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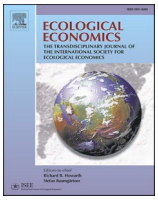

The European Union and United Kingdom's deforestation-free supply chains regulations: Implications for Brazil

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ABSTRACT

This paper analyses the potential implications of the proposed European Union Deforestation Regulation (EUDR) and the recently adopted United Kingdom (UK) legislation on deforestation-free supply chains (henceforth 'the legislation') for different stakeholders in Brazil. These regulations intend to address global commodity-driven deforestation and forest degradation by ensuring that targeted commodities and products placed on (or exported from) markets are of minimal risk of being associated with - in the EU - deforestation and forest degradation or - in the UK - illegal deforestation. The paper examines potential compliance readiness in cattle, cocoa, coffee, palm oil, soybean and tropical timber supply chains in Brazil, indicating specific challenges that may arise. Through the construction of a "Compliance Likelihood Index", our research provides comparable indications to policymakers on sectors and stakeholders that may need stronger support to meet the requirements, in order to maintain Brazil's access to EU and UK markets. The paper indicates that coffee is the sector with the highest level of incentivization and smallest hurdles for compliance, while the cattle sector may face stronger challenges to rapidly adjust its production system towards a deforestation-free value chain and prove compliance. Results of our analysis also highlight the need for collaboration between the EU/UK and Brazil in order to promote alignment between domestic and demand-side legislations so that they are mutually reinforcing. Results of this exercise, which has a focus on the producer-country view of demand-side legislation, will contribute to discussions on the merits of different approaches to strengthen the governance of deforestation-risk commodity trade.

1. Introduction

Agricultural expansion is a primary driver of deforestation and forest degradation in the tropics (Curtis et al., 2018; Pendrill et al., 2020, 2022), which has severe environmental impacts, such as biodiversity loss and climate change (Ortiz et al., 2021; Silvério et al., 2015; Spera et al., 2016; Sun et al., 2022). According to United Nations Food and Agriculture Organization (FAO) estimates, in the last 30 years the world lost approximately 420 million hectares (10%) of forest (FAO, 2020).

In spite of the recognition of the transnational connections between commodity production, international trade and deforestation (Hong et al., 2022), governments have been unable to negotiate binding

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multilateral agreements on forest protection, such as a comprehensive Forest Convention (Friis and Nielsen, 2019; Sotirov et al., 2020). Therefore, global deforestation-free initiatives currently intersect multiple schemes of governance, such as those linked to multilateral environmental agreements (particularly those related to biodiversity), in the multilateral trade system within the umbrella of the Agreement Establishing the World Trade Organization (the Marrakesh Agreement 1994/ the WTO Agreement 1994) and those linked to the climate change governance framework (including the Paris Agreement).

In an attempt to fill this multilateral governance gap, and respond to consumer demands, the number of private sector initiatives aimed at reducing deforestation in countries producing agricultural commodities has increased (Lambin et al., 2018; Ludwig, 2018). Major retailers, brands, traders, suppliers and investors, for example, have pledged to eliminate deforestation from their supply chains (WWF, 2021, 2022; Forest Trends, 2022; CDP and Accountability Framework Initiative, 2022). In parallel, in recent years we have seen an increasing 'willingness' of some national governments to take domestic regulatory action to support transition towards deforestation-free commodity supply chains. Although these pieces of legislation can be considered governance frameworks, they are not schemes of global governance, as they are unilateral and not as encompassing as multilateral agreements (Sotirov et al., 2020). Whilst similar proposals are under discussion in the United States (US) in the form of discussions linked to the Forest Act (United States Senate, 2021), the most advanced regulatory proposals are centred around the European Union (EU) and the United Kingdom (UK).

The EU legislation on deforestation-free products entered into force on June 29th 2023 (although some articles of the regulation will enter in application after a transition period of 18 months, or 24 months for micro and small enterprises).[1] Similarly, the UK has introduced legislation through Schedule 17 of the UK Environment Act 2021 concerning the use of forest-risk commodities in UK commercial activities.[2] The EU deforestation-free legislation rules that commodities or products in scope (cattle (beef and leather), cocoa, coffee, oil palm, rubber, soybean, wood products and a list of derivatives) cannot be placed on EU markets unless they are deforestation-free (after 31 December 2020), have been produced in accordance with local legislation, and covered by a due diligence statement. In the same vein, the UK legislation prohibits the use of illegally produced forest risk commodities and their derivatives. The commodities in scope have only been defined in the EU legislation (UK commodities under discussion tend to be similar). A table comparing the main aspects of the EU and UK legislation (henceforth, 'the legislation') can be found in Appendix A.

The EU legislation adopts the definition of forest developed by the United Nations Food and Agriculture Organization (FAO) Forest Resources Assessment (FRA) which considers "land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ" (FAO, 2018). Reportedly, the legislation will be reviewed within one year of its entry into force, to assess the impact of further expanding the scope to 'other wooded land'. After two years, a second review will assess the impact of expanding it to ecosystems beyond 'forests' and beyond 'other wooded land'. The adoption of this "forest" definition has raised particular concerns regarding its potential impact in Brazil, since it leaves a great part of the Cerrado biome out of scope (MAPBIOMAS, 2022a), and this is an area where most of the native vegetation conversion to agriculture and pasture is taking place (Azevedo et al., 2022). If the legislation becomes more stringent over time, compliance in the longer term could become more difficult.

Operators and non-SME traders are required to submit a due diligence statement through a dedicated information system to be established by the European Commission. Before placing relevant products on the EU market or exporting them, they will need to ensure the products are compliant. The due diligence process will comprise collection of detailed information, including coordinates of the plots of land where commodities were produced (to demonstrate that there is no deforestation in a specific location after the imposed cut-off date). In the due diligence process, operators and non-SMEs traders are also expected to carry out a risk assessment for each product and to mitigate risks.

In this context, our overarching research questions are what are the incentives and hurdles for producing countries for compliance with the legislation, and how might compliance readiness differ across the commodity systems in scope of the regulation? Moreover, we explore the extent to which the legislation will prevent negative unintended effects (such as smallholder exclusion) while fulfilling its objectives. We also question the legislation's capacity to control deforestation in countries of commodity origin, considering its limited structural role as a mechanism of transnational regulatory governance (Sotirov et al., 2020).

In order to address these questions, we have chosen Brazil as a case study. Brazil is a leading exporter of most of the commodities in the scope of the legislation (AGROSTAT, 2023; Andrade, 2016; Barros, 2019; Valdez, 2022). Brazil's agricultural production and exports have expanded rapidly in the last two decades, connected to significant land conversion, particularly in the Cerrado (Rudorff and Risso, 2015). Because of the potential significance of incoming legislation on Brazil, this paper analyses how consumer-country legislation based on "mandatory due diligence" may provide incentives for compliance in different sectors. In addition, it outlines hurdles for producer countries in transitioning to deforestation-free production and implementing the necessary mechanisms to comply with traceability and due diligence components of the legislation.

