EXTENDED ABSTRACT

Title: An employment footprint view of the global value chains reorganization

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1. Introduction

After a complaint presented last April by several human-rights collectives, the French justice is currently investigating four multinational fashion retailers for their alleged responsibility by sourcing inputs produced using forced labour in China(Henley, 2021). In 2020, several reports brought to light the dramatic situation suffered by the Uyghur minority in the Chinese region of Xinjiang, which is trapped into coercive labour as a part of the re-education strategy of Muslim minorities (Fair Labor Association, 2020; Lehr, 2020; Xu, Cave, Leibold, Munro, & Ruser, 2020; Zenz, 2020). Zenz (2020) estimates that, in 2018, at least 570,000 Uyghurs were forced into this kind of labour in the cotton picking industry, and figures could increase dramatically when considering other minorities in the same region. The responsibility of the Uyghur exploitation has reached occidental multinationals, mainly those in the fashion industry (Xu et al., 2020), as a consequence of two facts: on the one hand, cotton from Xinjiang represents the 83.7% of all Chinese cotton (National Bureau of Statistics of China, 2019) and more than the 20% of the world's cotton (Lehr, 2020). On the other hand, it is a primary input in a worldwide textile industry strongly outsourced to Asian countries (Malik et al., 2021; Peters, Li, & Lenzen, 2021), with China as the predominant supply centre in global textile trade networks (H. Xiao, Meng, Ye, & Li, 2020).

The driver of this systematic exploitation is not only the Chinese repression over the Uyghurs, but also the pressure on reducing labour costs in an industry poorly mechanized as compared to the United States cotton (only the 20% of Xinjiang cotton is machine-harvested (Zenz, 2020) and in a country which has experienced a notorious increase in labour costs in the last years (since 1990, unit labour costs have grown 2.5 times faster in China than in Germany and the United States (Antràs, 2020)). However, despite the international focus on the Xinjiang situation, it is not the only region in the world in which cotton cultivation is sustained by forced labour and even child labour, as shown in the list of goods produced by forced and child labour provided by USBILA (2020).

This framework reinforces the concept of "the business of forced labour" proposed by LeBaron (2021), which considers forced labour a phenomenon perpetrated to generate profits and a endemic part of current supply chains instead of an isolated practice. In fact, the United Nations has pointed at companies as implicated in these human rights abuses either directly or through their supply chains, claiming that "businesses must not turn a blind eye to this and must conduct meaningful human rights due diligence"(UN Human Rights Office of the High Commisioner, 2021). The first political initiative concerning this issue has been taken by the United States (US) government, which recently banned all cotton and tomato imports from Xinjiang.

Given the international repercussion of these affairs, both multinationals and governments face now the challenge of guaranteeing indecent-labour-free supply chains. García-Alaminos, Ortiz, Arce, and Zafrilla (2020) calculate the only the US multinationals' foreign affiliates were responsible -direct and indirectly- of 1.3% of the global forced workers in 2013. The international outcry on human rights have induced some of these firms to issue statements about ending their sourcing from tainted cotton picked by forced labourers or even children. What's more, the United States government has imposed a boycott to Xinjiang cotton for the same reasons.

The European Union (EU) has not yet taken any specific commercial position regarding the Xinjiang abuses on the Uyghur people. However, it has proposed a new trade strategy in the so-called "Open Strategic Autonomy" that addresses global problems regarding the sustainability of trade (European Comission, 2021). The Open Strategic Autonomy roadmap can be summarized into two pillars: on the one hand, the EU intends to encourage its own resilience and competitiveness by identifying strategic dependencies and diversifying commercial relationships. On the other hand, it wants to foster development through trade on partners in the neighbouring, enlargement countries and Africa, seeking for a greener and fairer global trade. An investment plan targeted to African countries -with special emphasis on the rural economy and agriculture (European Comission, 2019)- intends to contribute to the second goal and, at the same time, to provide a medium-term solution to the migration crisis between the two continents (European Comission, 2021).

