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CHILD LABOUR AND GLOBAL VALUE CHAINS

Abstract

We explore the impact the internationalization of production is having on child labour at the sector level, using data for 26 low- and middle-income countries. We find that sectors with stronger participation in foreign markets exhibit less child labour. Similarly, sectors that participate in global value chains by providing inputs to exporting firms in third countries (forward linkages) have fewer cases of child labour. On the other hand, sectors in which a large share of exports have foreign imported inputs embedded in them (backward linkages) experience higher incidences of child labour. Unlike the existing empirical literature on trade and child labour at the aggregate (country) level, which does not control for income effects, our results, at the sector level, do control for them.

JEL Classification: F14, F15

Keywords: child labor, global value chains, Sectoral employment

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Child Labour and Global Value Chains*

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1 Introduction

The internationalization of domestic production in developing countries can have ambiguous effects on child labour. As demand grows for the products for which developing countries have a comparative advantage, the demand for child labour may also grow (Kruger, 2007 or Atkin, 2016). On the other hand, increases in income that are associated with increases in exports from developing countries tend to be accompanied by reductions in child labour (Edmonds and Pavcnik, 2005 and 2006).

Recently, a number of initiatives have aimed at eliminating informal child labour from global value chains (GVCs).[1] These include the UN Guiding Principles on Business and Human Rights, the OECD Guidelines on Multinational Enterprises of 2011, the ILO's Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy of 2017, the California Transparency in Supply Chains Act of 2012, the UK Modern Slavery Act of 2015, France's due diligence law of 2017, Australia's Modern Slavery Act of 2018, and one can perhaps include Switzerland's Responsible Business Initiative, which will be subject to a referendum in at the end of 2020. The private sector and NGOs have also been developing codes of conduct to reduce the exposure of global firms to child labour as a response to the rapid growth in GVCs (Kork and van Tolder, 2002).

A priori, given these initiatives, one should observe declines in child labour as countries intensify their participation in GVCs. Unfortunately, it's not that simple. First, there is a growing literature suggesting that international or private conventions have little impact on firms' behavior (Blowfield and Dolan, 2010; Bookmann, 2010). Second, even if we were to observe a reduction in demand for child labour by domestic firms participating in GVCs, this can actually result in higher incidences of child labour in equilibrium because the supply of child labour may increase as poor households try to compensate for the potential decline in income when their countries participate in GVCs.

[1] The formal abolition of child labour at the international level can of course be traced back to the creation of the International Labour Organization in 1919 and its adoption of the minimum age convention.

The objective of this study is to assess the impact of the strengthening of developing countries' participation in GVCs on child labour. Using sector-level data for 26 developing countries, we find that as exports grow, the share of child labour declines. Importantly, unlike what the aggregate country-level literature often reports, this result is not driven by income effects. The result is magnified by the sector's participation in GVCs as a provider of imported inputs to foreign exporters, suggesting that participation in more complex GVCs helps reduce child labour in the exporting sector. On the other hand, when exports have strong foreign content (i.e., exporters import a large share of intermediate inputs), this does lead to increases in child labour. We also find that the difference in results between our sector-level evidence and the aggregate country-level evidence in the existing literature cannot be explained by child labour displacement across sectors or the reallocation of employment to export sectors with higher incidences of child labour.

These results are important for at least three reasons. First, it is estimated that 218 million children were working in 2016; among those, 152 million were in child labour.[2] This implies that 1 in 10 children between the age of 5 and 17 are engaged in child labour. In some regions the share is higher: in Africa, 20 percent of children between the age of 5 and 17 perform child labour. There is no doubt that this is an important phenomenon that needs to be addressed; UN Sustainable Development Goal (SDG) Target 8.7 recognizes this and aims to eliminate child labour by 2025. Progress has been slow. Since 2012, there has been a 10 percent decline in the incidence of child labour, which, according to the ILO (2017) is not enough if the target is to be reached by 2025. A better understanding of what can help reach the target is urgently needed. Second, GVCs have been growing rapidly over the past few decades, with global production being more and more intertwined across countries. This internationalization of production is sometimes blamed for contributing to child labour, and sometimes used as an example in the industry and national initiatives to curve child labour in GVCs. Our results help us understand how the increasing participation of developing countries in GVCs can contribute to or jeopardize the reaching of SDG Target 8.7. They also suggest that the internationalization of domestic exporters through participation

[2]Note that the ILO defines children in employment as the total number of children who have worked at least one hour during the week of the survey. Child labour is a subset of children in employment that weights the age of the child and the number of hours she/he has worked in the reference week.

in downstream GVCs should be preferred to their internationalization through upstream GVCs.[3] Finally, the absence of systematic evidence for displacement across sectors is an encouraging result for sector-level initiatives taken by global firms, as their efforts would not simply translate into child labour in sectors not exposed to GVCs.[4]

We are not the first to look at the question of how international trade affects child labour. Kruger (2007 and 2007a) uses variation in coffee production at the time of export booms in Brazil and Nicaragua, respectively, to measure how short-term shocks in the export market affect child labour and schooling. She finds that as coffee production increases, more child labour observed in poor and middle-income households, while children in rich households are unaffected. Similarly, Atkin (2016) finds that a higher share of Mexican children dropped out of school when exposed to the creation of export-manufacturing jobs. For every 25 jobs created in the export-manufacturing sector, one child dropped out of school. This effect is explained by the increase in the short-run opportunity cost of staying at school when unskilled manufacturing jobs are offered nearby.

Edmonds and Pavcnik (2005) find that more permanent shocks, such as the one experienced by Vietnamese rice producers when Vietnam's export ban was lifted, lead to significant increases in income that helped reduce child labour. Edmonds et al. (2009) find that in Indian regions that were exposed to larger permanent declines in tariff protection – and therefore larger declines in labour income – increases (or smaller declines) in child labour were observed. Using panel data across countries and time, Edmonds and Pavcnik (2006) indeed find a negative correlation between international trade and child labour at the country level, but this relationship disappears when controlling for income. This suggests that the way international trade reduces child labour is by increasing the income of poor households, not by firm participation in export markets by itself.[5]

[3]It is important to note that even though the results of this paper show that increasing participation in GVCs may be correlated with reductions in child labour, this does not necessary mean that increasing participation in GVCs is the most effective way to reduce child labour.

[4]See, e.g., Kolk and van Tulder (2002) for concerns regarding child labour displacement as multinational firms abolish their exposure to child labour. Note that even if there is no inter-sector migration of child labour, there might be intra-sector migration, shifting child labour within the same sector from firms exposed to GVC to those that are not exposed. Unfortunately, this is not a question our sector-level data can address.

[5]Davies and Roy (2009) report a similar finding in the case of Foreign Direct Investment (FDI). Using panel data cross country and time, they also find that the negative correlation between FDI and child labour disappears once they control for income, again suggesting an income channel. Similarly, Cigno et al. (2002)

This income channel may change, however, as international firms adopt codes that prevent them using child labour throughout their global production chain. None of the publications reviewed above explicitly examine the role played by GVCs, nor do they study the backward and forward linkages between domestic firms and foreign producers in global production (domestic value-added in foreign firms' exports, and foreign value-added in domestic firms' exports). The sector-level variation in our study is also new. Kruger (2007 and 2007a), Atkin (2016) work at the county or region level. Edmonds and Pavcnik (2005) focus in only one sector, Edmonds and Pavcnik (2006) work at the aggregate level, and Edmonds, Pavcnik and Topolova (2010) at the region level. The sector dimension is important as it allows us not only to examine the impact of exports and participation in GVCs at the sector level, but also the potential displacement of child labour to other sectors which are not exporting or exposed to GVCs, which is an important concern in the literature (see for example Kolk and van Tulder, 2002).

The remainder of the article is organized as follows. Section 2 provides a conceptual framework based on the existing literature to examine the ambiguous effect of participation in global markets on child labour in developing countries. Section 3 provides the empirical setup and 4 discusses data sources and provides summary statistics. Section 5 discusses the empirical results and the final section concludes.

2 Conceptual framework

Much evidence shows that household poverty is one of the strong forces behind the supply of child labour (Edmonds, 2008). When parents' income rises above subsistence levels and they can afford to take their children out of the labour force, child labour declines (Basu, 1999, Basu, 2000, Basu and Van, 1999, Bai and Wang, 2020). Conversely, if parents' income declines below subsistence levels, child labour is likely to increase (Bandara, Dehejia and Lavie-Rouse, 2015). An important mechanism through which international trade affects child labour is thus through the impact exports have on income. This is a well-studied and documented mechanism in the context of international trade (for example Edmonds and

find no impact of exposure to trade on child labour while looking at cross-country evidence.