In the remaining sections, we first explain the methods and research design. Our results provide an overview of the current situation and examine the likelihood of compliance in cattle, cocoa, coffee, palm oil, soybean and timber supply chains in Brazil, building a comparative index of assessment. We then discuss the main incentives and hurdles for compliance, based on this Compliance Likelihood Index, indicating the specific challenges associated with the legislation.

2. Materials and methods

2.1. Methods overview

We conducted a literature review to place the incoming legislation within existing forest governance arrangements, combining International Relations global governance concepts with integrated forest governance frameworks. Subsequently, we used the text of the initially proposed EU deforestation regulation[3] (EUDR) and its Annex 1 to analyse its main provisions and compared it with the UK Section 116 and

[1] The legislation was published in the Official Journal of the European Union on June 9th, 2023. The legal text can be found at https://eur-lex.europa.eu/eli/reg/2023/1115/oj. Applicability details can be found at https://environment.ec.europa.eu/system/files/2023-06/FAQ%20-%20Deforestation%20Regulation_1.pdf.

[2] Whilst formally adopted in UK law, it is expected that in the coming months secondary legislation will be published, providing further details for implementation.

[3] 2021/0366 - Proposal for a regulation of the European Parliament and of the Council on the making available on the Union market as well as export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010 - available at https://environment.ec.europa.eu/publications/proposal-regulation-deforestation-free-products_en.

Schedule 17 of the Environment Act 2021 regulating the use of forest risk commodities in commercial activity.[4] This content analysis was essential to provide a comparative view of both regulations and carry out the assessment of their potential impacts in Brazil.

As a next step, we developed a comprehensive cross-sectoral analysis of six commodities and derived products (cattle, cocoa, coffee, palm oil, soybean and wood) included in Annex 1 of the originally proposed EUDR (Appendix B of this paper) to better understand the organization of each sector and their incentives and hurdles for deforestation-free supply chains. As rubber is not in the original proposal and Brazil's production is consumed domestically, we did not include this commodity. The data used was composed of Brazil's commodity production statistics (sourced from the United Nations Food and Agriculture Organization – FAO statistics database); foreign trade statistics, (using the International Trade Center Trade Map database); analytical performance reports from sectoral associations, such as the Brazilian Association of Beef Exporting Industries (ABIEC); data from the Brazilian Institute of Geography and Statistics (IBGE) for smallholder's participation in each sector. In addition, we used sectoral reports from companies, non-governmental organisations, think-tank analysis, and academic papers.

In parallel, to undertake an assessment of the potential incentives and hurdles (costs) for compliance likely to be faced by different groups of stakeholders in Brazil we conducted a survey. The survey was conducted online, in Portuguese, from June 1st to July 22nd, 2022, and consisted of 11 multiple-choice and 15 open questions. We directly invited potential participants, and received anonymous responses for 25 questionnaires, with 14 respondents from the private sector, 9 from civil society and 2 from the federal government. Regarding the coverage of each organization, 13 operate internationally, 9 operate at the domestic level and 3 implement their activities at the regional/local level. Respondents reported linkages with the following commodity value chains: beef (8 respondents), soybean (7), coffee (7), cocoa (5), tropical timber (5), and palm oil (4). Most of the respondents were linked to more than one commodity and their operations covered more than one biome (e.g. Amazon and Cerrado), and government respondents had regulatory responsibilities over operations in all commodities. Since interviews were conducted while the EU legislation was still under discussion, the responses do not reflect an accurate analysis of the final regulation, but rather initial impressions from stakeholders.

We then triangulated the texts of the proposed legislation, the sectoral landscape analysis of each commodity, and the survey results, to inductively develop assumptions regarding proxies of potential incentives and hurdles for compliance with the legislation. The output of this exercise was a list of variables that could influence Brazil's likelihood of compliance.

We further refined this list through a search in academic and grey literature, government and international organization's databases and statistics platforms. Our searches for variables tested the availability of quantitative data for all commodities in scope, enabling the calculation of a set of consistent metrics. As a result of this exercise, we shortlisted six quantifiable variables, which were then used in the construction of a "Compliance Likelihood Index".

Other potentially useful variables, such as coverage of traceability systems and price premiums, were identified as important aspects likely to influence the likelihood of compliance. However, they could not be included in the Index due to the lack of homogeneous quantitative data covering all sectors. Nevertheless, these variables were used, when applicable, to add further qualitative description to the current landscape in the specific sectors and in the discussion of the results.

The Compliance Likelihood Index is constructed with two indicators that we consider "incentives" for compliance (share of production exported and share of Brazilian exports to the EU and UK) and four metrics that we consider "hurdles" (low coverage of voluntary sustainability standards; smallholder dominance in production, overall deforestation associated with production (absolute deforestation), and deforestation encroachment (relative deforestation). The Index was calculated using national data for all metrics, compiling indicators for the entire Brazilian territory, allowing the potential for future international comparisons. We acknowledge, however, the existence of significant regional differences in the distribution of our variables (e.g. deforestation, smallholders) throughout the sectors and, ideally, subnational data could help provide 'regional' resolution. This could be done in a future work, once disaggregated data becomes available.

In the next subsection, we detail the method applied to the "Compliance Likelihood Index", which is composed of three stages, and is based on United Nations et al. (2021) and Nardo et al. (2005). In addition, we explain the underlying assumptions and rationale for the inclusion of each of the variables in the index.

2.2. Compliance likelihood index methodology

The first step involved setting the measurement focus; defining and selecting characteristics, data and associated "compliance" metrics. Six metrics were shortlisted through the steps described above and were calculated on a dimensionless scale to make it easier to compare their values. The six metrics, weighted equally, combine into the Index, and are as follows:

2.2.1. The share of Brazilian production exported

The rationale for including the share of production exported in the Compliance Likelihood Index is that commodity supply-chains with a stronger connection to international markets may be more sensitive to market access requirements and regulations. Actors within these sectors may have already developed know-how on compliance procedures for other international regulations, therefore transaction costs may be smaller compared to sectors where most of the production is consumed domestically. In addition, other important trade partners are also discussing similar regulations, such as the US, and these requirements could eventually become a global trend.

The share of production exported was calculated for each commodity as the ratio between exports and total production. The following data sources were used: Cattle and Cocoa (data from 2021 based on Brazilian association of Beef Exporting Industries (ABIEC) (Associação Brasileira das Indústrias Exportadoras de Carne (ABIEC), 2022) and "Associação Brasileira da Indústria de Chocolates, Amendoim e Balas-ABICAB" (ABICAB, 2021); Coffee, Wood and Soybean (data from 2020 based on FAO (2020); and Oil palm (data from 2015 based on "Ministério da Agricultura, Pecuária e Abastecimento - MAPA" (MAPA, 2018).