In particular, the cotton industry development in Africa has its own roadmap in the EU-Africa Partnership on Cotton (WTO, 2018). This sector plays an important role for several reasons: first, it can be considered a strategic good because it is a primary input for several relevant industries in the EU such as garments, furniture or means of transport production. In fact, the EU is the a net importer of cotton and it has traditionally acted as a price-taker (European Comission, 2004). Second, the current dependence of Chinese cotton could be alleviated by alliances with new partners, which could enable the diversification targeted by the European Union. Third, investment leaded by the EU allows to guarantee the sustainability and fairness of the production in regions without jeopardizing its competitiveness. In addition, the suitability of the climate in some West-African countries already producing cotton -like Benin, Burkina Faso, Côte d'Ivoire, Chad and Cameroon (FAOSTAT, 2021)- make it possible to help farmers to expand their production and, at the same time, to correct the imbalances of power in the cotton supply chain (Fair Trade Advocacy Office, 2016).

Considering this context, the goal of this work is to analyse labour impacts linked to the cotton industry using a multi-regional input-output model. Using the source-shifting technique, we propose two scenarios in which cotton production made by those countries employing forced and child labour is blocked by the European Union and redirected to European and African countries. Our aim is to quantify which socio-economic implications could have this kind of actions.

2. Methods and data

This paper calculates changes on employment triggered by alternative dynamics in global trade relationships using a multiregional input-output (MRIO) model. This method allows to quantify impacts caused by human activities in complex economic systems encompassing several industries and regions. The versatility of these models lies in the different nature of the impacts that can be assessed: from economic impacts (H. Xiao et al., 2020) to environmental impacts (T. O. Wiedmann et al., 2015), covering social impacts too through a wide variety of indicators (A. Alsamawi, McBain, Murray, Lenzen, & Wiebe, 2017; Gómez-Paredes, Yamasue, Okumura, & Ishihara, 2015) that

go from bad-labour indicators (Simas, Golsteijn, Huijbregts, Wood, & Hertwich, 2014) to occupational health measures (Ali Alsamawi, Murray, Lenzen, & Reyes, 2017; García-Alaminos, Monsalve, Zafrilla, & Cadarso, 2020; Malik et al., 2021) or even extreme phenomena figures like forced labour (García-Alaminos, Ortiz, et al., 2020; Shilling, Wiedmann, & Malik, 2021) and child labour (Gómez-Paredes et al., 2016). Therefore, MRIO models provide relevant and complete results to analyze the implications of global trade on the Sustainable Development Goals (T. Wiedmann & Lenzen, 2018; Y. Xiao, Norris, Lenzen, Norris, & Murray, 2017), revealing the multiple consequences of specific policies and programmes (Monsalve, Zafrilla, Cadarso, & García-Alaminos, 2018) and synergies and trade-offs between different sustainability goals (Hubacek, Baiocchi, Feng, & Patwardhan, 2017; Schandl et al., 2016).

The basic extended MRIO equation is provided in expression (1):

$$F = \hat{f}(I - A)^{-1}\hat{Y} \quad (1)$$

where $\hat{\mathbf{f}}$ is a diagonalized vector of factor per unit of output; **A** is the matrix of technical coefficients, whose elements represents the intermediate consumption that each sector in each region requires from every industry (as given in the intermediate consumption matrix **Z**) per unit of output, and calculated as; **I** is the identity matrix; $\mathbf{(I - A)^{-1}}$ is the Leontief inverse matrix and $\hat{\mathbf{Y}}$ stands for the final demand per country diagonalized by regional sub-matrixes (Miller & Blair, 2009).

Matrix **F** provides the results in two complementary perspectives: on the one hand, adding by rows, we find the production-based account (PBA), in which the impact is attributed to the country and industry in which it takes place. On the other hand, the addition by columns provides the consumption-based account (CBA) or footprint, which represents the impact generated worldwide to cover each region's final demand.

The basic MRIO model admits different extensions. In this proposal, we work with the source-shifting technique, which is based in the modification of current trade fluxes according to a certain pattern or strategy, allowing to quantify its effects both in

direct and indirect terms. This technique has previously been applied to environmental issues in order to model how different strategies based on the reorganization of commercial relationships could impact on carbon footprints (de Boer, Rodrigues, & Tukker, 2019; Gilles, Ortiz, Cadarso, Monsalve, & Jiang, 2021). In this work, we apply it to simulate the effects that the new trade policy of the EU could have on employment, both in the regions punished for their social dumping, both in the areas fostered by investments and trade partnership with the EU.