Pavcnik, 2005 and 2006) and we control for this in our empirical setup.

Our focus is on the impact on child labour of different types of participation of domestic firms in international markets. To set up our conceptual framework, we start with the supply side of the market for child labour. Let us recall that the supply of child labour tends to decline with wages, contrary to most supply curves, which increase with prices. The reason for this, as explained in Basu and Van (1999) and Basu and Zarghamee (2009), is that as children's wages increase, the amount of child labour needed for the household to reach subsistence income levels declines. In other words, poor households tend to take their children out of the labour market and reduce the supply of child labour when wages increase. Similarly, when wages decline, there is a stronger need for child labour to reach subsistence levels, and the supply of child labour increases.[6] In their study of an Indian ban on child labour, Bharadwaj et al. (2016) provide empirical evidence of child labour supply sloping down with wages. They show that because the Indian ban reduced the demand for child labour and therefore child wages, child labour actually increased, which is consistent with a downward sloping labour supply curve.

On the demand side for child labour, we focus on the role played by the different forms that the participation of domestic firms in international markets can take. We decompose domestic firms' participation in international markets in three components: gross exports, forward linkages, and backward linkages. Gross exports refer to the total amount of exports at the sector level. As gross exports increase, one should expect the demand for labour, and therefore the demand for child labour, to likewise increase mechanically. Forward linkages capture the share of exports that are used as an input in the exports of third countries. Because we control for gross exports, this does not capture the impact of increased production and therefore labour demand, but rather the exposure of child labour demand to downstream GVCs. Given that more complex GVCs tend to be more sensitive to their exposure to child labour, we therefore expect child labour demand to decline as forward linkages increase. Finally, backward linkages capture the share of exports that are sourced from other countries. Given that we are controlling for gross exports, the larger the share of backward linkages,

[6]For child labour supply to decline with wages, one needs the income effect that is determining child labour supply to be stronger than the substitution effect.

the smaller the demand for labour in general, and therefore child labour, as well. To sum up, we expect increases in gross exports to lead to increases in the demand for child labour, while increases in both backward and forward linkages (controlling for gross exports) should lead to declines in the demand for it.

Figure 1 illustrates the impact of an increase in the demand for child labour associated with an increase in gross exports. Given the downward sloping supply curve, an increase in gross exports leads to a decline in child labour even when controlling for income effects. If child labour supply were to slope up, an increase in demand will undoubtedly result in more child labour. However, because child labour supply slopes down (at least for very low levels of household income), then the increase in child labour demand associated with gross exports results in a reduction in child labour.

The impact of an increase in backward linkages, controlling for gross exports and income effects, is illustrated in Figure 2. When backward linkages increase, a larger share of value-added embedded in exports is imported and produced in third countries, which implies that the demand for child labour declines. As child labour supply slopes downward, this leads to an increase in child labour.

An increase in forward linkages (controlling for gross exports and income effects) is illustrated in Figure 3. A stronger participation in GVCs reduces the demand for child labour due to the highest sensitivity to child labour in global GVCs. This reduction in demand for child labour tends to increase the equilibrium level of child labour as child labour supply slopes down. This is not the only effect, however. Controlling for gross exports, the higher sensitivity to child labour embedded in production leads to a larger share of value-added produced by non-child labour, increasing the share of adult income in total household income. This shifts the supply of child labour inward, as less child labour is needed to reach the household subsistence income level for a given household income. This tends to reduce the equilibrium level of child labour. Thus, whether an increase in forward linkages leads to more or less child labour will depend on whether the shift in child labour demand is stronger or smaller than the increase in child labour supply. In Figure 3, we have assumed that the supply shock was stronger than the demand shock.

To summarize our predictions, we are expecting that: (1) an increase in gross exports

will lead to a reduction in child labour even after controlling for income; (2) an increase in backward linkages (controlling for gross exports) will lead to an increase in child labour; and (3) an increase in forward linkages will have an ambiguous effect on child labour.[7]

An important caveat for our framework and data is that the mechanisms we are exploring tell us very little about the extent to which child labour is used in firms involved in GVCs. In other words, an increase in the amount of child labour as GVCs intensify can be perfectly consistent with the absence of child labour in the GVCs. The reason is that child labour gets displaced to other firms in the same sector, which may not be participating in the GVCs. Our sector-level data does not allow us to address this issue; that would require employer-employee–level data.

3 Empirical setup

In order to capture how the different forms of domestic firms' participation in international markets affect child labour, we propose the following empirical specification:

$$\begin{aligned} y_{cts} &= \beta_1 Gross\ Exports_{cts} + \beta_2 Backward\ Linkage_{cts} \\ &+ \beta_3 Forward\ Linkage_{cts}\alpha_{c,t} + \varepsilon_{cts} \end{aligned} \tag{1}$$

where y_{cts} is the share of child labour in total employment in sector s of country c at period t, and *Gross Exports*, *Backward Linkage* and *Forward Linkage* are the total value of exports, the imported value of intermediate inputs by domestic exporters, and the exported value of intermediate inputs used by exporting firms in the rest of the world; $\alpha_{c,t}$ are country*year fixed effects to control any sector invariant characteristics within a country and year, such as colonial links, geography, business cycles and possible measurement issues associated with national surveys. More importantly, given the importance of income effects in the previous literature, $\alpha_{c,t}$ allows us to control for aggregate income (GDP per capita or GDP).

[7]Note that different predictions could be obtained if we were to assume an upward sloping child labour supply curve, and/or if simple participation in international trade (through gross exports or backward linkages) changes the relative demand for adult or child labour (as we assumed for forward linkages.

Equation (1) is estimated using ordinary least squares and a fractional logit model, as in Papke and Wooldridge (1996), as the left-hand variable is a ratio that varies between 0 and 1, and as in many cases the share of child labour in total employment is at the lower or higher bound as discussed in the data section.

Using equation (1), we can also examine the extent to which child labour is affected by increases in gross exports and backward and forward linkages in other sectors. The idea is that as demand for labour may shift to other sectors due to their participation in GVCs, child labour supply may be displaced toward sectors not participating in GVCs. Several anecdotal examples in the literature on child labour support this hypothesis. For example, following a scandal involving Walmart and Bangladeshi apparel exporters, US senator Tom Harkin (D-IA) introduced legislation in the US senate aiming to ban imports from countries that use child labour. The result was a sharp decline in child labour in Bangladesh's apparel sector, as expected, but this was accompanied by a displacement of child labour toward more hazardous, unsafe, and less well-paid jobs (UNICEF, 1997). To check for this, we introduce three additional variables in equation (1) that capture gross exports and backward and forward linkages in other sectors, which we use to evaluate whether there is systematic evidence of displacement of child labour from other sectors that participate in GVCs. Note that the presence of displacement across sectors could potentially explain the divergence of results at the aggregate and sector level, since child labour can be affected by trade at that level, but not at the aggregate level because of the displacement of child labour across sectors.

4 Data

Child labour is defined by ILO Convention No. 138 as "employment or work which by its nature or the circumstances in which it is carried out is likely to jeopardise the health, safety or morals of young persons." Its statistical measurement was defined by the International Conference of Labour Statisticians in 2008 and this framework is structured around two main factors: (1) the age of the child, and (2) the activities of the child (their nature, conditions, and duration). Two concepts can be derived from these two factors: children

in employment, and children in child labour. The former captures all children engaged in economic activities within the SNA framework and the latter is a subset of the former and is obtained by conditioning for work hours according to age groups and the level of employment hazard in each sector.

For the purpose of this article, we use a definition in line with SDG indicator 8.7.1 by taking account the age and number of hours spent at work.[8] We calculate the number of children engaged in child labour based on large-scale surveys used by the ILO for the compilation of the last two versions of Global Estimates of Child Labour.[9] Any child between 5 and 17 years old engaged in economic activity for at least 1 hour in the reference week is considered to be engaged in employment. All children aged 5 to 11 working at least 1 hour, children between 12 and 14 years old working for at least 14 hours, and children between 15 and 17 years old working for at least 43 hours are considered to be engaged in child labour. The econometric analysis at the core of the study is conducted using child labour, but we provide a robustness check using employed children.