2.2.2. The share of Brazilian exports to the EU and UK

We assume that greater participation of the EU and UK markets in Brazilian exports may generate increased incentives for compliance in order to maintain market access. We calculated the share of Brazilian exports to different markets using countries' trade flow data for the year 2021, available via the International Trade Center Trademap platform (ITC, 2021a). Exports values of each commodity and related goods[5] listed in Annex 1 of the proposed EU legislation (European Commission, 2021) have been aggregated to relevant primary commodities. We then

[4] UK Public General Acts - Environment Act 2021 – Schedule 17. Available at https://www.legislation.gov.uk/ukpga/2021/30/schedule/17#:~:text=Prohibition%20on%20using%20illegally%20produced%20commodities&text=(3)In%20this%20Schedule%20%E2%80%9C,was%20grown%2C%20raised%20or%20cultivated.

[5] According to Annex 1 to the Proposed EU legislation, the nomenclature codes were taken from the Combined Nomenclature as defined in Article 1(2) of Council Regulation (EEC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff.

calculated the ratio between Brazilian exports to the EU and the UK and the total value of Brazilian exports of each group of relevant commodities and related goods.

2.2.3. Coverage of voluntary sustainability standards

We assume that sectors that already have environmental certification implementation experience may be more prepared for compliance, having acquired know-how on VSS mechanisms and deforestation-free production practices. In addition, this metric also indirectly reflects the costs and hurdles for adhering to these certifications (these difficulties are also explored in metric iv - smallholders).

We used the State of Sustainable Markets 2021 Report (ITC, 2022) as our main data source for calculating the coverage of VSS[6] applicable to Brazilian commodities. We aggregated the main global VSS certified areas in the Brazilian territory (assuming that there is no double certification for the same harvested area), calculating the share between the certified area harvested and the total area harvested for each commodity. The ITC report does not include the cattle sector and, to the best of our knowledge, there is no similar data available to assess the area of certified pasture in Brazil. However, adherence of Brazilian cattle producers and processors to global sustainability standards is still limited.[7] Producers have been primarily concerned with complying with food standards, sanitary requirements and related regulations. Therefore, we attributed a zero value in the Index for coverage of existing voluntary standards in the cattle sector.

2.2.4. Smallholder dominance in production

We recognize that small-scale producers may have difficulty complying with legislation, given potential operational challenges and associated costs. In addition, this proxy also reflects the complexity in value chains, with smallholders and increased layers of intermediaries and potential hurdles and costs related to traceability, disclosure of information and proof of land legality. Therefore, we calculated the proportion of total properties owned by legally defined family farmers[8] versus the total area of all rural properties for the six relevant commodities in Brazil,. Since the agricultural census does not have a category for "wood", we used the available data regarding "forest production" (native and planted forests). However, according to IBGE's National Classification of Economic Activities, forest production comprises timber and non-timber goods. Therefore, to consider only wood products, we estimated the proportion of smallholder dominance in wood products calculating the average of the proportion of total property area in the hands of legally defined family farmers in planted and native forests in 2017 based on IBGE (2019), weighted by the proportion of the production value of wood products of planted and native forests in 2020 (the most recent data available) (IBGE, 2021).

2.2.5. Absolute deforestation

A significant share of forest loss in Brazil can be attributed to agricultural expansion, partly to supply the international trade of commodities (Pendrill et al., 2020). Currently, Brazil is under international pressure to regain control over native vegetation loss, mainly due to the fact that most of the deforestation is illegal in the country (MAPBIOMAS, 2022b). Thus, due to the extensivity of deforestation which will require potential action by supply chain actors across Brazil we assume that the sectors associated with higher rates of deforestation are likely to face larger compliance challenges related to the costs of implementing and monitoring actions to curb unsustainable practices and prevent deforestation. Producers may be more inclined to adopt commitments when compliance costs are relatively small (Börner et al., 2015). If costs are high, such as for a sector which is currently associated with deforestation, then diverting exports to less stringent markets may be more attractive than compliance.

Therefore, we consider absolute deforestation as an indication of "extensiveness" (its potential damage in terms of area affected) and how pervasive it might be across supply chains that operate through biodiversity rich biomes, such as the Amazon. In the context of companies sourcing across multiple landscapes and suppliers, this increases potential complexity and may act as a disincentive for compliance if alternative markets are available. The absolute deforestation metric is defined by the share of each commodity in overall deforestation embodied in the production of agricultural and forestry commodities in Brazil. It was calculated by the ratio between the deforestation area of each commodity and the total deforestation area associated with expansion of cropland, pastures and forest plantation, both in the 2005–2018 period, using data from Pendrill et al. (2020).

2.2.6. Relative deforestation

For the previous metric (absolute deforestation), commodities with large cultivated areas (e.g. cattle and soybean) tend to have greater shares in overall deforestation, while commodities with small cultivated areas (e.g. palm oil and cocoa) tend to have smaller shares in overall deforestation. To counterbalance these size differences, we also use a metric that indicates how much deforestation there is present within each commodity's cultivated area. This deforestation activity relative to cultivated area indicates the share of new land encroachment for each commodity and therefore also provides insight into potential difficulties in compliance with regulation as activities, however small, that more commonly result in deforestation may also struggle to uncouple deforestation from production.

The relative deforestation metric demonstrates how much of each hectare of cultivated area for each commodity is associated with deforestation. For this, we calculated the ratio between the deforested area embodied in each commodity (Pendrill et al., 2020) and its respective cultivated area (MapBiomas, 2020 and IBGE, 2021). We used the accumulated values from 2005 to 2018 (the same period used in the absolute deforestation metric) for both ratios (deforested area and cultivated area).

It should be noted that the inclusion of two metrics linked to deforestation in the Index effectively 'double-weights' deforestation as a contributor to Index scores. However, as existing connections to deforestation is likely to be a key barrier to compliance, and both relative and absolute rates of deforestation may be relevant to compliance tendency, we deem this to be justified.

2.3. Compliance likelihood index

Each individual metric within the Index is comprised of different units, and therefore a normalisation step was conducted to scale all metrics between 0 and 1 using the lowest and highest values that are present for each metric.

We calculated the compliance indicators as follows:

$$I = (V–VL)/(VH–VL) \quad (1)$$

where I is the resultant value of the compliance indicator, V is the original (raw) value of the metric for each commodity, VH is the highest value of the metric and VL is the lowest value of the metric across the studied commodities.

For structuring the Index, we consider that the higher the index, the closer the commodity systems are to potential compliance readiness with the new legislation. For the first three metrics - i) Brazilian pro-

[6] A complete list of the VSS included can be found at https://intracen.org/media/file/11643#:~:text=The%202021%20report%20adds%20data,challenges%20through%20certified%20sustainable%20production.

[7] Further information can be found at the Sustainable Livestock Initiatives Map, at https://gtps.org.br/.

