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Do voluntary sustainability standards increase countries' access to cocoa export markets?

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Abstract

Large chocolate manufacturers have committed themselves to only using certified cocoa beans and some governments want to increase the share of certified cocoa products consumed in their countries. Thus, Voluntary Sustainability Standards (VSSs) become quasi-mandatory for cocoa producers and grinders to ensure access to these markets. Yet, their trade effects are unclear. We study the effect of a VSS on raw and processed cocoa exports. We use a unique dataset that contains the UTZ Certified cocoa production quantity of cocoa-producing countries from 2010 to 2016. This allows us to estimate a gravity model of trade and analyse the effect of the share of UTZ Certified cocoa production quantity in a country on the trade value of raw cocoa beans, cocoa powder, cocoa paste and cocoa butter. Our results show that UTZ certification only enhances bilateral exports of cocoa beans and paste, while it reduces exports of cocoa butter and has mixed effects on cocoa powder exports.

Keywords: cocoa trade, UTZ Certified, voluntary sustainability standards, gravity model

JEL Classification: F14, Q17, Q18

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1 Introduction

In a world of global food supply chains, retailers and large food companies set up their own private food safety standard systems to trace the production process and monitor production requirements. In addition to safe and high-quality food products, discerning consumers worldwide increasingly demand sustainably- and ethically-produced food, which has led to the growth of private VSSs.[1] Most private food safety standards were developed by retailers, e.g. British Retail Consortium (BRC) and International Food Standards (IFS). These are Business-to-Business (B2B) standards that mainly aim to govern risk along the supply chain concerning food safety issues. VSSs are often developed by producer groups or NGOs, e.g. Fairtrade and UTZ Certified. These are Business-to-Consumer (B2C) standards that focus on product differentiation by addressing social and environmental issues such as fair labour conditions or nature protection. However, a clear distinction between the two types of private food standards is difficult because some private food safety standards also include social or environmental requirements and some VSSs include food safety requirements (Henson and Humphrey, 2010). Hereafter, we refer to B2C standards that mainly focus on environmental issues when using the term VSS.
The product and / or process requirements set by private food standards can affect import and exports decisions, but they are not yet regulated under any World Trade Organization (WTO) agreement. The WTO Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) agreements regulate public food quality and safety standards to ensure that they are scientifically justified and non-arbitrary (WTO, 2010). Private food safety standards such as GlobalGAP or BRC have rapidly become a major requirement particularly to enter the European market. Therefore, empirical studies have analysed the trade effect of these standards to understand whether they are an additional barrier to trade and might be regulated at the international level. Scientific evidence remains ambiguous. Some authors - e.g. Anders and Caswell (2009), Disdier and Marette (2010) and Fiankor et al. (2019) - find that private food safety standards induce positive trade effects at the macro level, while others estimate negative (Shepherd and Wilson, 2013) or no effects (Xiong and Beghin, 2012; Schuster and Maertens, 2015). Some studies find mixed effects depending on the product and export region (Ehrich and Mangelsdorf, 2018) or estimation method (Ferro et al., 2015).
To the best of our knowledge, Guan et al. (2019) is the only empirical study analysing the trade effect of a VSS at the macro-level. They show that Forest Stewardship Council (FSC) certification reduces net exports of raw wood products and increases net exports of processed wood products. Possible reasons explaining why the empirical literature has paid little attention to VSSs at the macro level include the lack of data on VSS certified farmers or hectares per country (Elamin and de Cordoba, 2020) and VSSs only

[1] Hereafter, we only refer to private VSSs when using the term VSSs.

recently gaining importance for international trade as they are increasing their market share (Lernoud et al., 2018). Several empirical studies have examined the effect of VSSs on producers' market access at the micro-level and find mixed results. Kleemann et al. (2014) find positive effects on market access for organic-certified pineapple producers that are already active in the export market. Masakure et al. (2009) confirm increased export sales due to ISO 9000 certification only for firms that started to export later and find no effect for long-time established export firms.

With our study, we aim to provide further insights into the macro-level trade effects of VSSs. In 2016, the top five commodities certified by VSSs in terms of share of total area were coffee, cocoa, tea, oil palm and cotton (Lernoud et al., 2018). The analysis of VSSs is especially relevant in the cocoa sector because large chocolate manufacturers such as Ferrero and Hershey have committed themselves to only using sustainably-produced and certified cocoa beans by 2020. Furthermore, the Netherlands government wants to transform cocoa consumption to only certified products by 2025 (Barrientos, 2016) and Germany's agriculture minister Julia Klöckner stated at the 4th World Cocoa Conference that Germany wants to consume 70 percent certified cocoa by 2020 (Deutsche Welle, 2018). Hence, one could argue that compliance with VSSs such as UTZ Certified becomes quasi-mandatory for cocoa producers and grinders when it comes to trade. Most cocoa producers are located in the Global South due to climatic conditions in a weak institutional environment and the majority are smallholders with limited access to finance and inputs (Fold and Neilson, 2016). These circumstances make it difficult to meet strict and costly requirements set by standard-setting organisations that might not only aim at the protection of human and plant life or health but could also create additional barriers to trade. If this is the case, regulations and control mechanisms may be introduced by international organisations or national governments to ensure that VSSs are scientifically justified and non-arbitrary.