To implement the source-shifting method, we modify both the technical intermediate consumption matrix (**Z**) and the final demand ($\hat{\mathbf{Y}}$) following the proposal by Gilles et al. (2021). We propose two scenarios whose correspond to the following assumptions: first, we suppose that the EU blocks all raw cotton imports from regions producing it with either forced labour or child labour according to USBILA (2020) and shown in Table 1 according to the Exiobase regional classification. Second, we reassign these imports to EU producing countries -just Spain and Greece due to climate conditions required for cotton farming. This reallocation is made under the assumption that both EU countries cannot expand their current capacity because of the unavailability of land and the already highly mechanization of current production. In consequence, if these two countries redirect their production to the intra-EU market, they must stop exporting to non-EU regions. Third, we reassign the remanent not covered by Spain and Greece to RoW Africa. In this case, we suppose that an expansion of capacity is possible through investments leaded by the EU. Scenario I would correspond to this situation, as shown in panel I in Figure 1. Scenario II introduces an additional step in the reconfiguration of trade (see panel II in Figure II). It assumes that the extra-EU markets left unattended by Spanish and Greek cotton are now taken by the regions previously blocked by the EU. The reallocation of these exports between the producing regions is made according to the business-as-usual participation of each region in extra-EU exports of cotton.

Exiobase region	*Involved countries*	*Percentage of Exiobase region to reallocate*	*Forced labour*	*Child labour*
Brazil	--	100%	No	Yes
China	--	100%	Yes	Yes
India	--	100%	Yes	Yes
Turkey	--	100%	No	Yes
RoW America	Argentina	76%	No	Yes
RoW Asia and Pacific	Kyrgyz Republic	91%	No	Yes
	Pakistan		Yes	No
	Turkmenistan		Yes	Yes
	Tajikistan		Yes	Yes
	Uzbekistan		Yes	No
RoW Middle East	Azerbaijan	76%	No	Yes
	Egypt		No	Yes

Table 1. Countries and regions involved in forced and child labour in the* cultivation of plant-based fibers *industry. 2020

Own elaboration based on USBILA (2020) and FAOSTAT (2021)

Note: the percentage of Exiobase region to reallocate *column shows the share of exports made by these regions to EU that must be shifted to Spain, Greece and RoW Africa. It has been calculated as the participation of the countries involved in forced or child labour on total production of raw cotton in the corresponding region*

I

		ESP Other ind.	ESP Cotton ind.	GRE Other ind.	GRE Cotton ind.	Rest EU Other ind.	Rest EU Cotton ind.	...	BRA Other ind.	BRA Cotton ind.	...	ROW Africa Other ind.	ROW Africa Cotton ind.
ESP	Other ind.												
ESP	Cotton ind.	REALLOCATION ACCORDING TO CURRENT CAPACITY							0	0	0	0	0	0
GRE	Other ind.												
GRE	Cotton ind.	REALLOCATION ACCORDING TO CURRENT CAPACITY							0	0	0	0	0	0
Rest EU	Other ind.												
Rest EU	Cotton ind.												
...													
BRA	Other ind.												
BRA	Cotton ind.	TOTAL TO REALLOCATE from region blocked											
...													
ROW Africa	Other ind.												
ROW Africa	Cotton ind.	REALLOCATION OF THE REMANENT (WITHOUT ANY CAPACITY LIMIT)											

II

		ESP Other ind.	ESP Cotton ind.	GRE Other ind.	GRE Cotton ind.	Rest EU Other ind.	Rest EU Cotton ind.	...	BRA Other ind.	BRA Cotton ind.	...	ROW Africa Other ind.	ROW Africa Cotton ind.
ESP	Other ind.												
ESP	Cotton ind.	REALLOCATION ACCORDING TO CURRENT CAPACITY							0	0	0	0	0	0
GRE	Other ind.												
GRE	Cotton ind.	REALLOCATION ACCORDING TO CURRENT CAPACITY							0	0	0	0	0	0
Rest EU	Other ind.												
Rest EU	Cotton ind.												
...													
BRA	Other ind.												
BRA	Cotton ind.	TOTAL TO REALLOCATE from region blocked							ORIGINAL ESP AND GRE XX NOW COVERED BY BRA					
...													
ROW Africa	Other ind.												
ROW Africa	Cotton ind.	REALLOCATION OF THE REMANENT (WITHOUT ANY CAPACITY LIMIT)												

Region blocked
Region fostered
Region of reallocation with no investment

Figure 1. Source-shifting technique applied to the intermediate consumption matrix and the final demand in Scenarios I (panel I) and II (panel II). Simplified regional and sectoral structure: two industries and just Brazil involved in forced labour in the cotton industry.