[8] In the Agricultural Census carried out by the IBGE, the legal definition of family farming is adopted, which is contained in Decree No. 9064, of May 31, 2017. For this research, the same definition was adopted.

duction exported, ii) Brazilian exports to the EU, and iii) VSS, the higher the values of their indicators, the greater the probability of legal compliance of the commodity. However, for the last three metrics - iv) Smallholder dominance, v) Absolute deforestation, and vi) Relative deforestation, the higher the values of these metrics, the further the commodity systems are from potential compliance. Therefore, the values of these indicators (iv, v, vi) were inverted to allow for inclusion:

$$ICI = 1 - I \quad (2)$$

where ICI is the inverted compliance indicator, and I is the (original) compliance indicator.

Finally, we calculated the Compliance Likelihood Index by combining and averaging across the six compliance indicator values for each commodity. The Index ranges from 0 to 1, so that the closer a score is to 1, the more likely the commodity may be associated with more favourable conditions for legislative compliance.

2.4. Incentives and hurdles for compliance

We also separated the Compliance Likelihood Index results into those related to the 'incentivization' that the legislation provides for different sectors and those related to existing 'hurdles' for compliance. We assume that producers of commodities with higher shares of exports in total production and which have the EU and UK as top export destinations may feel more compelled to comply with the regulations in order to maintain market access. Therefore, the Index indicators i) share of Brazilian production exported and ii) share of Brazilian exports to the EU and UK within total exports are considered as incentives for compliance.

On the other hand, we assume that the Index indicators iii) VSS coverage; iv) smallholder dominance; v) absolute deforestation and vi) relative deforestation may be perceived as hurdles for compliance. For indicator (iii) VSS coverage, we consider that a low coverage of VSS can constitute a hurdle for compliance. Therefore, we used the inverse proportion, which indicates the share of cropland not covered by a VSS.

For this component of the analysis we calculated the average value of incentives (i and ii) and the average value of hurdles (iii; iv; v and vi) separately. Finally, we compared the resulting level of hurdles and incentives for each commodity, scaled as follows: very low (0–0.2); low (0.2–0.4); moderate (0.4–0.6); high (0.6–0.8); very high (0.8–1.0) (Fig. 2).

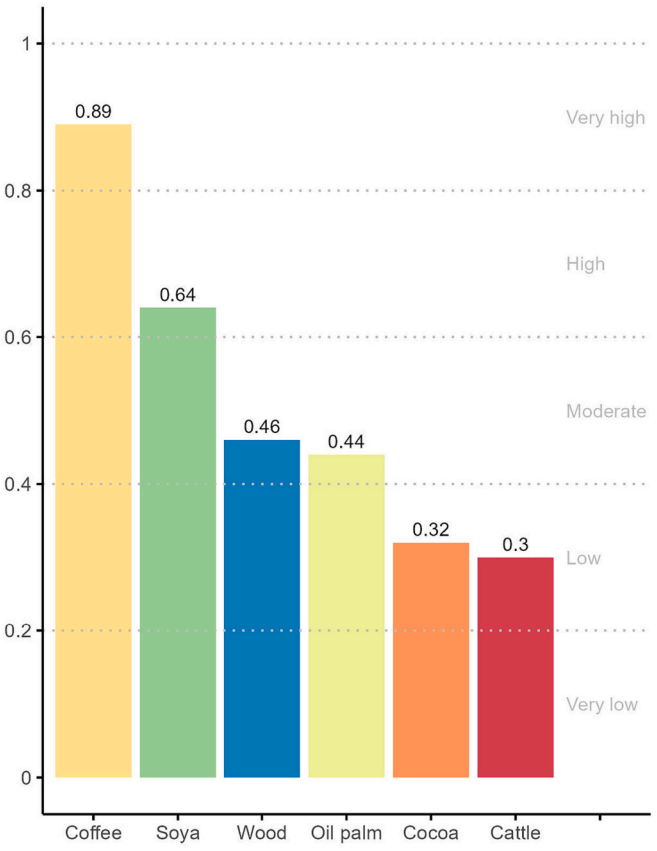

Fig. 1. Compliance Likelihood Index indicating the potential for each commodity system to comply with the EU and UK regulations. The Index considers: the share of Brazilian production exported; the share of Brazilian exports to the EU; the coverage of existing voluntary standards; the dominance of smallholders; the absolute deforestation associated with the relevant commodity and the deforestation relative to the total cultivated area of the commodity. Maximum score of 1, with scores based on normalised values of individual compliance indicators.

Table 1
Compliance Likelihood Index metrics with results of assessments on the potential for compliance for each commodity value chain assessed.

	Incentives		Hurdles			
	Brazilian production exported	Brazilian exports to the EU	Voluntary standards	Smallholder dominance	Absolute deforestation	Relative deforestation
Cattle	25.5%	8.3%	0.0%	22.0%	61.2%	0.7%
Cocoa	5.1%	4.5%	2.3%	50.9%	0.2%	0.4%
Coffee	64.1%	49.8%	33.0%	34.2%	0.1%	0.1%
Oil palm	13.7%	14.4%	27.2%	40.3%	0.1%	2.0%
Soybean	68.1%	15.1%	5.0%	7.1%	13.0%	0.8%
Wood	47.9%	20.1%	2.0%	12.6%	11.3%	2.4%

Table 2
Normalised compliance Likelihood Index indicators.

	Incentives		Hurdles			
	Brazilian production exported	Brazilian exports to the EU	Voluntary standards	Smallholder dominance	Absolute deforestation	Relative deforestation
Cattle	0.32	0.08	0.00	0.66	0.00	0.75
Cocoa	0.00	0.00	0.07	0.00	1.00	0.87
Coffee	0.94	1.00	1.00	0.38	1.00	1.00
Oil palm	0.14	0.22	0.82	0.24	1.00	0.20
Soybean	1.00	0.24	0.15	1.00	0.79	0.69
Wood	0.68	0.34	0.06	0.87	0.82	0.00

3. Results

There are different implications of the EU and UK deforestation-free legislation for sectors in scope in Brazil. While some sectors may have greater incentives for compliance (particularly if their main export destinations are the EU and UK markets), others may be disincentivized by the costs of compliance (e.g. implementing traceability systems, collecting and processing information on legality of producers and ultimately, halting deforestation). Hurdles, furthermore, are different in each sector, depending on various factors, such as their current linkage with native vegetation conversion to expand production, the size and institutional organization of producers and the extent of their adherence to voluntary sustainability standards.

We, therefore, analysed the current situation in each sector in terms of incentives and hurdles for compliance, operationalizing the quantifiable variables in the Compliance Likelihood Index. In this section we outline the results of the Index, highlighting the main attributes of the six commodities. The underpinning results from the metrics that compose the Index for each commodity are outlined in Table 1 and the normalised indicators are shown in Table 2. Indicator results are discussed in each commodity subsection (subsections 4.1 to 4.6).

Results from Table 1 were then normalised (Table 2) and aggregated into the "Compliance Likelihood Index" (Fig. 1).

As outlined in Fig. 1, across the commodities assessed and using the chosen indicators, the coffee sector had the highest Compliance Likelihood Index (0.89), followed by soybean, wood and oil palm. Cocoa and cattle are indicated as the sectors in which a transition to deforestation-free value chains triggered by the legislation could potentially be more challenging.