The surveys aim try to capture all economic activities covered within the System of National Accounts, including child labour. In some cases, it is not possible to precisely extrapolate total populations for children and adults based on surveys, as compared to UN World Population Prospects by age groups.[10] This might be caused by several factors, such as the main focus of the surveys being on capturing child labour, age coverage, and geographical scope, or their sampling strategies. The number of children working in each country survey as well as the number of working adults are rescaled to be in line with UN population estimates.[11]

There are 65 country-year surveys in the developing world providing information on child and adult employment by economic sector which can mapped to several revisions of the International Standard Industrial Classification (ISIC) classification. There is substantial heterogeneity in the data availability across countries as some countries conduct a yearly

[8]The text of SDG indicator 8.7.1 can be found at `https://unstats.un.org/sdgs/metadata/?Text=&Goal=8&Target=8.7`

[9]ILO (2017).

[10]See the UN World Population Prospects at `https://www.un.org/en/development/desa/population/publications/database/index.asp`

[11]The rescaling for children is relatively important for Mexico, Pakistan, and Nicaragua while the rescaling for working adults is important for Armenia, Panama, Nicaragua, and Ethiopia.

survey while others may have conducted only one or two surveys over a decade.[12] The majority of country-year surveys announce a compatibility with revisions 3.1 and 4 of the ISIC classification, and to facilitate subsequent data matching with GVC indicators, Revision 3.1 is privileged. The level of disaggregation varies across countries, and while in some cases further detailing under national classifications is reported, in other cases information is less disaggregated (the 2- or 3-digit level). Initial coding of economic activity in each country-year survey is key for the harmonization of the data across countries and years.

Information reported under other revisions of the ISIC classification is aggregated to international agreed sub-sectors at the 4-digit level in a first step, and then converted to ISIC Revision 3.1 using correspondence tables established by UN Statistical Department. During this procedure, some significant sectors in terms of child labour or adult employment in a country-year survey might remain unmatched due to imprecise or nonexistent initial coding of activities. This leads us to discard 8 country-year surveys. Additionally, two surveys for East Timor in 2010 and 2013 cannot be used in our analysis as the country is not covered by the estimates for trade in value added published by the United Nations Conference on Trade and Development (UNCTAD). The survey for Ethiopia in 2015 also remains unexploited due to partially missing information (the value of gross exports at the sectoral level was missing from the UNCTAD-EORA dataset).

Based on the remaining sample of 54 country-year surveys for 26 countries between 2007 and 2015, we are able to extract information on the number of children in child labour and children in employment across 24 sectors of the ISIC Revision 3.1 classification.[13] Table 1 provides the number of sectors for each of the 54 country-year surveys covering 26 developing countries in Africa, Asia, and Latin America. As not all sectors are reported or identified in every country-year survey, note that this number is not constant but that on average it is around 21.

We calculate the ratio of the number of children in employment or in child labour with respect to the total number of employees, i.e., adults and children, for each sector available

[12]Most countries in the developing world do not have an updated assessment of child labour in the form of a survey.

[13]Keep in mind that our sectors do not perfectly correspond to the 17 sections of the ISIC Revision 3.1 classification and that some of these sections, notably Manufacturing, are further disaggregated.

in the survey. We name these ratios the children in employment rate (CER) and the child labour rate (CLR). They denote the likelihood of observing children among employees in a given sector s in country c and year t. Figure 4 shows the substantial heterogeneity that exists in these rates.[14] Although some countries, such as Peru, Pakistan, and El Salvador, seem to show a high incidence at least in some sectors, it is also possible to see that some sectors, such as private households activities, tend to have a high propensity for child labour, indicating a labour force consisting almost exclusively of child workers. Heterogeneity is significant as well within countries. To illustrate this, Figure 5 shows the CER and CLR ratios for Ethiopia in 2013. Ethiopia's employment is dominated by agriculture, as indicated by the bubble size, but it also has a high incidence of children in employment and child labour given its position on the upper-right corner of the figure. This explains why agriculture is the only sector above the average level of child labour and children in employment shown by the red line in Figure 5.

Figure 6 explores regional differences in CER and CLR and shows that the labour participation rates of children and child labour are more prominent in African countries than in Asia. The median share of child labour in total employment is well above 10% in Africa, whereas it is less than 5% in Asia and Latin America. Some substantial heterogeneity within regions does exist, however, with a few African countries being below the average in both Asia and Latin America.

Figure 7 explores the heterogeneity of children's participation in labour and child labour in relation to overall employment across sectors by comparing them with employment shares by sector. Three sectors confirm their high incidence of child labour or children in employment when compared to overall employment: Agriculture (A), Hotels and restaurants (H), and Private households (P).[15] Agriculture has been identified by international agencies (the ILO and FAO, among others), as a key sector for the fight against child labour and our descriptive result confirms its relevance. It is important to note that quantitatively GVCs will mainly affect child labour through their impact on agriculture, as child labour in hotels

[14]Note that rates presented in the following tables and figures range between zero and one. A value of 0.6 in Figure 4 for a particular sector and country implies that 60% of the employees in that sector and country are younger than 18 years old.

[15]Fishing (B) also shows a high incidence of child labour, however characterized by a rather low share on total employment.

and restaurants or private households have a significant amount of child labour, but their participation in GVCs remains small.

To characterize gross exports, and backward and forward linkages, we use trade in value-added estimated at the sectoral level by the UNCTAD-Eora (2019) Global Value Chain Database, as it has broad geographic coverage – which we need, given our focus on developing countries.[16] This database provides time series for usual GVC indicators at the country-industry level covering the time period between 2000 and 2018.[17] Among indicators in the dataset, the foreign value-added content of domestic exports – known as the backward linkage of GVCs – and the domestic value-added embedded in a third country's exports – known as the forward linkage of GVCs – are aggregated to match the sectoral information on child labour rates. In addition to these two trade flows, we also use the value for sectoral gross exports to ensure the consistency of different trade flows used in our empirical analysis.

Table 2 provides summary statistics for child labour, children in employment, gross exports, and forward and backward linkages by region (Africa, Asia, and Latin America). While child labour represents, on average, 10 percent of sectoral employment in Africa, 6 percent in Asia, and 5 percent in Latin America, in some sectors or countries in each of these regions the share can get above 80 percent. Regarding export data, note that because we are working at the sector level it is possible on have sectors in which backward or forward linkages are larger than gross exports. This would happen for example if a particular country does not export leather directly, but domestic and foreign produced leather is used as an input it many other sectors, leading to forward and backward linkages in the leather sector (see Los, Timmer and de Vries, 2016).

5 Results

Table 3 provides the results of the estimation of Equation (1) using child labour as the dependent variable. Columns 1 to 3 provide estimates using ordinary least squares and

[16]The UNCTAD-Eora (2019) Global Value Chain Database can be accessed at `https://worldmrio.com/unctadgvc/`

[17]De Backer and Miroudot (2013) provide an introduction to the calculation of trade in value added based on Input-Ouput databases.

columns 4 to 6 provide estimates using a fractional logit estimator to account for the fact that the share of child labour is a fraction with a significant share of observations at the upper or lower bound. Columns 1 and 4 do not control for any type of fixed effects. Columns 2 and 5 control for country and year fixed effects, whereas columns 3 and 6 control for country×year fixed effects and therefore for anything that is specific to a country in a specific year, such as GDP or GDP per capita.

All three components describing the participation of firms in international markets (gross exports, backward linkages, and forward linkages are statistically significant in all columns and are robust across specifications. Gross exports have a negative and statistically significant correlation with the share of child labour in total employment regardless of whether we control for country and year fixed effects, or country×year fixed effects. This is interesting because, contrary to what the literature has found at the sector level, the negative correlation between gross exports and child labour does not vanish once we control for income, which varies at the country×year level. This is consistent with a setup, such as the one in the conceptual framework section, in which child labour supply slopes downward with child labour wages. The increase in gross exports leads to a general increase in demand for labour. A potential reason for why this effect is observed at the sector level, but not at the aggregate country level when controlling for income, is displacement. Indeed, what we could be observing is that as gross exports increase, child labour declines at the sector level, while getting displaced to other sectors, causing us to not observe a decline in child labour at the aggregate level. This is something we explore below.

An increase in GVC participation through backward linkages, controlling for gross exports, seems to systematically lead to an increase in child labour, whether or not we control for country and year fixed effects or country×year fixed effects. This again is consistent with the setup presented in the conceptual framework section, in which child labour slopes downward with child labour wages. As backward linkages increase, keeping gross exports constant, domestic value-added embedded in exports declines. This leads to a decline in labour demand, including child labour demand, which leads to an increase in child labour.