Own elaboration

Note: ESP stands for Spain, GRE for Greece and BRA for Brazil. Changes on the original intermediate consumption and final demand matrixes are applied in coloured rows, white rows remain unchanged.

The database used in our model is the Exiobase input-output table (IOT) for 2019 (Stadler et al., 2018), which provides information for 49 regions and 163 industries, among which we find detail for the "cultivation of plant-based fibers" sector, mainly devoted to cotton crops. Employment satellite accounts provided by Exiobase include employment by skill level and gender, as well as a variable of vulnerable employment. First results have been implemented for total employment, but this working paper is yet to be expanded with additional social indicators.

3. Results

The first part of the analysis focuses in scenario I, in which cotton EU imports from regions with forced or child labour in this industries have been substituted by production from Spain, Greece, South Africa and Rest of Africa. As the only region being able to expand its production is the last one, the boost in employment is exclusively generated in it. On the other hand, regions that have been boycotted by the EU suffer a leakage on employment. Left panel in Figure 2 represents employment effects after this source-shifting simulation.

The global leakage (79,481 workers in direct terms and 96,462 workers in total terms) is greater than the boost in Africa (25,272 direct workers and 32,520 direct and indirect workers). These results are a consequence of the substitution of part of the production from emerging countries (like China or India) by the Spanish and Greek cotton, which is less-intensive in labour due to the higher rates of mechanization. Looking at the different patterns in the countries suffering leakages, Row Asia and Pacific, India and Turkey are the most affected in absolute terms by the boycott. However, in relative terms, Row Middle East suffers the greatest direct lost with a destruction of 5.2% of initial employment in the cotton industry, followed by RoW Asia and Pacific and Turkey with a direct leakage of 5.13% and 4.41% respectively, as can be checked in Table 2. The case of China is surprising: despite being the greatest producer of cotton in the world (FAOSTAT, 2021), it is barely affected by the boycott from the EU to raw cotton. In fact, the greatest fall is produced in indirect terms, with the direct loss of jobs only representing 15.7% of the total fall. The reason of the

divergent behaviour of the Chinese industry is that its exports to the EU (either as intermediate consumption or final demand) are not significative over the total production, with the bulk of it remaining in China and the Rest of Asia as an input for textile industry.