The Index results can also be interpreted in terms of the level of 'incentivization' the legislation provides for different sectors and the existing 'hurdles' for compliance (Fig. 2).

Commodity-specific composition, results of the Compliance Likelihood Index and the analysis of incentives and hurdles are discussed in the subsequent subsections. To provide a comprehensive discussion and analysis of the circumstances in Brazil, the inclusion of additional qualitative data regarding each commodity value chain helps to further contextualise the Index results.

4. Discussion

4.1. Coffee

According to the Index results, the coffee sector has the greatest compliance likelihood, registering a very high score of 0.89. Among the main contributions to this result, we highlight the high share of Brazilian production exported (64%). Brazil is the world's largest coffee producer; in 2020, production surpassed 3.7 million tonnes (FAO, 2022). In the same year, exports reached 2.3 million tonnes, valuing US$ 4.9 billion (International Trade Center - ITC, 2021a).

A second indicator that underpins the high Index score is the high share of coffee exports directed to the EU and UK's markets. Half of Brazil's coffee exports are directed to these markets, while the other main importing markets are the US (19.3%) and Japan (6.9%).

Regarding the indicator of coverage of existing voluntary sustainability standards (VSS), the coffee sector was one of the first adopters of VSS in Brazil. Approximately 33% of the total area harvested with coffee in the country is covered by some kind of VSS, such as those developed by the Rainforest Alliance and Fairtrade certification programs. The main difficulties for adopting VSS in the coffee supply chain are related to the availability of technical assistance for certification, especially in remote production areas (Piao et al., 2019).

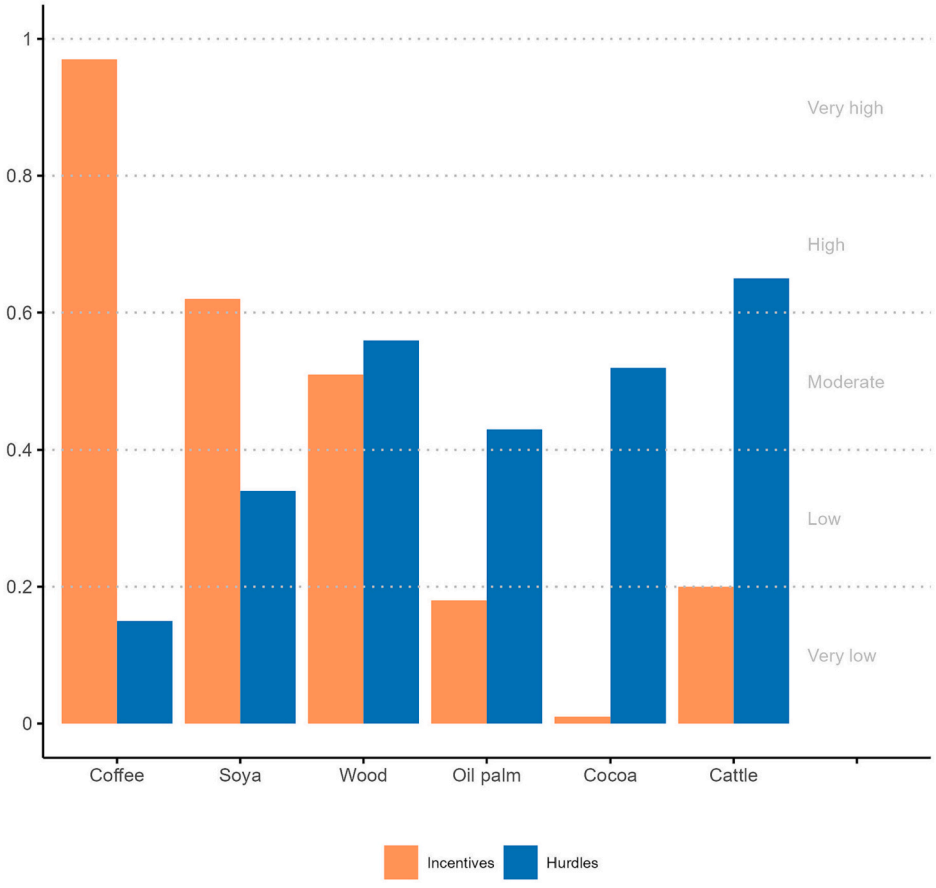

Fig. 2. Incentives and Hurdles for compliance with the legislation.

Coffee plantations are generally concentrated in consolidated areas and smallholders account for 34.1% of the total area under production (IBGE, 2019). Although there are a few regions in the Brazilian Amazon where coffee is cultivated, it is not considered a main driver of deforestation, responsible for only an estimated 0.13% of the total converted area associated with the commodities production (Pendrill et al., 2020). Similarly, the ratio between the deforested area embodied in coffee production and its total cultivated area (Pendrill et al., 2020, MapBiomas, 2020 and IBGE, 2021) - in the period from 2005 to 2018 - is only 0.1%. Coffee is therefore associated with the lowest level of deforestation exposure of the commodities analysed in our research.

4.2. Soybean

Soybeans presented a high "Compliance Likelihood Index" (0.64), the second highest of the commodities studied. Soybean is the top agricultural commodity in Brazil's exports, accounting for approximately 13.4% of the country's total exports in 2021 (COMEXSTAT, 2023) . Similar to coffee, most of Brazil's soybean production is exported (68.1%). However, the EU and UK's share in Brazil's total soybean exports is considerably smaller than in the coffee sector, accounting for 15.1%. Conversely, approximately 58% of Brazilian soybean exports were directed to China in 2021, while only 0.2% to the US.

The coverage of existing voluntary sustainability standards in the soybean sector is low, reaching only 5% of the total harvested area. Although there are various certification systems available, such as the Roundtable on Responsible Soy (RTRS) and Proterra, most producers do not adhere to those mechanisms and the market uptake is also limited. Producers indicate that the premium added in the sale price is not sufficient to cover the high costs of certification (Soendergaard et al., 2021).

Among the commodities we analysed, soybean had the lowest level of smallholder participation, accounting for only 7.1% of soybean farmland. According to our assumptions, the resultant property concentration in the hands of large commercial producers may contribute to compliance, since they potentially have greater capacity to cover implementation costs. However, despite progress, traceability remains a challenge in the sector (Schilling-Vacaflor et al., 2021), since most of the major soybean traders' traceability systems do not currently fully cover indirect suppliers (Song et al., 2021).

Soybean, furthermore, was the third commodity most associated with deforestation in Brazil, accounting for an estimated 13% of the total area deforested for pasture, agriculture and forestry in the 2005–2018 period (Pendrill et al., 2020). The deforestation ratio related to the cultivated area was 0.8% during this period. It also represents a major driver of indirect deforestation, via cattle pasture displacement (Trase Insight, 2020). Soybean planted area has grown by more than 200% in thirty years and production has increased almost 500% (Embrapa, 2019), with most of the expansion taking place in the Brazilian Cerrado regions and across the Amazon border (IBGE, 2021; Soterroni et al., 2019).

