport their true answer. This potential strategy of concealment, known as strategic measurement errors, has raised concerns among researchers and advice related to the design of the list experiment to avoid floor or ceiling effects. The main one is that researchers should avoid proposing a list of high-prevalence or low-prevalence items (Blair and Imai, 2012; Glynn, 2013; Tsuchiya et al., 2007). In both cases, this increases the likelihood that a respondent will answer yes or no to all the items. To avoid these phenomena, Glynn (2013) advises to propose negatively correlated non-sensitive items. This option also has the advantage of reducing the variance of the difference-in-means estimator, which is known to be less powered than the direct method. For each list experiment, we follow these recommendations to design our list of non-sensitive items (see above description of the items). Table 3 shows a ceiling effect for the list experiment related to farm preparation and employed child labor (with about 15% of respondents answering yes to all items in the treatment group). We account for this effect in the multivariate analysis below (Table 5).

3.4.2 Measuring social desirability bias

To assess the magnitude of the social desirability bias related to child labor, we compare the prevalence of child labor estimated by the list experiment to that obtained using the direct questioning method, for lists 1 (harvest and pod-breaking) and 2 (farm preparation).

Blair and Imai (2012) defined the social desirability bias as follows :

Table 3: Distribution of farmers according to their answer to the list experiments

	Harvesting & pod-breaking				Farm preparation				Employed child labor			
	Control		Treatment		Control		Treatment		Control		Treatment	
y value	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)
0	79	3.43	52	2.41	65	3.02	67	2.91	79	3.43	59	2.74
1	681	29.56	555	25.77	682	31.66	646	28.04	614	26.65	569	26.42
2	1 218	52.86	1 062	49.30	973	45.17	991	43.01	1 128	48.96	889	41.27
3	326	14.15	271	12.58	434	20.15	323	14.02	483	20.96	305	14.16
4			214	9.94			277	12.02			332	15.41
Total	2 304		2 154		2 154		2 304		2 304		2 154	

Note : The table shows the distribution of farmers based on the total number of items to which they answered yes. For example : 52.86% of farmers in the control group answered affirmatively to 2 items, compared to 49.30% in the treatment group.

$$S(x) = Pr(Z_{i,J+1}(0) = 1 \mid X_i = x) - Pr(Z^*_{i,J+1} = 1 \mid X_i = x) \tag{3}$$

where $Z_{i,J+1}(0)$ is the potential response of respondent i to the sensitive item when asked directly, and $Z^*_{i,J+1}$ the truthful answer to the sensitive item obtained using the list experiment.

The first term can be estimated using a logit model for respondents from the control group, i.e. those who were asked the direct question. The second term can be estimated using the maximum-likelihood estimator presented below.

We make several assumptions about social desirability bias in our context. First, we assume that the measure from the list experiment, if not perfectly accurate, is more accurate than the one obtained from the direct question. Second, we assume that the social desirability bias related to hazardous child labor implies under-reporting by respondents when asked directly. Hence, our third hypothesis is that the prevalence of child labor estimated by the list experiment will be higher than that measured using the direct question.

3.4.3 Maximum-likelihood estimator

In order to identify individual and community factors associated with the use of child labor, we conduct a multivariate analysis following the method proposed by Imai (2011). Using a maximum-likelihood (ML) estimator, we compute the following joint distribution :

$$g(x, \delta) = Pr(Z^*_{i,J+1} = 1 \mid X_i = x), \tag{4}$$

$$h_z(y; x, \Psi_z) = Pr(Y_i(0) = y \mid Z^*_{i,J+1} = z, X_i = x), \tag{5}$$

where $g(x, \delta)$ and $h_z(y; x, \Psi_z)$ correspond to the conditional expectation functions of the control and sensitive items given the covariates. X_i is a set of respondents' characteristics and (x, δ) is a vector of unknown parameters. $Z^*_{i,J+1}$ is the truthful answer to the sensitive item and can take the value of 0 or 1. $Y_i(0)$ is the potential answer respondent i would give under the control condition.

We address issues of strategic measurement errors following the methodology of Blair and Imai (2012) that accounts for potential ceiling effects using the ML estimator.