Finally, if GVC participation increases through forward linkages, because we control for gross exports, we observe a decline in child labour. As we argued in the conceptual

framework section, when the share of forward linkages in total exports increases, there are two effects working in opposite directions. Because downstream global producers tend to set high standards for upstream inputs in terms of social responsibility (including child labour), we expect a reduction in the demand for child labour as the share of forward linkages in total exports increase. In the presence of a downward sloping child labour supply curve, this leads to an increase in child labour. On the other hand, given that we are keeping gross exports constant, the decline in child labour demand is accompanied by an increase in adult labour demand. This leads to an increase in the share of adult income in total household income and therefore a contraction of the child labour supply, which leads to a reduction in child labour. According to our estimates, the second effect dominates, and child labour declines as the share of forward linkages in total exports increases.

Using the results of column 6 (which uses a fractional logit estimator and controls for country×year fixed effects, we see that a 1-percent increase in gross exports leads to a 0.175 percent decline in child labour. This is controlling for income, and therefore not taking into account the impact that increases in gross exports have on income and therefore on child labour. A 1-percent increase in forward linkages leads to a reduction of 0.281 percent in child labour, whereas an increase in backward linkages of 1 percent leads to an increase in child labour of 0.302 percent. These results suggest that increasing forward linkages can have a much larger impact on reducing child labour than simple increases in exports. Helping domestic firms to enter GVCs as providers of inputs to third-country exporters, rather than as simple exporters, seems to be an efficient manner to reduce child labour. Another way of seeing this is that if we were to simultaneously increase gross exports and backward and forward linkages by 1 percent (keeping the share of backward and forward linkages in total exports constant), we would observe a 0.154 percent decline in child labour. A 1-percent increase in forward linkages without increasing gross exports would generate a decline twice as large.

5.1 Aggregate versus sector-level results

The above results contradict the existing aggregate country-level empirical literature, which tends to conclude that international trade does not have an impact on child labour beyond

its impact through income. There are at least two potential explanations to reconcile the aggregate results with our sector-level results. First, child labour may get displaced to other sectors, and therefore nothing is observed at the national level. Second, the incidence of child labour may be higher in sectors exposed to GVCs than in sectors not exposed to GVCs, and as resources are reallocated from the latter to the former, child labour may increase. To see this, let us assume that there are two types of sectors in the economy; those that are exposed to GVCs (noted GVC) and those that are not exposed to GVCs (noted No). The overall share of child labour in employment is then given by:

$$\theta^{CL} = \theta^{CL}_{GVC} \times \theta^{L}_{GVC} + \theta^{CL}_{No} \times \theta^{L}_{No} \tag{2}$$

where θ^{CL}, θ^{CL}_{GVC} and θ^{CL}_{No} are the share of child labour in employment at the aggregate level, in sectors exposed to GVCs and in sectors not exposed to GVCs, respectively. θ^{L}_{GVC} and θ^{L}_{No} is the share of employment in sectors exposed to GVS and sectors not exposed to GVCs, respectively.

Taking the total differential of (2), considering that $\theta^{L}_{GVC} + \theta^{L}_{No} = 1$, and rearranging we obtain:

$$d\theta^{CL} = d\theta^{CL}_{GVC}\, \theta^{L}_{GVC} + d\theta^{CL}_{No}\, \theta^{L}_{No} + \left(\theta^{CL}_{GVC} - \theta^{CL}_{No}\right)\, d\theta^{L}_{GVC} + \tag{3}$$

In the empirical results reported above, we have found that as GVC exposure increases in a sector, $d\theta^{CL}_{GVC} < 0$ in the case of gross exports and forward linkages, which leads to a decline in aggregate child labour. The second and third term, however, may potentially be positive, which would lead to an increase in child labour as gross exports or forward linkages increase. In the case of the second term, this will occur if the share of child labour in total employment in sectors not exposed to child labour increases as child labour gets displaced to sectors not exposed to GVCs. In the case of the third term, the increase in aggregate child labour can occur, even when the incidence of child labour at the sector-level declines, if the prevalence of child labour is higher in sectors exposed to GVCs. Indeed, as gross exports or forward linkages increase, the reallocation of labour (including child labour) to these sectors with higher child labour incidence leads to an increase in the aggregate shares of child labour in total employment.

In Table 4 we explore the possibility that the second term (3) may help us reconcile the sector- and aggregate-level evidence, that is, the displacement of child labour from sectors exposed to GVCs toward sectors that are not exposed to them. To do this, we construct three additional variables that measure gross exports, and backward and forward linkages in other sectors.

The first four columns use an OLS estimator; the last four use a fractional logit estimator. In columns 1 and 5 of Table 4, we introduce a variable that captures gross exports in other sectors. In columns 2 and 6, we introduce backward linkages in other sectors. In columns 3 and 7, we introduce forward linkages in other sectors. Finally, in columns 4 and 8, we introduce all three new variables simultaneously. None of the coefficients for gross exports, or for backward and forward linkages in other sectors, are statistically significant, except for forward linkages in other sectors in column 7. On the other hand, all coefficients for gross exports and forward and backward linkages in the sector where we are measuring child labour remain statistically significant and with coefficients that have the same sign and similar size to the ones reported in Table 3. We conclude that there is no systematic evidence of displacement that could have helped reconcile the results at the aggregate and sector level.

To examine whether the third term in (3) may help explain the differences between sector- and aggregate-level results, we compute the average share of child labour in employment in sectors with and without GVC exposure. Figure 8 provides the averages for gross exports, backward linkages, and forward linkages. If anything, the incidence of child labour seems higher in sectors less exposed to GVCs (in the first quintiles), suggesting that the third term cannot help us reconcile the differences between aggregate and sector-level results.

Thus, neither displacement to other sectors nor a higher incidence of child labour in sectors with a higher exposure to GVCs can explain the difference in results at the aggregate and sector level. We are left with aggregation bias. This would occur if, for example, gross exports decline in most sectors, but increase in another sector that is large in terms of exports, but small in terms of child labour. In this case, even if our sector-level results hold (as gross exports increase, child labour declines at the sector level), once we aggregate, we would observe an increase in child labour (driven by the small sectors in terms of exports)

while observing an increase in exports (driven by the large sector in terms of exports). To check for the potential of aggregation bias to explain differences in results using our data, we run (1) at the aggregate level. As reported in Table 7, the results are consistent with the existing literature at the aggregate level (the literature that suggests that trade has no impact on child labour). This is consistent with the presumption that the difference in results may be due to aggregation bias.

5.2 Robustness: Using children in employment

As discussed in the data section, there exists a broader measure of child labour, which is children in employment. Children in employment does not consider the age of the child and the number of hours she works but is simply given by the number of children between 5 and 17 years old engaged in economic activity for at least 1 hour in the reference week. The results of the estimation of Equation (1) using child in employment instead of child labour are reported in the tables 5 and 6 which correspond to Tables 3 and 4 in the article. The results are qualitatively robust to the use of children in employment instead of child labour as dependent variable.

6 Concluding remarks

SDG Target 8.7 aims at eliminating child labour by 2025. Progress so far has been slow and there is a need for a better understanding of the different leverages that can be used to reach this target. In this article, we explore the extent to which stronger participation in GVCs by developing countries exporters can help reach this goal faster. As firms in developing countries integrate in GVCs, the requirements for socially sustainable practices increase. However, this can have unintended consequences. As firms integrating into GVCs reduce their demand for child labour, their wages decline, which can lead to an increase in child labour supply as households struggle to maintain a subsistence level of income.

This article empirically addresses the question of whether GVC participation by firms in developing countries helps reduce or increase child labour. We find that increases in gross exports lead to declines in child labour at the sector level, even after controlling for income.

This is at odds with the existing literature at the aggregate level, which finds no impact of international trade on child labour beyond its impact through income. We also find that participation in downstream GVCs (forward linkages) by exporting goods that are used as intermediates by exporters in other countries leads to a strong decline in child labour. The marginal effect of an increase in forward linkages is much larger than the marginal effect of increasing gross exports, suggesting that encouraging domestic firms to participate in downstream GVCs rather than to simply export would lead to a larger decline in child labour. On the other hand, increases in the participation of domestic exporters in GVCs upstream is associated with increases in child labour. Thus, encouraging domestic exporters to source from third countries, while it may lead to increases in economic efficiency, does not seem to translate into reductions in child labour.