4.3. Wood

Wood has the third highest compliance likelihood. In 2021, production of wood products included in the EU legislation reached 76 million tonnes with a total export value of US$13.8 billion. Brazil exported 47.9% of its production. The EU and UK import 20.1% of Brazil's total exports. The other two major importing markets are the US (approximately 27%) and China (22.8%) (ITC Trade Map data). Timber imported into the EU is currently covered under the EU Timber Regulation,[9] which will be replaced by the EUDR. Since exports to the EU already comply with the EUDR, this may imply that, perhaps, readiness could be higher than captured in the Index.

Smallholders account for 12.6% of the properties producing wood in Brazil. Producers need to comply with a series of regulations to guarantee the conservation of production forests and compliance with minimum social and environmental standards (Vidal et al., 2020). In addition, there are also private mechanisms in place, such as the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC), aimed at guaranteeing traceability and sound production practices. That said, the coverage of the existing sustainability voluntary standards analysed is very low, accounting for only 2% of total harvested area.

Wood and derived products are the commodity third-most associated with deforestation in Brazil, accounting for approximately 11.3% of the total area deforested (Pendrill et al., 2020). For relative deforestation, however, wood takes the lead, with a 2.4% ratio of deforestation to the total area cultivated.

4.4. Palm oil

Palm oil appeared fourth highest in the Index, with a moderate score (0.44). Brazil is a relatively minor palm oil producer (10th in the global producer's rank). Brazil exports only 13.7% of its production. In 2021, Brazilian oil palm exports reached US$ 24.2 million. From this total, approximately 14.4% of Brazilian exports were directed to the EU, while 31% were sold to Switzerland, 19.5% to Argentina and 10.4% to the US (TradeMap, 2023).

Only in the 2000s did palm oil emerge as a promising crop in Brazil and production expansion has been regulated through governmental initiatives, such as the Agro-ecological Zoning of Oil Palm Cultivation for Deforested Areas in the Legal Amazon (ZAE) and the Sustainable Oil Palm Production Program (SPOPP) (Benami et al., 2018; Brandão and Schoneveld, 2015). In addition to these governmental initiatives, producers have adopted voluntary sustainability standards, such as the certification scheme developed through the Roundtable on Sustainable Palm Oil (RSPO). Among the commodities we analysed, palm oil has the second largest uptake of voluntary sustainability standards (VSS) by producers, behind only coffee. According to the annual State of Sustainable Markets 2021 report (ITC, 2021b), approximately 27% of the palm oil harvested area in Brazil is covered by some kind of VSS.

Although production is increasing in the Amazon region, palm oil has not been a key driver of deforestation, accounting for only an estimated 0.1% of the absolute deforestation associated with commodities (Pendrill et al., 2020). This proportion increases to 2%, however, when we look at the deforestation ratio related to the total area cultivated with palm oil (relative deforestation).

Palm oil value chains in Brazil are typically led by a small number of companies, which operate through a combination of company-managed and owned plantations and third-party sourcing (Ministério da Agricultura, Pecuária e Abastecimento, 2018). This model usually involves the negotiation of exclusive off-take contracts, integrating smallholders in the production (Kuss et al., 2015; Brandão and Schoneveld, 2015). As reflected in Table 2, family farms account for 40.3% of the total area dedicated to palm oil production (IBGE, 2019).

4.5. Cocoa

The Compliance Likelihood Index indicates that the cocoa sector has the second lowest compliance likelihood. The fact that Brazil exports only a minor fraction of its total production and that the EU and UK are not major importing markets for Brazil may disincentivize action towards rapid compliance. Brazil produced 269 k tonnes of cocoa beans in 2021, and is the 7th largest cocoa producer worldwide. Brazil exports only 5.05% of its total production and imports cocoa for processing. In 2021, Brazil exported US$354 million and approximately 4.48% of the total was directed to the EU, while around 36% went to Argentina, 18%

[9] Further information can be found at https://environment.ec.europa.eu/topics/forests/deforestation/illegal-logging/timber-regulation_en.

to Chile and 17.8% to the US (ITC trade map).

Cocoa is not one of the main deforestation drivers in Brazil, as it is estimated to account for only 0.23% of total deforestation related to agricultural production (Pendrill et al., 2020). This number doubles if we take into account the deforestation relative to the area cultivated (relative deforestation), but remains low, at 0.4%. In fact, this commodity system is often used to restore degraded pastures in the Eastern Amazon region (Schroth et al., 2016). Smallholders account for 50.89% of the total area cultivated with cocoa (IBGE, 2019), the largest participation among all the commodities analysed.

Considering traceability tools in the cocoa value chain, the most important ones are implemented via VSS certification programs. Examples of the most widely adopted in Brazil are the Rainforest Alliance/UTZ, Fairtrade, ISO/ARSO, and organic standards. However, only 2.26% of the cocoa harvested area in Brazil is covered by a VSS and premiums offered for certified cocoa in Brazil are not very attractive to farmers (Viotto et al., 2018).

4.6. Cattle

Cattle presents the lowest Compliance Likelihood Index score (0.3). The results indicate that the transition in the beef sector towards deforestation-free supply chains may therefore be more challenging compared to other analysed commodities. Brazil is one of the largest beef producers in the world. In 2021, the Brazilian herd was estimated at 196 million heads of cattle and nearly 9.71 million tonnes of beef were produced (Associação Brasileira das Indústrias Exportadoras de Carne (ABIEC), 2022). The domestic market is the main destination for Brazilian beef. However, exports have increased and reached 2 million tonnes in 2021 (AGROSTAT, 2023). Overall, approximately 25.5% of beef produced in Brazil was exported in 2021, while 74.4% was consumed domestically (Abiec, 2022). In 2021, the largest importers of Brazilian beef (HS codes included in the EU proposed legislation) were China (44%), the EU (8.26%) and the US (6.8%).

In spite of several sustainability initiatives in the beef sector, there is a lack of voluntary sustainability standards addressing deforestation. One of most important initiatives is the "Terms of Adjustment of Conduct" (TAC), a public-private agreement led by the Public Prosecutors Office (MPF), through which the main slaughterhouses committed to stop purchasing cattle from illegally deforested areas in the Amazon. However, it does not monitor zero deforestation, but legality (checking for illegal logging, land invaders and land grabbers) and it does not monitor indirect cattle suppliers (Imaflora, 2021, 2022).