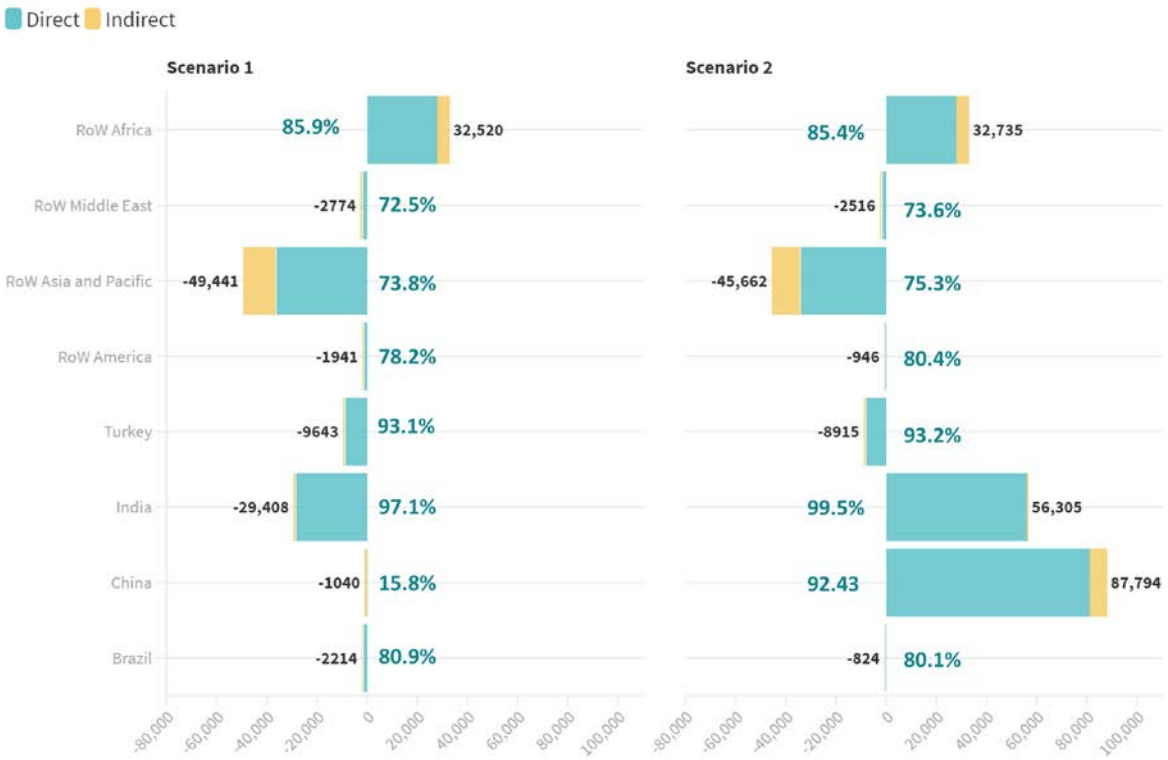

Figure 2. Direct and indirect employment effects in scenarios I and II (comparison with* business-as-usual *scenario). Producer Based Account perspective.

Own elaboration

Note: The number besides each bar (in black) represents total boost or leakage (direct+indirect employment effects). Percentages in green represent the direct effect over the total impact for each region.

Looking at the right panel in Figure 2, scenario 2 produces more diverse results as compared to the initial *business-as-usual* scenario. While the boost generated in RoW Africa has barely changed from scenario I, the boycotted regions present different performances when entering the markets left by Spain and Greece. The great winners are China and India, that manage to generate more than 87,000 direct and indirect employments in the first case and more than 56,000 in the second. This reinforcement

of these two Asiatic industries after the EU boycott is caused by the combination of two circumstances: first, the EU was not an important import market for cotton from these economies. As mentioned before, most of Indian and Chinese cotton remains in Asia to be integrated in the value chain of the fashion industry. In addition, the markets left by Spain and Greece outside the European Union have been distributed according to the share on production sold in the non-EU area by each country. Therefore, China and India get most of these new markets because of their huge market share in the business-as-usual situation. In conclusion, these two countries gains from new markets are greater than the lost from EU imports, so paradoxically the EU boycott could hinder sustainability instead of promoting it. On the other hand, RoW Asia and Pacific, Turkey, RoW Middle East, Row America and Brazil keep losing employment in scenario II with a slightly less intense fall than in scenario I.

		Scenario I				*Scenario II*			
	Region	*Persons*	*% over emp. in the cotton industry in the region*	*Persons*	*% over total emp. in the region*	*Persons*	*% over emp. in the cotton industry in the region*	*Persons*	*% over total emp. in the region*
Regions fostered by the EU	RoW Africa	**27933**	3.48%	**32520**	0.01%	**27938**	**3.85%**	**32735**	**0.01%**
Regions blocked by the EU	Brazil	-1792	0.71%	-2214	0.00%	-660	-0.26%	-825	0.00%
	China	-164	0.00%	-1039	0.00%	81148	0.47%	87794	0.01%
	India	-28554	0.15%	-29408	-0.01%	56050	0.30%	56305	0.01%
	Turkey	-8979	4.41%	-9643	-0.04%	-8305	-4.08%	-8914	-0.04%
	RoW America	-1519	0.84%	-1941	0.00%	-760	-0.42%	-945	0.00%
	RoW Asia and Pacific	-36461	5.13%	-49441	-0.01%	-34373	-4.84%	-45662	-0.01%
	RoW Middle East	-2011	5.21%	-2774	-0.01%	-1852	-4.79%	-2516	-0.01%
		-79481		**-96462**		**91248**		**85237**	

Table 2. Employment effects: comparative between scenarios I and II and the business-as-usual figures. Detail on direct and indirect boost and leakages generated in regions fostered and blocked.

Own elaboration

Previous results have been obtained using the PBA perspective. Switching into the CBA point of view, Table 3 shows the changes suffered by the labour footprint of each region when comparing the business-as-usual situation (denoted as 0), scenario I and scenario II.