We also examine the extent to which our sector-level results, which are at odds with existing aggregate country-level results, could be explained by the displacement of child labour across sectors or the reallocation of resources toward sectors with a higher incidence of child labour. We found no evidence that either child labour displacement or the reallocation of labour can explain the difference between country- and sector-level results, and we provide evidence that this discrepancy may be due to aggregation bias. More importantly, this suggests that concerns about the displacement of child labour to other sectors, associated with sector-level initiatives to eradicate child labour from GVCs, are unfounded.

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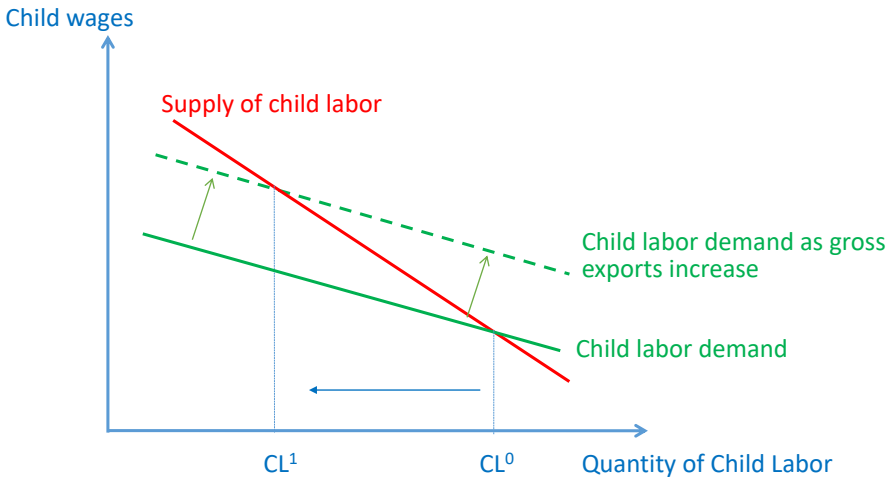
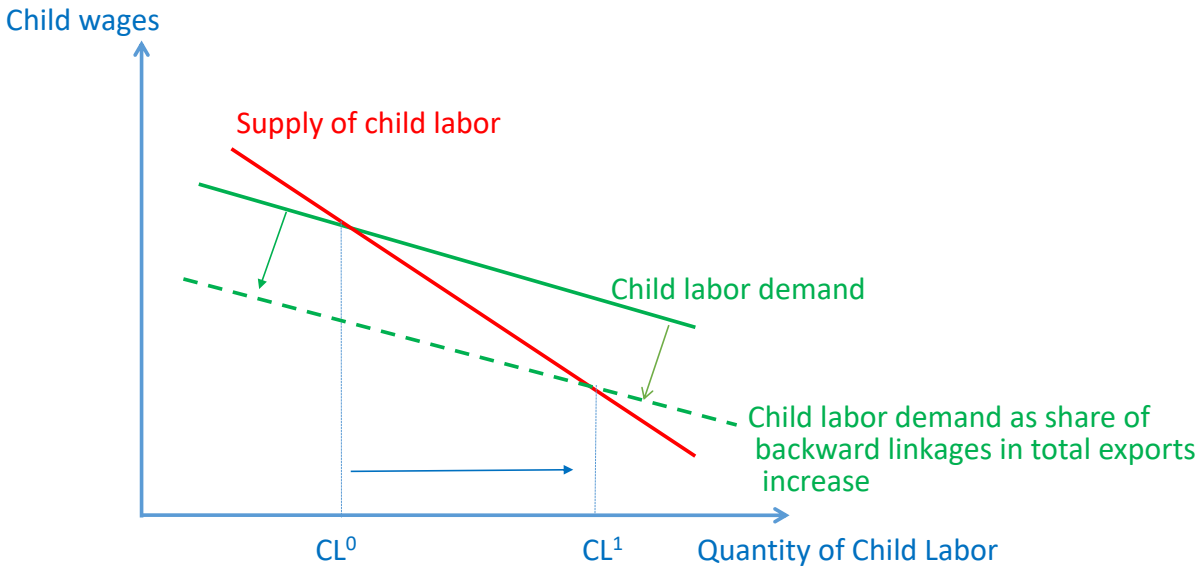
Figure 1: Impact on child labour of an increase in gross exports



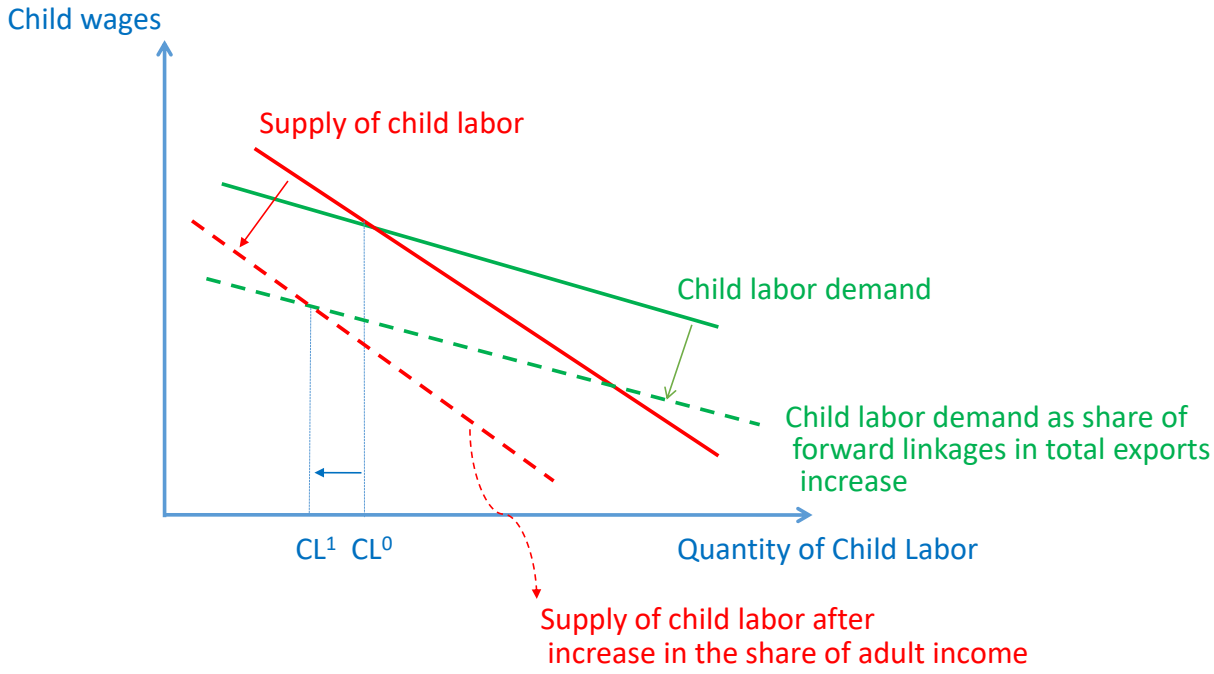
Note: The supply curve is downward sloping as in Basu and Zhargame (2009) to capture that as wages decline more child labour may be needed to reach the household subsistence income level. The figure also assumes that as gross exports increase income is unchanged (as we will control for this in our empirical model.