In addition to strategic measurement errors, recent work has focused on non-strategic measurement errors that can also occur when conducting a list experiment (Ahlquist, 2018). Indeed, enumerators are prone to mistakes when reporting answers, and respondents may misunderstand the question. Two different types of errors have been defined : the top-biased error, which appears when some respondents answer yes to all items, even when this is not their true answer; and the uniform error, which occurs when respondents answer randomly to the question. While the ML estimator has been shown to be biased in the presence of top-biased errors (Ahlquist, 2018; Blair et al., 2019), it is unlikely that this type of error occurs in our case.

Indeed, answering the maximum number of items regardless of their truthfulness implies that the farmers are indifferent to reveal, erroneously, that they use child labor on their farm. That is, there would be no social desirability bias, which is contradictory to our initial hypothesis. While the possibility of the existence of uniform errors is not ruled out, the ML estimator has been shown to be relatively robust to this type of error (Blair et al., 2019).

4 Results

4.1 Are certified cocoa farmers hiding child labor ?

Table 4: Estimated mean prevalence from the list experiment of different types of child labor

	(1) Control mean	(2) Treatment mean	(3) Difference-in-means	(4) Direct question	(5) Difference
List 1 : harvesting & pod-breaking					
	1.777	2.018	24.12	12.76	11.36***
N	2 304	2 154	4 458	2 304	
List 2 : preparing the plot					
	1.824	2.042	21.75	11.28	10.47***
N	2 154	2 304	4 458	2 154	
List 3 : employed child labor					
	1.874	2.130	25.63		
N	2 304	2 154	4 458		

Note : $^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$.

Table 4 reports the results of the list experiment, the direct question, and the difference between the two measures, for each type of child labor we are interested in. The estimates obtained with the list experiment show that certified cocoa farmers in our sample are still using child labor, despite the additional prohibition of child labor associated with certification schemes. This finding seems to confirm the assumption made in Section 2.3, that certified cocoa farmers are just as likely as non-certified farmers to face some market failures that prevent them from stopping their use of child labor. Our findings show that the use of child labor is not an isolated practice among certified cocoa farmers : 24% of the farmers in our sample used child labor for harvesting and breaking the pods during the past 12 months, 21.7% for farm preparation, and 25.6% of them employed and paid a child under 16 to perform any task on their cocoa farm.

Column 4 of Table 4 reports the prevalence of farmers who responded positively to the direct question regarding child labor for harvesting and pod-breaking, and farm preparation. When cocoa farmers are asked directly, 12.76% of them report having been helped by a child under 16 for harvesting and breaking the pods in the last 12 months, and 18% of them declared that they used child labor for the farm preparation. These results are half as high as those obtained using the list experiment, supporting the existence of a social desirability bias among certified cocoa farmers when asked about their use of child labor to perform hazardous tasks. Although we did not ask farmers directly about hiring and paying children under 16 to perform any task on their farm, we believe that this category of work is prone to the same social desirability bias as hazardous child labor. Indeed, employing and remunerating a child under 16, regardless of the work performed, is legally prohibited under Ivorian law (Article 23.2 of the Labour Code). This information is also common knowledge in cocoa farming communities that benefit from child labor awareness-raising campaigns.

The difference of over 10 percentage points between the direct method and the list experiment indicates that at least half of the farmers who do use child labor are not willing to declare it. These results are in line with our initial hypothesis about the existence of a social desirability bias and our field observations. The social desirability bias exhibited by certified cocoa farmers might be partly explained by the double pressure

they face regarding hazardous child labor, which is both prohibited in Côte d'Ivoire and by the certification labels.

By overcoming the social desirability bias associated with questioning certified farmers about child labor use, the list experiment allows us to identify a higher proportion of cocoa farmers who rely on child labor than the direct questioning method. Yet, the finding may still be affected by other types of bias. As the method does not overcome bias arising from self-image concerns, and a poor selection of the items listed along the sensitive item may influence the respondent's answer. Chuang et al. (2021) showed that when the items listed along the sensitive item are too common, the sensitive item is likely to draw the attention of respondents. In our case, our non-sensitive items relate to the same topic as the sensitive item, that is, the type of labor used by the farmer on his cocoa farm, and we believe that the likelihood of the sensitive item attracting particular attention of farmers is relatively moderate. The list experiment may also represent a more demanding cognitive process compared to a direct question, which may confuse the cocoa farmer. Nevertheless, we consider that this bias is probably low as each farmer tested the method and the instructions on a more familiar topic before conducting our list experiments. In any case, if respondents misunderstood the instructions, they are likely to answer to the list experiment using a random number. This effect should a priori affect both the control and treatment groups in the same way. If, on the other hand, they have fully understood the guidelines but are still mistrustful and do not wish to disclose their true answer, they are likely to omit their response to the sensitive item, leading to a downward bias.