Smallholders account for approximately 22% of the total area dedicated to cattle raising. It is important to note, however, that livestock properties with fewer than 50 animals account for 76.3% of the total properties and 16.5% of the Brazilian herd (Malafaia et al., 2021). The Federal government has implemented an official traceability system in Brazil, the "Cattle and Buffalo Identification and Certification Administration System" (SISBOV[10]). This system, however, is currently only related to sanitary control and is mandatory only to exporting companies. In addition, since it does not trace the animal from birth, some animals enter the system only 90 days before slaughter (Brazilian Coalition, 2020). However, regional level traceability systems, such as the SeloVerde in Pará State, provide enhanced batch traceability and cover all suppliers from farm to slaughterhouse. The system offers promise regarding compliance to EU and UK legislation (ADP, 2023). Cattle production, by some estimates, accounts for 61.2% of the total area deforested for agriculture in Brazil, between 2005 and 2018 (Pendrill et al., 2020). In relative terms, however, it appears only fourth, with 0.7% of deforestation relative to total pastureland. Cattle ranching in the Amazon has been historically used to make tenure claims, as a proof of use of the land to obtain property rights (Pendrill et al., 2022; Silva et al., 2021; Zycherman, 2016).

4.7. Incentives and hurdles for compliance

As outlined in Fig. 2, coffee and soybeans have very high and high market incentives for compliance, respectively, presenting high export shares and significant participation of the EU and UK markets in total exports. Wood enjoys a moderate level of incentivization for compliance, while oil palm, cattle and cocoa have very low incentives for compliance. EU and UK beef, oil palm and cocoa imports represent a small fraction of Brazil's exports and therefore, in relative terms, these three commodities are not highly incentivised to comply with the legislation. In these sectors, there is a risk of dual market creation (e.g. Masiero et al., 2015).

In some sectors, the EU requirements may generate segregated supply chains, separating deforestation-free exports to Europe from non-compliant exports directed to other markets. Brazil's experience with segregation of conventional and genetically modified soybeans, however, outlines the difficulties related to infrastructure bottlenecks, as well as the additional costs involved in the process (Leitão et al., 2016; Oliveira and Alvim, 2017). In cases where segregation is not feasible, producers and operators may instead choose to divert their sales to less exigent markets instead of adhering to additional processes for certifying compliance. For these commodities in particular then, if the EU and UK wish their policy to reduce overall rates of deforestation, they may need to step up their efforts to "lead by example", "influence the global market" and "strengthen cooperation with major consumer countries by, inter alia, encouraging trade in deforestation-free products and the adoption of similar measures", as stated in the introductory text of the legislation. The adoption of similar regulations by other key markets, such as China, could substantially incentivise deforestation-free production and landscape level change. Similarly, the US may be a key partner for Europe in providing incentives, since it is among the top importers of Brazilian commodities in scope (except for soybeans) and is already discussing similar legislation (Forest Act 2021).[11]

Other indicators within the Compliance Likelihood Index allow us to visualise that there are commodity systems with potentially higher levels of compliance readiness; already showcasing a low association with deforestation and high coverage of VSS. Coffee, for instance - in addition to high level of market incentives, accruing from its 49.8% share of exports to the EU - has a very low association with deforestation (0.1%) and a 33% coverage of VSS. Within this sector, however - despite these incentives and pre-existing existence of conditions which remove compliance hurdles - its greatest challenge may be related to implementing enhanced traceability and information disclosure mechanisms that might be necessary to adequately demonstrate compliance, due to the high levels of participation of smallholders in coffee production.

5. Conclusion

The Brazilian production systems of the commodities in scope of the legislation have their own particularities, and each sector has its own potential stumbling blocks in any transition to a deforestation free value chain. Via the application of a 'Compliance Likelihood Index' we indicate that Brazil's coffee sector may currently have the greatest potential for ready compliance with the EU and UK deforestation free requirements. On the other hand, we outline that cattle may be the sector to which the regulations may pose the greatest challenges, requiring a potentially longer transition period and investments, or - in the worst case - being diverted to alternative markets.

Further improvements in the Compliance Likelihood Index

[10] Additional information on SISBOV can be found at https://sistemasweb.agricultura.gov.br/pages/SISBOV.html.

[11] Further details are available at https://www.congress.gov/bill/117th-congress/senate-bill/2950.

introduced here could be developed in future research - including variations of the Index for Brazil's regions - especially once more information and sub-national data becomes available regarding other variables that may ultimately influence compliance, such as the existence and coverage of traceability mechanisms.

Our analysis also outlines that the prevalence of smallholders, who are likely to exhibit a relative lack of technical capability and financial resources, might make compliance with UK and EU regulations challenging. Even in supply chains that are ultimately of low risk of deforestation exposure, suppliers may face challenges associated with the traceability and information disclosure requirements of the legislation. Although the legislation requires due diligence from Operators, the burden of proof of deforestation-free and legally compliant production of the commodity may rest on producers (independent of the size of their land holdings). Incentives for independent smallholders to provide a precise geo-location of their production areas and proof of the legality of their land are thus necessary (Solidariedad, CPOPC and MVO, 2023). Furthermore, the legislation may lead to additional scrutiny of smallholder practices, also increasing their administrative and financial burden (Blot and Hiller, 2022).

These potentially perverse outcomes need to be addressed through public policies, as well as by EU and UK investments and implementation of cooperation mechanisms. In Brazil, the coffee and cocoa sectors present low deforestation exposure, but are the ones with larger smallholder participation. The EU and UK should therefore focus attention on providing financial means, technical assistance and capacity building for smallholders so that they can readily implement any traceability requirements and other associated proofs of compliance. By doing so, the regulations might represent an opportunity for smallholders to increase recognition and to access differentiated markets, with fairer prices, as already mentioned in smallholders' associations position letters in other countries (SPKS, 2022; Zei et al., 2022). Otherwise, these mandatory regulations may mirror the unintended effects of VSS and private sector commodity-centric deforestation-free mechanisms, increasing inequalities between larger producers and smallholders (UNFSS, 2018; Grabs et al., 2021).

To promote a wider decoupling of commodity production from deforestation, the EU legislation will need to be accompanied by domestic policies and regulations in Brazil. It is important to note that the EU and UK legislation are regulating areas that are not yet fully regulated in Brazil. In this context, while the legislation could be perceived as a positive regulatory example and model greater responsibility for actors within value chains, bilateral collaboration between the EU/UK and Brazil is needed to promote alignment between domestic and demand-side legislations so that they are mutually reinforcing.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. Appendix

Table 1
UK and EU regulatory provisions and their scope.