Figure 2: Impact on child labour of an increase in the share of backward linkages in exports



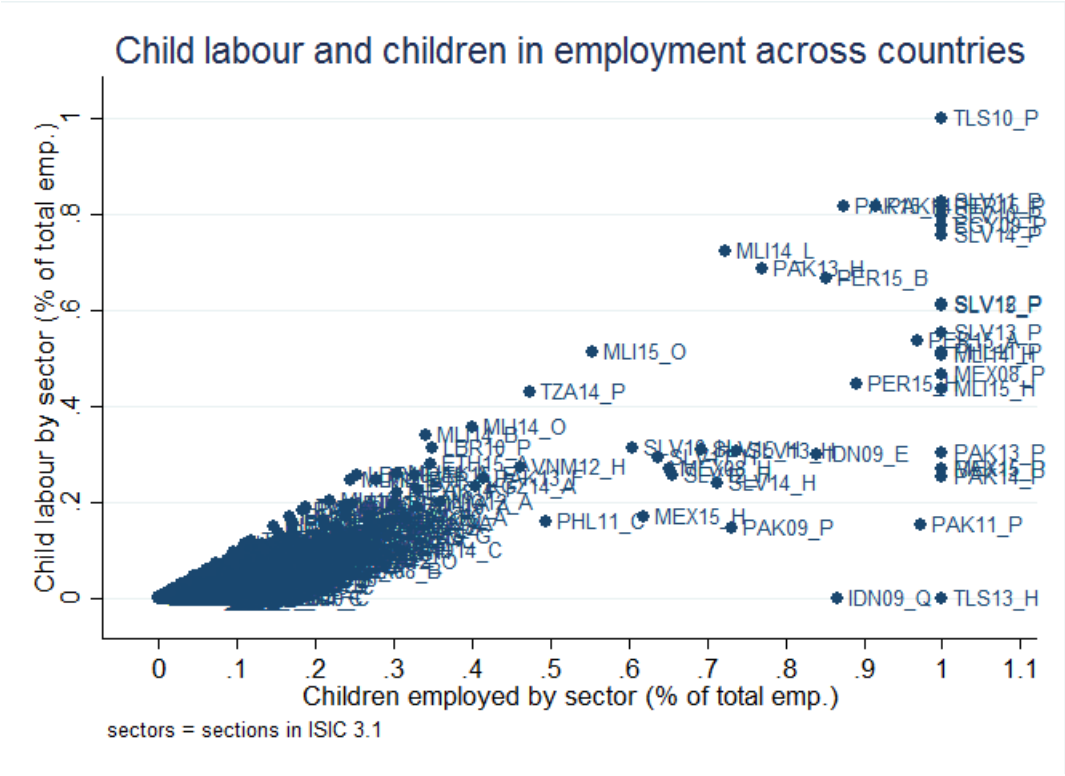
Note: The supply curve is downward sloping as in Basu and Zhargame (2009) to capture that as wages decline more child labour may be needed to reach the household subsistence income level. The figure also assumes that as gross exports increase income is unchanged (as we will control for this in our empirical model.

Figure 3: Impact on child labour of an increase in the share of forward linkages in exports



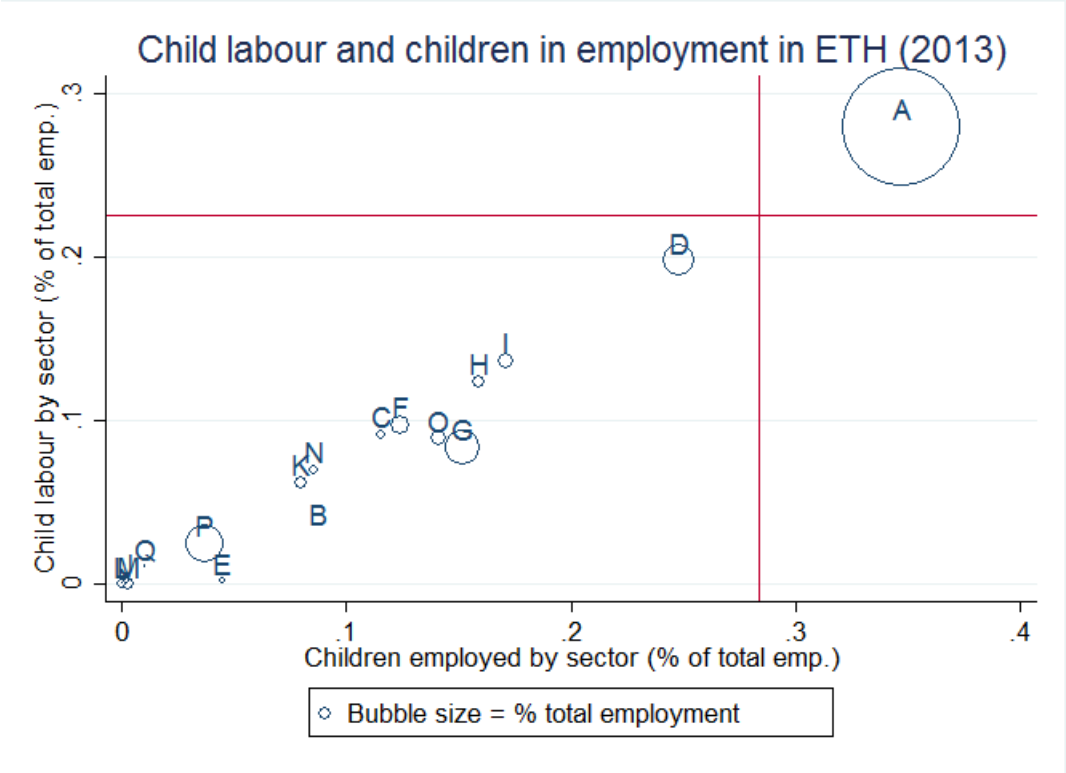
Note: The supply curve is downward sloping as in Basu and Zhargame (2009) to capture that as wages decline more child labour may be needed to reach the household subsistence income level. The figure also assumes that as gross exports increase income is unchanged (as we will control for this in our empirical model.

Figure 4: Child labour and children in employment shares in total employment by country and sector



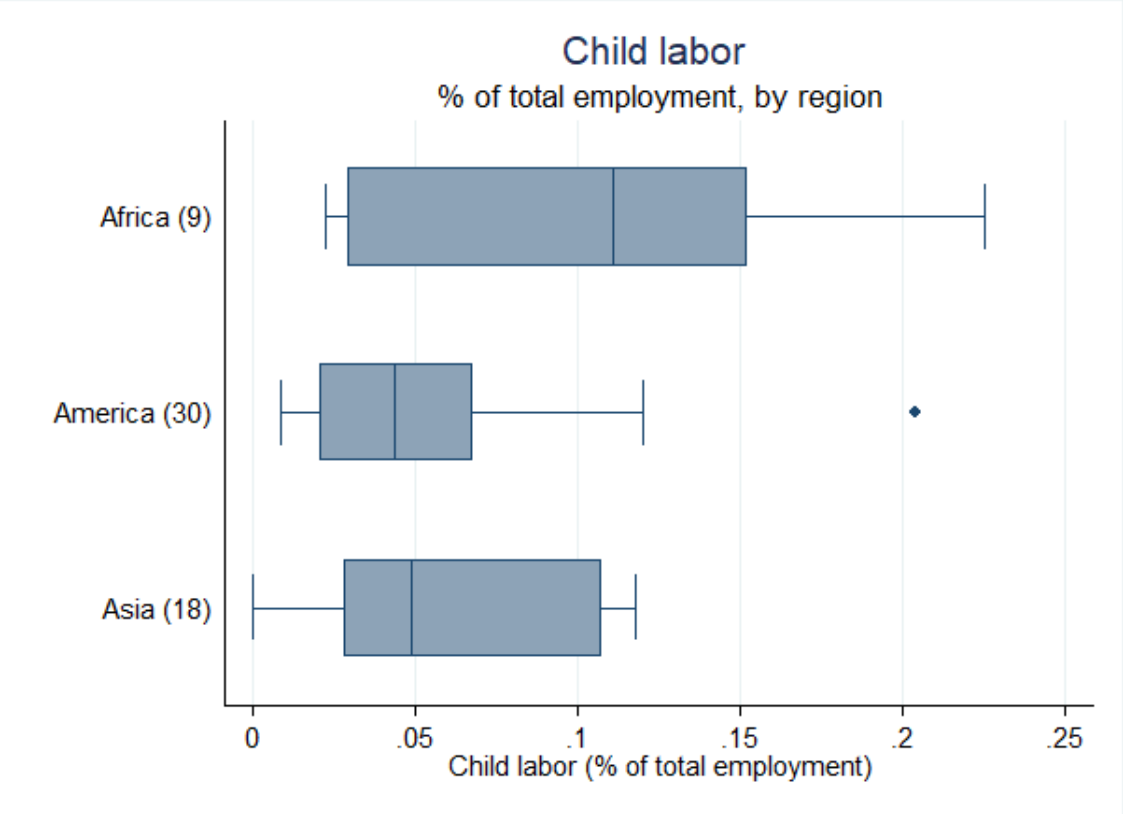
Note: The ILO defines children in employment as the total number of children who have worked at least one hour in the week of the survey. Child labour is a subset of children in employment that weights the age of the child and the number of hours it has worked in the reference week to capture more stringent conditions.