4.2 Multivariate analysis

Table 5: Results of multivariate analysis for the three types of child labour (ceiling effects)

Variables	Harvesting & pod-breaking Coeff.	Marg. Effect	Preparing the farm Coeff.	Marg. Effect	Employed child labor Coeff.	Marg. Effect
Farmer characteristics						
Gender dummy	0.551	0.113	-0.667	-0.114	0.389	0.091
	(0.419)		(0.435)		(0.351)	
Farmer age	-0.008	-0.001	-0.011	-0.002	-0.001	-0.000
	(0.009)		(0.009)		(0.008)	
Education dummy	-0.488*	-0.088	0.035	0.007	0.048	0.010
	(0.213)		(0.183)		(0.177)	
Household characteristics						
Number of adults	-0.234**	-0.043	-0.010	-0.002	-0.146*	-0.008
	(0.073)		(0.064)		(0.059)	
2nd cocoa income tercile	1.101***	0.221	1.103***	0.236	0.752***	0.174
(ref. 1st tercile)	(0.275)		(0.246)		(0.220)	
3rd cocoa income tercile	0.362	0.068	1.159***	0.247	0.603**	0.139
(ref. 1st tercile)	(0.278)		(0.255)		(0.228)	
Farm location						
Distance road, between 2km	0.663*	0.126	0.356	0.072	0.678**	0.154
& 5km *(ref. <2km)*	(0.259)		(0.229)		(0.212)	
Distance road, more than 5 km	0.971***	0.198	0.970***	0.210	0.857***	0.201
(ref. <2km)	(0.280)		(0.244)		(0.224)	
Distance protected area	-0.003	-0.000	0.002	0.000	-0.027	-0.001
	(0.015)		(0.015)		(0.014)	
Community characteristics						
Population density	0.004	-0.000	0.008**	0.001	0.001	0.000
	(0.002)		(0.003)		(0.002)	
Primary schools dummy	-0.615**	-0.117	-0.556**	-0.114	-0.385*	-0.087
	(0.222)		(0.195)		(0.182)	
Intercept	-0.978		-1.578		-0.633	
	(0.571)		(0.525)		(0.498)	
Control	Yes		Yes		Yes	

Note : Included control : farm size. $^{*}p < 0.05$,$^{**}p < 0.01$, $^{***}p < 0.001$. Standard errors in parentheses.

We rely on multivariate analyses to provide new insights to explain the persistence of hazardous child labor on cocoa farms that are certified child labor free. The results for the three different types of child labor are presented in Table 5. We test several specifications for each of the three types of child labor, reported in Table A4, Table A5, and Table A6 (Appendix). Variables included in the analysis are further described in Table A2 (Appendix).

As previously discussed, certified cocoa farmers are likely confronted with the same market failures as non-certified farmers, undermining the potentially positive effects of a higher cocoa income on child labor.

Our results indeed show that cocoa income is positively associated with the likelihood of using child labor, regardless of the type of work involved. With the price of cocoa being fixed during the season, a higher cocoa income implies a higher volume of production. As cocoa-related tasks are not mechanized, higher cocoa production means a greater demand for labor. Our results mitigate the findings of Nkamleu and Kielland

(2006), who found that the prevalence of child labor is negatively correlated with the overall income of cocoa households in Côte d'Ivoire. More specifically, our results indicate that households with average cocoa production, belonging to the 2nd tercile of cocoa income, are the most likely to use child labor to meet this labor need. For the farm preparation, the effect of cocoa income on child labor is almost equivalent between the 2nd and 3rd tercile, possibly indicating a wealth effect : the higher the cocoa income, the more households can afford to purchase pesticides and therefore need additional labor.