	UK Environment Act 2021	REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the making available on the Union market as well as export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010
Overview of prohibition	Prohibition on using illegally produced forest risk commodities and their derivatives. Legality is based on compliance with local laws relating to the ownership or use of land or other laws relating to the land. No specific cutoff dates currently defined. Regulated persons using regulated forest risk commodities in commercial activities must have in place a due diligence system	Commodities or products in scope cannot be placed on EU markets unless they are deforestation- and forest degradation-free (after 31 December 2020), have been produced in accordance with local legislation, and covered by a due diligence statement.
Commodities in scope	Regulated forest risk commodities are to be specified in secondary legislation.	Cattle (beef and leather), cocoa, coffee, oil palm, soya, rubber and wood products (including those covered under the EU Timber Regulation).
Forest definition	"Forest" is defined as "areas of land of more than 0.5 ha with a tree canopy cover of at least 10%" (excluding trees planted for the purpose of producing timber or other commodities). With reference to compliance with local laws, the regulations may specify a local law only if it relates to the prevention of forest being converted to agricultural use.	It covers "land spanning more than 0,5 ha with trees higher than 5 m and a canopy cover of more than 10%, or trees able to reach those thresholds in situ, excluding agricultural plantations and land that is predominantly under agricultural or urban land use".
Deforestation definition	Deforestation is not referred to or defined in the relevant parts of the Act, Scope of legislation defined by compliance with local laws.	The conversion of forest to agricultural use, whether human-induced or not (see definition of "forests" above). Forest degradation is also in scope for wood products.
Businesses in scope	Only large companies will be in scope, with the turnover threshold to be set in secondary legislation. Will apply to any large companies using in-scope	All operators (which includes large traders) placing in-scope goods on or exporting them from the EU market would be subject to the regulation,

(*continued on next page*)

Table 1 (*continued*)

	UK Environment Act 2021	REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the making available on the Union market as well as export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010
	commodities in the UK no matter their supply chain position. Exemptions for companies handling small volumes.	including its due diligence obligations. SME traders making available goods on the market would be subject to certain information-keeping requirements.
Due diligence expectations	Requires the establishment of a system to identify and obtain information about commodities, assess risk of non-compliance with local laws and mitigate risk. Exact details to be outlined in secondary legislation.	Establishment of a system to identify and obtain information about commodities, assess risk and mitigate. Operators must make available to competent authorities a due diligence statement confirming that the due diligence was carried out and that there is no or negligible risk of non-compliance.
Risk benchmarking	No provision for benchmarking to be used.	Countries will be assessed as low-, standard- or high-risk of producing commodities that are deforestation-free. Simplified due diligence processes for low-risk areas, enhanced checks on operators/traders for high-risk regions. Benchmarking at subnational level is also envisaged.
Traceability	There is no express provision for traceability beyond the due diligence requirements.	Geolocation of plot-level points of production required for sourcing across all risk levels.
Public reporting requirements	Companies must provide the regulating authority with an annual report on actions taken by the company to establish and implement due diligence. The relevant authority must make at least part of the annual report available to the public, but the manner and scope is to be determined in secondary regulations.	Operators (excluding SMEs) are expected to publicly report on an annual basis on their due diligence processes (including risk assessment and mitigation). Member States Competent Authorities to report annually on application of the regulation.

Appendix B. Appendix

Table 2
Harmonized system codes of products included in the EU proposal for a regulation on deforestation-free products.

Harmonized System codes included in the EU proposal for a regulation on deforestation-free products	
Catlle	ex 0102 Live cattle
	ex 0201 Meat of cattle fresh or chilled
	ex 0202 Meat of cattle frozen
	ex 0206 10 Edible offal of cattle fresh or chilled
	ex 0206 22 Edible cattle livers, frozen
	ex 0206 29 Edible cattle offal (excluding tongues and livers), frozen
	ex 4101 Raw hides and skins of cattle (fresh or salted, dried, limed, pickled or otherwise preserved, but not tanned, parchment-dressed or further prepared), whether or not dehaired or split
	ex 4104 Tanned or crust hides and skins of cattle, without hair on, whether or not split, but not further prepared
	ex 4107 Leather of cattle, further prepared after tanning or crusting, including parchment-dressed leather, without hair on, whether or not split
Cocoa	1801 00 00 Cocoa beans, whole or broken, raw or roasted
	1802 00 00 Cocoa shells, husks, skins and other cocoa waste
	1803 Cocoa paste, whether or not defatted
	1804 00 00 Cocoa butter, fat and oil
	1805 00 00 Cocoa powder, not containing added sugar or other sweetening matter
	1806 Chocolate and other food preparations containing cocoa
Coffee	0901 Coffee, whether or not roasted or decaffeinated; coffee husks and skins; coffee substitutes containing coffee in any proportion
Oil palm	1511 Palm oil and its fractions, whether or not refined, but not chemically modified
	1207 10 Palm nuts and kernels
	1513 21 Crude palm kernel and babassu oil and fractions thereof
	1513 29 Palm kernel and babassu oil and their fractions, whether or not refined, but not chemically modified (excluding Crude oil)
	2306 60 Oilcake and other solid residues of palm nuts or kernels, whether or not ground or in the form of pellets, resulting from the extraction of palm nuts oils or kernels oils
Soya	1201 Soya beans, whether or not broken
	1208 10 Soya bean flour and meal
	1507 Soya-bean oil and its fractions, whether or not refined, but not chemically modified
	2304 Oilcake and other solid residues, whether or not ground or in the form of pellets, resulting from the extraction of soya-bean oil
Wood	4401 Fuel wood, in logs, in billets, in twigs, in faggots or in similar forms; wood in chips or particles; sawdust and wood waste and scrap, whether or not agglomerated in logs, briquettes, pellets or similar forms
	4403 Wood in the rough, whether or not stripped of bark or sapwood, or roughly squared
	4406 Railway or tramway sleepers (cross-ties) of wood
	4407 Wood sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or end-jointed, of a thickness exceeding 6 mm
	4408 Sheets for veneering (including those obtained by slicing laminated wood), for plywood or for other similar laminated wood and other wood, sawn lengthwise, sliced or peeled, whether or not planed, sanded, spliced or end-jointed, of a thickness not exceeding 6 mm
	4409 Wood (including strips and friezes for parquet flooring, not assembled) continuously shaped (tongued, grooved, rebated, chamfered, V-jointed, beaded, moulded, rounded or the like) along any of its edges ends or faces, whether or not planed, sanded or end-jointed
	4410 Particle board, oriented strand board (OSB) and similar board (for example, waferboard) of wood or other ligneous materials, whether or not agglomerated with resins or other organic binding substances
	4411 Fibreboard of wood or other ligneous materials, whether or not bonded with resins or other organic substances
	4412 Plywood, veneered panels and similar laminated wood
	4413 00 00 Densified wood, in blocks, strips or profile shapes
	4414 00 Wooden frames for paintings photographs, mirrors or similar objects
	4415 Packing cases, boxes, crates, drums and similar packings, of wood; cable-drums of wood; pallets, box pallets and other load boards, of wood; pallet collars of wood (Not including packing material used exclusively as packing material to support, protect or carry another product placed on the market.)
	4416 00 00 Casks, barrels, vats, tubs and other coopers' products and parts thereof, of wood, including staves

(*continued on next page*)

Table 2 (*continued*)

Harmonized System codes included in the EU proposal for a regulation on deforestation-free products
4418 Builders' joinery and carpentry of wood, including cellular wood panels, assembled flooring panels, shingles and shakes
Pulp and paper of Chapters 47 and 48 of the Combined Nomenclature, with the exception of bamboo-based and recovered (waste and scrap) products
9403 30, 9403 40, 9403 50 00, 9403 60 and 9403 90 30 Wooden furniture
9406 10 00 Prefabricated buildings of wood

Source: https://environment.ec.europa.eu/publications/proposal-regulation-deforestation-free-products_en.

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