Figure 5: Child labour employment shares in Ethiopia



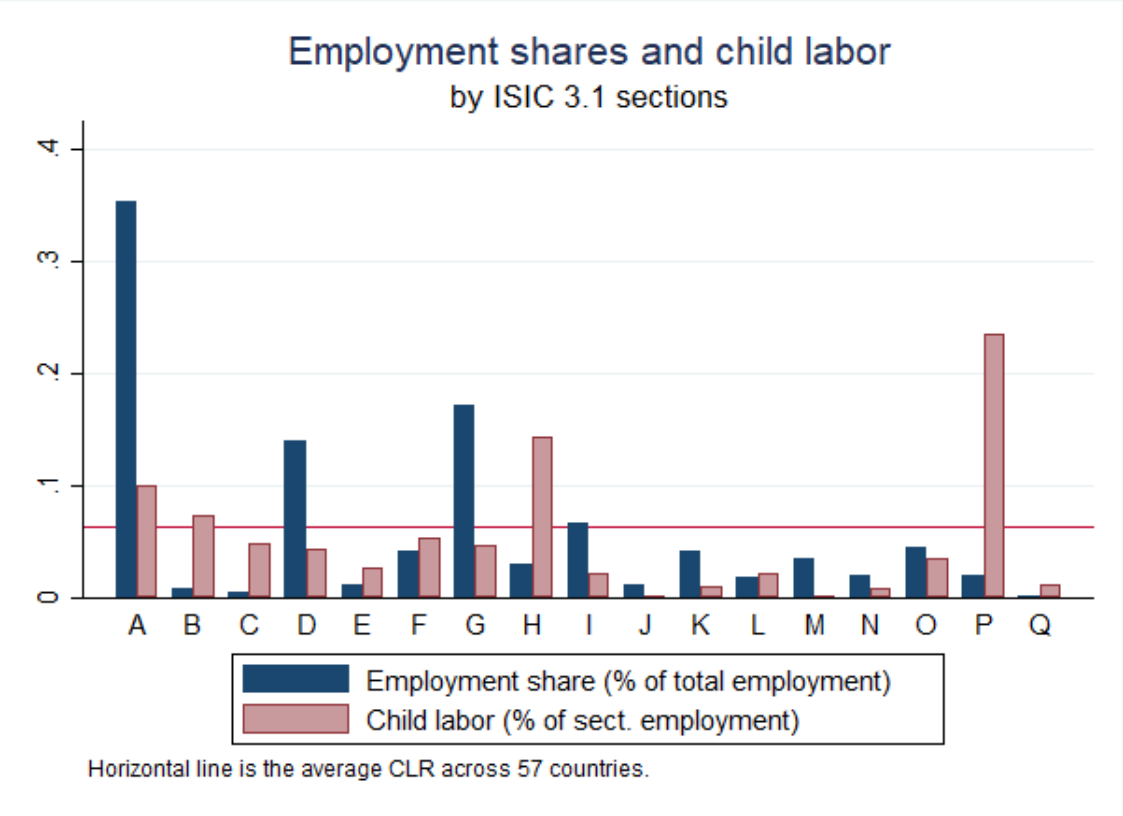
Note: Red lines are 'national rates' for children in employment or in child labour w.r.t. total employment. The ILO defines children in employment as the total number of children who have worked at least one hour in the week of the survey. Child labour is a subset of children in employment that weights the age of the child and the number of hours it has worked in the reference week to capture more stringent conditions.

Figure 6: Child labour employment shares across regions



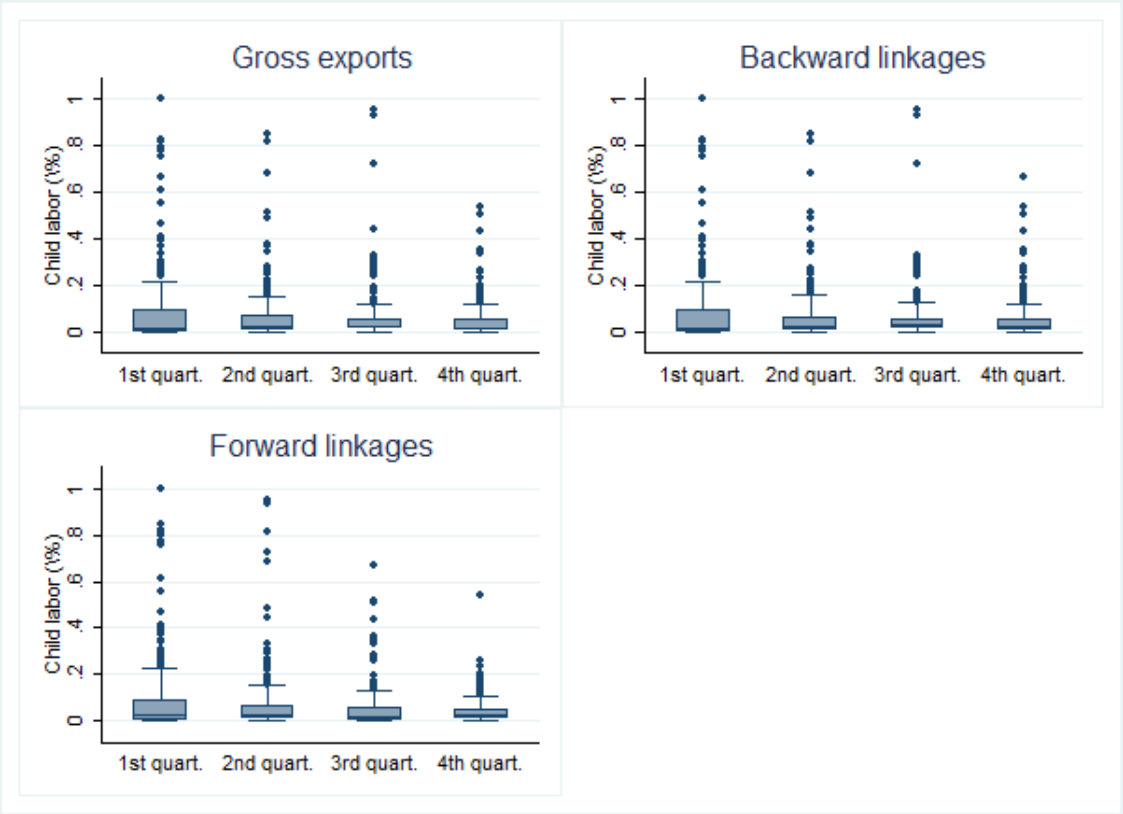
Note: The ILO defines children in employment as a subset of the total number of children who have worked at least one hour in the week of the survey which is weighted by the age of the child and the number of hours in the reference week to capture harder work conditions. The line in the middle of the box is the median and the top and bottom of the box show the top 25 and 75 percentile. The adjacent line show the lower and upper adjacent values.

Figure 7: Employment shares and child labour by sector



Note: Agriculture (A), Fishing (B), Mining (C), Manufacturing (D), Electricity (E), Construction (F), Wholesale and retail (G), Hotels and restaurants (H), Transport (I), Finance (J), Real Estate (K), Public Administration (L), Education (M), Health (N), Social and Personal services (O), Private households (P), International Organizations (Q).

Figure 8: Share of child labour on total employment declines with GVC presence



Note: The top left quadrant divides gross exports per quintile and shows the distribution of child labour in total employment per sector. The top right quadrant provides the same information for backward linkages, and the bottom left quadrant for forward linkages.

Table 1: Country coverage

ISO country	Year	# of sectors	ISO country	Year	# of sectors
ARM	2015	24	MEX	2008	23
BGD	2013	24	MEX	2015	22
BRA	2007	19	MLI	2014	22
BRA	2009	19	MLI	2015	20
BRA	2012	19	NIC	2008	23
BRA	2013	19	NIC	2010	24
BRA	2014	19	NIC	2012	24
BRA	2015	19	PAK	2009	23
COL	2012	22	PAK	2011	22
COL	2014	23	PAK	2013	23
COL	2015	21	PAK	2014	23
ECU	2010	21	PAK	2015	21
ECU	2011	21	PAN	2014	24
ECU	2012	21	PER	2015	19
EGY	2008	19	PHL	2011	19
EGY	2009	23	SLV	2010	22
EGY	2012	23	SLV	2011	22
GHA	2013	24	SLV	2012	21
GTM	2011	14	SLV	2013	22
GTM	2013	24	SLV	2014	22
HND	2013	21	SLV	2015	23
HND	2014	21	TZA	2014	23
IDN	2009	19	VEN	2012	23
IDN	2010	21	VNM	2012	22
IND	2008	21			
IND	2010	21			
KGZ	2014	21			
KHM	2012	24			
LAO	2010	23			
LBR	2010	24			

Note: Based on ILO (2017) and UNCTAD-EORA (2019).