We explore the hypothesis that this ambiguous relationship between farmer income and child labor is partially explained by market failures. In particular, we investigate possible labor market imperfections that would prevent cocoa farmers from finding adult labor when they need it. We find that the presence of an additional adult in the household reduces the probability that the farmer has been helped by a child to harvest and break the pods by 4.1%, and the probability of having employed a child for any task by 3.3%. Consistent with the substitution axiom of Basu and Van (1998) this result implies that when cocoa farmers have available adults in their household, they will prefer not to involve children on their farms. In the case where there are few adults in the household, children are nevertheless a possible alternative, even for hazardous tasks such as harvesting and breaking the pods. These tasks, which are labor-intensive and carried out all year long, involve the highest proportion of child labor in the Ivorian cocoa sector (Nkamleu and Kielland, 2006). Preference for adults over children to perform tasks on the cocoa farm may be stronger if the farmer is educated, and thus better able to appreciate the negative effects of child labor. Our results support the beneficial impact of farmer education on the use of child labor for harvesting and breaking the pods. If the number of adults in the household is not sufficient to meet their labor needs, cocoa farmers may decide to hire adults who are available for work, located in or around their community. We test the hypothesis that limited access to non-household labor contributes to the use of child labor by certified farmers. First, we investigate the association between the use of child labor and the population density at 20 km around the farm. We find little or no effect of population density, perhaps because of the imperfect nature of the proxy used to represent the available labor force around the cocoa farm. Our proxy might be only capturing the total population in the surrounding area and not the available adult labor force interested in cocoa-related work. Second, we test the hypothesis that the more remote and far from the road a farm is, the more difficult it is for the farmer to access adult labor, and the more likely it is to use child labor. We do find a positive and increasing relationship between the distance from the cocoa farm to the nearest main road and child labor. Cocoa farms located 5 km or more from the nearest road see their likelihood of using child labor (employed or not) increase by about 20%. This suggests that the most remote cocoa farmers are the most likely to use child labor, likely because available adult labor is not easily accessible.

Another explanation for this result can be provided by the fact that farms that are less likely to be monitored are associated with higher levels of child labor than those where enforcement of the ban on child labor is highest. Indeed, cocoa farms located closer to roads are easier to reach and therefore more likely to be monitored for child labor, which may discourage farmers from using child labor. In addition to the accessibility of the cocoa farm, specific locations may be more likely to be monitored because of particular characteristics. In Côte d'Ivoire, protected forests, where cocoa production is illegal, are under frequent inspections by the Ivorian authorities, who expel cocoa farmers illegally established in these forests. We test the hypothesis that cocoa farms located close to these protected forests might use less child labor, but we find no significant relationship between distance to the nearest protected forest and child labor, regardless of the type of work involved. The associated coefficients for harvesting and pod-breaking and paid work are nevertheless negative, suggesting support for our hypothesis, but remain low.

Our finding suggests that labor market failures and difficulties in monitoring child labor on remote cocoa farms are partly responsible for the persistence of child labor use among certified farmers. Our results also show that a lack of school infrastructure near the cocoa farm is an important driver of child labor use among farmers.

We find that the availability of a primary school within a 10 km radius of the farm has a negative effect on all types of child labor, of about 14.8% for harvesting and pod-breaking, 11.% for farm preparation, and 9.6% for employed child labor. This negative relationship between child labor and the availability of a primary school is in line with previous findings for Côte d'Ivoire (Grootaert, 1999), and might be explained by several factors. The availability of a primary school in an area close to the cocoa farm probably increases

the likelihood that children belonging to a cocoa household will attend school. If schooling is a possible option for children in the community, farmers seeking to rely on child labor to help them on their farm are likely to face a limited supply of child labor, at least in the area surrounding their cocoa farm. Conversely, the absence of a primary school close to the household's farm may discourage farmers from sending their children to school. If the nearest school is far from the household's village, it may be harder to reach and increases the cost of education. As a result, children are more available to help their parents on cocoa farms, or to sell their labor force to other cocoa households.

Findings from our multivariate analysis provide several explanations for the persistence of child labor, including hazardous child labor, among certified cocoa farmers. Some important drivers of child labor seem to be community-based and structural. Thus, while certification might increase cocoa productivity and income, these potentially positive effects for the cocoa farmer are likely to be mitigated by several factors. Specifically, certified cocoa farms are just as isolated as non-certified farmers, suggesting that they are just as likely to face difficulties in finding available adult labor. The lack of school infrastructure is also a factor contributing to the persistence of child labor on certified cocoa farms, children being more available for work as they may not have any other alternative. Our results also suggest that when cocoa farms are very remote, farmers tend to use more child labor, perhaps in part because they do not fear sanctions, as ban enforcement remains challenging.