EU countries	CBAI - CBA0	CBAII- CBA0
Austria	347	792
Belgium	-1210	977
Bulgaria	-198	171
Cyprus	-23	36
Czech Republic	-175	139
Germany	-6200	379
Denmark	-266	87
Estonia	-198	-142
Spain	-1599	917
Finland	-236	-22
France	-2383	783
Greece	207	752
Croatia	-215	-66
Hungary	-300	6
Ireland	-485	67
Italy	-10901	-8649
Lithuania	-92	-26
Luxembourg	-82	320
Latvia	9	54
Malta	-7	34
Netherlands	-2234	127
Poland	-1515	-638
Portugal	-829	-504
Romania	-456	184
Sweden	-476	-35
Slovenia	178	299
Slovakia	-177	2

Extra-EU regions	CBAI - CBA0	CBAII- CBA0
United Kingdom	-2041	2164
United States	-4743	14162
Japan	-1376	5035
China	-7306	30146
Canada	-493	1080
South Korea	-621	1741
Brazil	-416	1389
India	-1874	9224
Mexico	-228	489
Russia	-780	1057
Australia	-310	1030
Switzerland	-509	317
Turkey	-1626	6107
Taiwan	-220	646
Norway	-233	86
Indonesia	-1226	5939
South Africa	-175	513
RoW Asia and Pacific	-3508	11438
RoW America	-910	2970
RoW Europe	-975	1761
RoW Africa	-2571	11887
RoW Middle East	-3569	11931

Table 3. Changes in labour footprints: comparative between scenarios I and II and the business-as-usual figures.

Own elaboration

The employment footprint in scenario I is lower than the business-as-usual footprint for most countries. In the case of EU countries, the change in suppliers from developing regions to Europe have decreased the labour intensity of the cotton consumed in the EU. In extra-EU regions, the footprint falls as the demand falls artificially: Spain and Greece have stopped exporting to these areas and no other seller has covered these markets yet.

The most interesting comparison is the one between scenario II and the business-as-usual situation. All extra-EU regions suffer an increase in their labour footprint. This effect happens because their demand of cotton is now covered by emerging regions in which cotton crop is less mechanized than in Greece or Spain. In the case of EU countries, most of them decrease their footprint as now the origin of the cotton is mostly European. However, some of these European footprints are larger in scenario II (with the case of Italy as the most notorious one), which happens due to the backward effects generated by the worldwide change of suppliers. If a country like Italy imports textiles already manufactured from Asia which are now produced with Chinese cotton while they used to be made from Spanish cotton before the shifting, its global labour footprint will be expected to be greater.

4. Discussion

In this working paper, we analyse the employment implications of a reconfiguration of cotton imports in the European Union. Main conclusion could be the unexpected consequences of a boycott to tainted cotton from countries that are using forced and child labour in its production: on the one hand, some countries like Turkey would be losing a considerable amount of direct and indirect jobs due to their dependence of the UE imports. This penalization could encourage producers and legislators in these countries to act against these undesirable practices in order to gain again the trust of the EU. However, other regions like India or China could be winners from this situation: their employment loss would be insignificant but their potential win could be substantial if they take advantage of new markets left by the EU as a consequence of its resilience strategy and the reinforcement of its inner market.

Therefore, anti-dumping policies must be carefully designed. International trade is an entangled network in which it is not trivial to identify the ramifications of an initial intervetion.

Regarding future possibilities to expand this proposal, the main goal of this work is to extend the source-shifting proposal to all industries into the fashion value chain that are alleged to produce with either forced or child labour according to the list provided by USBILA (2020). This would imply the global reconfiguration of the textile industry, the garment manufacturing and the footwear production, reducing the dependency of the EU from Asia and strengthening trade relationship with different developing partners. Following the Open Strategic Autonomy guidelines, EU imports from these industries in countries not respecting the basic workers rights could be redirected to either the EU itself, neighbour countries like the South-Mediterranean area or Eastern Europe or regions that are on the development agenda of the EU such as sub-Saharan Africa or Latin-America. In addition, this kind of analysis could be extended to other strategic sectors that are on the spotlight of bad labour practices, like construction-inputs manufacturing (like bricks) or the agriculture and food industry (products like cocoa or coffee are thought to embody high amounts of indecent labour).

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