Table 2: Summary Statistics by region

Country code	Child labour	Children in empl.	Gross Exports	Backward Linkages	Forward Linkages
Africa					
Mean	0.10	0.13	372.47	341.18	418.62
St. dev	0.18	0.22	864.77	808.81	846.71
Min	0.00	0.00	1.24	1.13	1.01
Max	1.00	1.00	5'273.63	5'076.95	5'410.30
Asia					
Mean	0.06	0.11	3'254.32	3'104.92	3'603.38
St. dev	0.10	0.17	8'121.54	7'917.49	8'700.56
Min	0.00	0.00	0.60	1.04	0.02
Max	0.82	1.00	59'230.51	57'712.16	87'228.04
Latin America					
Mean	0.05	0.10	3'595.00	3'273.23	3'549.14
St. dev	0.10	0.16	10'327.96	10'056.52	8'945.57
Min	0.00	0.00	0.00	0.97	0.87
Max	0.82	1.00	112'755.00	112'319.93	118'445.53

Note: Based on ILO (2017) and UNCTAD-EORA (2019). Million USD for export and GVC linkages' values.

Table 3: Child labour and GVCs

	Linear regression			Fractional logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Gross exports (in logs)	-0.0110*	-0.0116**	-0.0115**	-0.208**	-0.172**	-0.175**
	(0.00434)	(0.00414)	(0.00415)	(0.0676)	(0.0546)	(0.0535)
Backward GVC (in logs)	0.0124**	0.0151**	0.0150**	0.263**	0.296**	0.302**
	(0.00478)	(0.00460)	(0.00461)	(0.0744)	(0.0606)	(0.0593)
Forward GVC (in logs)	-0.0130**	-0.0164**	-0.0163**	-0.261**	-0.282**	-0.281**
	(0.00215)	(0.00246)	(0.00246)	(0.0335)	(0.0324)	(0.0317)
Country FE		Yes			Yes	
Year FE		Yes			Yes	
Country×Year FE			Yes			Yes
Observations	1'166	1'166	1'166	1'166	1'166	1'166
R^2	0.067	0.199	0.210	n.a.	n.a.	n.a.
Adjusted R^2	0.065	0.173	0.170	n.a.	n.a.	n.a.

Note: Standard errors in parentheses. Significance levels: † : 10% * : 5% ** : 1%

Table 4: Child labour and GVCs: exploring displacement

	Linear regression				Fractional logit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gross exports (in logs)	-0.0106*	-0.0113**	-0.0119**	-0.0111*	-0.158**	-0.171**	-0.174**	-0.152**
	(0.00419)	(0.00416)	(0.00423)	(0.00458)	(0.0537)	(0.0534)	(0.0545)	(0.0587)
Backward GVC (in logs)	0.0145**	0.0139**	0.0149**	0.0149**	0.287**	0.286**	0.302**	0.291**
	(0.00462)	(0.00477)	(0.00462)	(0.00520)	(0.0592)	(0.0612)	(0.0594)	(0.0667)
Forward GVC (in logs)	-0.0195**	-0.0167**	-0.0165**	-0.0197**	-0.329**	-0.284**	-0.280**	-0.334**
	(0.00312)	(0.00249)	(0.00247)	(0.00338)	(0.0400)	(0.0319)	(0.0319)	(0.0433)
Gross exports elsewhere (in logs)	-0.0201			-0.0206	0.0550			0.199
	(0.0356)			(0.0757)	(0.458)			(0.970)
Backward GVC elsewhere (in logs)		-0.0315		0.0173		-0.377		0.115
		(0.0341)		(0.0834)		(0.438)		(1.070)
Forward GVC elsewhere (in logs)			-0.0874	-0.0946			-1.343†	-1.520
			(0.0537)	(0.0725)			(0.688)	(0.929)
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1'166	1'166	1'166	1'166	1'166	1'166	1'166	1'166
R^2	0.211	0.210	0.210	0.212	n.a.	n.a.	n.a.	n.a.
Adjusted R^2	0.171	0.170	0.169	0.169	n.a.	n.a.	n.a.	n.a.

Note: Standard errors in parentheses. Significance levels: † : 10% * : 5% ** : 1%

Table 5: Children in employment and GVCs

	Linear regression			Fractional logit		
	(1)	(2)	(3)	(4)	(5)	(6)
Gross exports (in logs)	-0.0334**	-0.0333**	-0.0331**	-0.253**	-0.212**	-0.211**
	(0.00654)	(0.00619)	(0.00622)	(0.0654)	(0.0532)	(0.0526)
Backward GVC (in logs)	0.0353**	0.0365**	0.0363**	0.300**	0.314**	0.316**
	(0.00720)	(0.00687)	(0.00691)	(0.0719)	(0.0590)	(0.0584)
Forward GVC (in logs)	-0.0169**	-0.0241**	-0.0242**	-0.201**	-0.252**	-0.249**
	(0.00324)	(0.00367)	(0.00369)	(0.0324)	(0.0315)	(0.0312)
Country FE		Yes			Yes	
Year FE		Yes			Yes	
Country×Year FE			Yes			Yes
Observations	1'166	1'166	1'166	1'166	1'166	1'166
R^2	0.064	0.209	0.216	n.a.	n.a.	n.a.
Adjusted R^2	0.062	0.184	0.176	n.a.	n.a.	n.a.

Note: Standard errors in parentheses. Significance levels: † : 10% ∗ : 5% ∗∗ : 1%

Table 6: Children in employment and GVCs: exploring displacement

	Linear regression				Fractional logit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gross exports (in logs)	-0.0348**	-0.0327**	-0.0319**	-0.0355**	-0.218**	-0.209**	-0.200**	-0.214**
	(0.00633)	(0.00623)	(0.00628)	(0.00685)	(0.0535)	(0.0525)	(0.0529)	(0.0579)
Backward GVC (in logs)	0.0359**	0.0340**	0.0355**	0.0385**	0.316**	0.302**	0.305**	0.322**
	(0.00691)	(0.00714)	(0.00692)	(0.00779)	(0.0583)	(0.0602)	(0.0584)	(0.0659)
Forward GVC (in logs)	-0.0246**	-0.0248**	-0.0284**	-0.0297**	-0.250**	-0.252**	-0.286**	-0.294**
	(0.00370)	(0.00372)	(0.00467)	(0.00505)	(0.0313)	(0.0314)	(0.0394)	(0.0427)
Gross exports elsewhere (in logs)	-0.0747			-0.147	-0.233			-0.498
	(0.0532)			(0.113)	(0.450)			(0.957)
Backward GVC elsewhere (in logs)		-0.0630		0.110		-0.390		0.593
		(0.0510)		(0.125)		(0.430)		(1.056)
Forward GVC elsewhere (in logs)			-0.119	-0.159			-1.128	-1.453
			(0.0805)	(0.108)			(0.679)	(0.917)
Country×Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1'166	1'166	1'166	1'166	1'166	1'166	1'166	1'166
R^2	0.217	0.217	0.217	0.219	n.a.	n.a.	n.a.	n.a.
Adjusted R^2	0.177	0.177	0.177	0.177	n.a.	n.a.	n.a.	n.a.

Note: Standard errors in parentheses. Significance levels: † : 10% * : 5% ** : 1%

Table 7: Child labour and GVCs at the aggregate level

	Linear regression		Fractional logit	
	(1)	(2)	(3)	(4)
Gross exports (in logs)	0.115	0.0481	0.152	-1.127
	(0.0785)	(0.150)	(1.607)	(1.668)
Backward GVC (in logs)	-0.170	0.258	-0.565	4.632
	(0.0870)	(0.230)	(1.781)	(2.554)
Forward GVC (in logs)	0.0407	-0.252	0.148	-3.351
	(0.0335)	(0.156)	(0.686)	(1.735)
Country FE		Yes		Yes
Year FE		Yes		Yes
Observations	54	54	54	54
R^2	0.341	0.970	n.a.	n.a.
Adjusted R^2	0.302	0.907	n.a.	n.a.

Note: Std. errors in parentheses. Significance levels: † : 10%; ∗ : 5%; ∗∗ : 1%