5 Conclusion

Eradicating child labor remains a major challenge for both the public and private sectors. To provide effective and well-targeted policies, it is essential to measure this phenomenon accurately to ensure a full understanding regarding its nature, magnitude, and geographical and social distribution. The measurement of child labor is especially difficult given its sensitive nature, which incites the people involved to hide the truth to protect themselves from negative consequences, whether social or legal. In this article, we use list experiments to measure the prevalence of child labor in cocoa value chains certified as child labor free. This indirect survey method is used to overcome the social desirability bias associated with questions related to hazardous child labor, which is prohibited both by national legislation and cocoa certification schemes.

We find that 24% of certified cocoa farmers were helped by a child under 16 for harvesting and breaking the cocoa pods during the past 12 months, 21% for preparing their farm, and 25% employed and paid a child to perform any task on their cocoa farm. Consistent with our initial hypothesis, we find that the proportion of farmers using child labor doubles when using the indirect method. This result supports the existence of a social desirability bias associated with child labor and raises concerns about the relevance of direct questioning in this context.

Our results are of interest for three reasons : first, they underline the importance of considering the social desirability bias when attempting to measure the prevalence of child labor in contexts prone to dissimulation (hazardous work, presence of a ban). Indeed, the use of indirect elicitation methods can lead to a higher prevalence of child labor than using the direct method. An imperfect measurement is likely to lead to an underestimation of the phenomenon and perhaps a misperception of reality, weakening the effectiveness and relevance of both public and private policies aimed at reducing child labor in cocoa.

Second, our results indicate that poverty among certified cocoa households might not be the only factor determining their reliance on child labor. Poor road access significantly increases the likelihood that cocoa farmers will rely on child labor, probably because they have no access to adult labor from outside their community. Yet, given the seasonality of cocoa and its labor-intensive nature, it is likely that households in the same cocoa-growing community will seek to hire adults at the same time, creating tensions in the adult labor market. Being remote also implies a lack of access to primary school infrastructure, making substitution between adults and children even easier, since children who are not attending school are available to work on cocoa farms. These results appear to be consistent with those found by Fafchamps and Wahba (2006) regarding the positive impact of urban proximity on the reduction of child labor in rural areas.

Third, we show that despite their belonging to certified value chains cocoa farmers continue to use child labor, even to perform dangerous tasks on their farms. While these results do not allow a comparison of child

labor use in certified and non-certified cocoa chains, they do raise the question of the effectiveness of certified farmers' monitoring by certification bodies. We argue that two reasons may explain the lack of effectiveness of certification in cocoa. First, as previously discussed, the use of child labor by certified farmers appears to be explained more by structural and community-based reasons than by their socioeconomic characteristics. The most important factors determining the use of child labor thus seem to be beyond the expertise of certification bodies. Second, the remoteness of cocoa farms makes it difficult for certification bodies to properly monitor them. Challenges associated with ban enforcement may make it less effective, as cocoa farmers may not fear sanctions or perceive them as low risk.

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Appendix

Table A1: Descriptive statistics of basic farmers characteristics

	N	Proportion (%)
Age		
Less than 35 years	1 237	27.75
Between 35 & less than 50 years	2 195	49.24
50 years and above	1 026	23.01
Marital status		
Single	377	8.46
Divorced	24	0.54
Married/in a relationship	3 975	89.17
Widowed	82	1.84
Education		
No education	2 524	56.62
Primary education	1 163	26.09
Middle school	574	12.88
High school & higher	197	4.42
Nationality		
Ivoirian	3 297	73.96
Burkinabe	1 093	24.52
Other	68	1.52
Children in the household		
Yes	4 002	89.77
No	456	10.23
Polygamous household		
Yes	727	16.31
No	3 731	83.69
Cocoa income		
Less than 500 000 CFA	1 276	28.62
Between 500 000 & 1 000 000 CFA	1 637	36.72
More than 1 000 000 CFA	1 545	34.66
Cocoa farm size		
Less than 1.5 Ha	1 321	29.63
Between 1.5 Ha & 3 Ha	1 919	43.05
More than 3 Ha	1 218	27.32
Other crop		
Yes	2 282	51.25
No	2 171	48.75
Region		
Agnéby-Tiassa	195	4.37
Cavally	1 157	25.95
Gôh	322	7.22
Grands Ponts	459	10.30
Guémon	624	14.00
Lôh-Djiboua	776	17.41
Nawa	490	10.99
Tonkpi	435	9.76

Table A2: Description of variables included in the multivariate analysis

Variable	Description
Farmer characteristics	
Gender dummy	Gender dummy of the farmer. 0 = male ; 1 = female.
Farmer age	Farmer age in years.
Education dummy	Education dummy of the farmer. 0 = the farmer has never been to school ; 1 = the farmer has been to school.
Household characteristics	
Number of adults	Number of adults in the household.
Cocoa income tercile	Cocoa income was obtained by multiplying the number of cocoa bags sold by the farmer by the official cocoa price per kilogram. As the quantity of cocoa in a bag can vary slightly, we made the calculations using the average weight of a cocoa bag (65 kilos). 0 = 1st tercile ; 1 = 2nd tercile ; 2 = 3rd tercile.
Farm location	
Distance to the road from the farm	Distance from the farm to the nearest main road, in kilometers. 0 = less than 2km ; 1 = between 2km and 5km ; 3 = more than 5km.
Distance protected area	Distance from the farm to the nearest protected forest, in kilometers.
Community characteristics	
Population density	Population density within a 20km radius around the farm.
Primary school	Dummy indicating the presence or absence of at least one primary school in a 10km radius around the farm. 0 = no school ; 1 = at least one school.

Table A3: Estimated prevalence from the list experiment of employed child labor for any tasks on the farm

	Control mean	Treatment mean	Difference-in-means
Age			
Less than 35 years	1.833	2.126	29.35
Between 35 & less than 50 years	1.921	2.161	23.99
50 years and above	1.820	2.064	24.37
Education			
No education	1.903	2.152	24.81
Primary education	1.864	2.124	25.96
Secondary and higher	1.790	2.063	27.28
Cocoa income			
1st tercile	1.722	1.932	21.02
2nd tercile	1.976	2.294	31.72
3rd tercile	1.944	2.222	27.77
District			
Bas-Sassandra	1.764	2.112	34.79
Gôh-Djiboua	1.727	1.761	3.43
Montagnes	1.931	2.231	30.02
Lagunes	2.206	2.603	39.74
Distance from the road			
Less than 2 km	1.789	1.930	14.11
Between 2 & 5 km	1.859	2.182	32.30
More than 5 km	2.029	2.320	29.10
Distance from protected forest			
Less or equal to 5 km	1.866	2.131	26.44
More than 5 km	1.877	2.130	25.33

Note : Figures are rounded.

Table A4: Results of multivariate analysis for the "harvest" list

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-0.663	-1.272	-1.580	-1.083	-0.978	-0.915
	(0.445)	(0.487)	(0.531)	(0.525)	(0.571)	(0.558)
Sex	0.231	0.415	0.472	0.449	0.551	0.508
	(0.387)	(0.402)	(0.413)	(0.405)	(0.419)	(0.406)
Farmer age	-0.005	-0.005	-0.005	-0.007	-0.008	-0.005
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Education	-0.483*	-0.498*	-0.476*	-0.497*	-0.488*	-0.503*
	(0.202)	(0.205)	(0.209)	(0.210)	(0.213)	(0.212)
Number of adults	-0.174*	-0.171*	-0.169*	-0.174*	-0.234**	-0.199**
	(0.070)	(0.071)	(0.074)	(0.074)	(0.073)	(0.061)
Cocoa income						
2nd tercile	1.014***	0.954***	1.010***	1.023***	1.101***	1.113***
	(0.260)	(0.263)	(0.269)	(0.249)	(0.275)	(0.272)
3rd tercile	0.431	0.367	0.369	0.363	0.362	0.457
	(0.268)	(0.274)	(0.274)	(0.255)	(0.278)	(0.267)
Distance to the road						
Between 2km & 5km		0.712**	0.710**	0.668**	0.663*	0.639*
		(0.254)	(0.256)	(0.254)	(0.259)	(0.255)
More than 5km		1.121***	1.124***	0.956***	0.971***	0.942***
		(0.268)	(0.270)	(0.275)	(0.280)	(0.277)
Population density			0.003	0.003	0.004	0.004
			(0.002)	(0.002)	(0.002)	(0.002)
Primary school				-0.541**	-0.615**	-0.574**
				(0.198)	(0.222)	(0.205)
Distance protected area					-0.003	-0.007
					(0.016)	(0.016)
Control	Yes	Yes	Yes	Yes	Yes	No

Note : Included control : farm size. $^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$
Standard errors in parentheses.

Table A5: Results of multivariate analysis for the "preparation" list

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-0.965	-1.563	-1.954	-1.559	-1.578	-1.718
	(0.414)	(0.460)	(0.495)	(0.519)	(0.525)	(0.520)
Sex	-0.565	-0.615	-0.624	-0.632	-0.667	-0.674
	(0.424)	(0.428)	(0.429)	(0.436)	(0.435)	(0.433)
Farmer age	-0.011	-0.009	-0.011	-0.013	-0.011	-0.013
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
Education	0.013	0.071	0.065	0.046	0.035	0.052
	(0.175)	(0.179)	(0.180)	(0.183)	(0.183)	(0.182)
Number of adults	0.021	0.020	0.022	0.018	-0.010	-0.015
	(0.060)	(0.062)	(0.063)	(0.063)	(0.064)	(0.064)
Cocoa income						
2nd tercile	1.136***	1.096***	1.109***	1.137***	1.103***	1.069***
	(0.240)	(0.243)	(0.243)	(0.247)	(0.246)	(0.244)
3rd tercile	1.257***	1.182***	1.157***	1.151***	1.159***	1.022***
	(0.248)	(0.251)	(0.255)	(0.255)	(0.255)	(0.243)
Distance to the road						
Between 2km & 5km		0.498*	0.468*	0.407	0.356	0.331
		(0.227)	(0.233)	(0.230)	(0.229)	(0.228)
More than 5km		1.010**	1.062**	1.004***	0.970***	0.972***
		(0.236)	(0.239)	(0.242)	(0.244)	(0.243)
Population density			0.005*	0.006*	0.008**	0.008**
			(0.002)	(0.002)	(0.003)	(0.003)
Primary school				-0.498*	-0.556**	-0.519**
				(0.195)	(0.195)	(0.193)
Distance protected area					0.002	0.002
					(0.015)	(0.015)
Control	Yes	Yes	Yes	Yes	Yes	No

Note : Included control : farm size. $^{*}p < 0.05, ^{**}p < 0.01, ^{***}p < 0.001$
Standard errors in parentheses.

Table A6: Results of multivariate analysis for the "employed" list

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	-0.646	-1.209	-1.203	-0.867	-0.633	-0.622
	(0.385)	(0.419)	(0.443)	(0.464)	(0.498)	(0.416)
Sex	0.276	0.401	0.383	0.392	0.389	0.395
	(0.336)	(0.348)	(0.347)	(0.347)	(0.351)	(0.351)
Farmer age	-0.002	0.000	0.000	-0.000	-0.001	-0.001
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)
Education	0.020	0.046	0.037	0.033	0.048	0.051
	(0.171)	(0.174)	(0.175)	(0.176)	(0.177)	(0.177)
Number of adults	-0.125*	-0.126*	-0.103	-0.129*	-0.146*	-0.149**
	(0.055)	(0.057)	(0.056)	(0.058)	(0.059)	(0.056)
Cocoa income						
2nd tercile	0.768**	0.717***	0.747***	0.751***	0.752***	0.743***
	(0.215)	(0.218)	(0.217)	(0.219)	(0.220)	(0.218)
3rd tercile	0.664**	0.601**	0.607**	0.595**	0.603**	0.597**
	(0.221)	(0.224)	(0.223)	(0.224)	(0.228)	(0.219)
Distance to the road						
Between 2km & 5km		0.686**	0.681**	0.688**	0.678**	0.683**
		(0.210)	(0.210)	(0.211)	(0.212)	(0.211)
More than 5km		0.945***	0.943***	0.880***	0.857***	0.865***
		(0.220)	(0.220)	(0.222)	(0.224)	(0.223)
Population density			-0.000	0.000	0.001	0.001
			(0.002)	(0.002)	(0.002)	(0.002)
Primary school				-0.432*	-0.385*	-0.385*
				(0.181)	(0.182)	(0.180)
Distance protected area					-0.027	-0.027*
					(0.015)	(0.013)
Control	Yes	Yes	Yes	Yes	Yes	No

Note : Included control : farm size. *p < 0.05,**p < 0.01, ***p < 0.001
Standard errors in parentheses.

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