In addition to sustainability and ethical issues in the cocoa sector, the structure of the cocoa-chocolate value chain is debated (Fold and Neilson, 2016). Most cocoa-grinding and -processing activities that add value to the product take place in the importing countries, which are mostly located in the Global North. Most cocoa-producing countries export low value cocoa products and are unable to benefit from value-added production. This is why VSSs follow a "theory of change" approach to not only ensure supply chain traceability but to also promote a sector-wide change. For instance, an expected industry or sector outcome stated by UTZ is: "Actors in the supply chain see a common urgency for and are willing to invest in sustainable supply chains" (UTZ, 2017, p. 6). As highlighted by Arton et al. (2020) for the case of Marine Stewardship Council (MSC) - an important VSS in the fish sector - most studies only focus on the effect on raw products and do not or rarely consider processed products. Indeed, based on our observation, this also holds for studies analysing other VSSs. Most VSS certification schemes offer so-called Chain of

Custody (CoC) certification to all actors along the supply chain to ensure that processing activities are also carried out sustainably and every production step can be traced back. The only study analysing trade effects of CoC certification along the supply chain is Guan et al. (2019) who apply a Heckscher-Ohlin-Vanek model and focus on raw and processed wood products. To the best of our knowledge, we are the first to particularly examine the effect of a VSS on cocoa-grinding exports.

For this purpose, we will use a gravity model of trade, which allows analysing the effect of the share of UTZ Certified cocoa beans production quantity in a country (and other trade-cost measures) on the trade value of raw cocoa beans, cocoa powder, cocoa paste and cocoa butter. Accordingly, we can measure the degree of compliant production, which increases the probability of acceptance of the exported product and thus reduces trade costs, e.g. through the reduction in information asymmetry or search costs. We use a unique panel dataset on the quantity in tonnes of UTZ Certified cocoa beans production in nineteen countries covering the 2010-2016 period. This dataset allows us to study the VSS certification scheme with the current largest certified area share in the cocoa sector (Lernoud et al., 2018).

This paper makes four major contributions to the current debate. First, we study the trade effects of a VSS on food products, while previous studies focus on food safety standards (e.g. Shepherd and Wilson, 2013; Ehrich and Mangelsdorf, 2018). Second, we can identify trade effects for different processing stages of agricultural products, taking advantage of the various cocoa processing stages to make this contribution to the literature. Third, we analyse trade effects occurring from a VSS at the global scale and focus on UTZ Certified, which is rarely studied even at the micro-level (Bray and Neilson, 2017). Fourth, we take into account the scale of certification within a country by using the share of UTZ Certified cocoa beans production quantity in a country's total production. As highlighted by Fiankor et al. (2019), ignoring the relative size of certification within a country might lead to biased results. We will answer two research questions: How do VSSs (here UTZ Certified serves as an example) affect cocoa beans exports (RQ1)? Can we observe spill-over effects along the value chain on cocoa paste, butter and powder exports (RQ2)?

The next section explains the relevance of VSSs in the global cocoa market in general and in particular UTZ Certified. Subsequently, Section 3 explains the underlying conceptual framework of the paper and the possible channels through which a VSS could affect cocoa trade flows. Therefore, Section 4 introduces the gravity model and data used, before the results are shown and discussed in Section 5. Finally, Section 6 concludes the paper.

2 Voluntary sustainability standards and the cocoa sector

In the 1990s, the early initiatives of VSSs were designed to serve a niche market via product differentiation. In the 2000s, increasingly more VSSs entered the market and started to explicitly target global mainstream markets (Potts et al., 2014). At the same time, Non-Governmental Organisations (NGOs), consumers and governments increasingly raised concerns about the environmental and ethical issues of cocoa production, with the Netherlands and Germany committing to 100% and 70% sustainable cocoa consumption by 2025 and 2020, respectively. This resulted in the public commitment of several large chocolate manufacturers such as Hersheys, Mars and Ferrero to only source certified cocoa beans by 2020 (Lernoud et al., 2018). In 2013, these chocolate manufacturers produced 28.4% of the world's total chocolate production (Euromonitor, 2013, cited by Poelmans and Swinnen (2016)). They use the sustainability labels to signal to the consumer that the cocoa contained in the chocolate bar was produced under environmentally-sustainable and ethical conditions. The VSSs not only help the chocolate manufacturers to satisfy consumer demand, but also to reduce transaction costs; for instance, by providing quality control and traceability systems, as well as farmer training on farm management and production practices (Lernoud et al., 2018). The different channels through which VSSs potentially increase import demand and reduce trade costs will be explained in more detail in Section 3.

These changing demand patterns spilled over to other parts of the global cocoa value chain, downstream as well as upstream. Large retailers such as Lidl, Rewe, Migros and Coop - which produce their own branded chocolate through subsidiary companies - started to require their subsidiaries to source up to 100% of their cocoa beans in a standard-compliant manner (Fromm, 2016; Langen and Hartmann, 2016). Moreover, the eight largest cocoa grinders and traders[2] - which control 60-80% of the world market - started to produce part of their grindings in a standard-compliant manner, ranging from 3% (Continaf) to 23% (Ecom) in 2013 (Fountain and Hütz-Adams, 2015). Finally, the global cocoa production volume certified by a VSS increased nearly four-fold from 2011 to 2016 (Lernoud et al., 2018).

In 2016, cocoa was the second most certified agricultural commodity after coffee. Four of the fourteen largest VSSs certified on average[3] 30.2% of the global cultivated cocoa land. The largest share was certified by UTZ (21%), followed by Fairtrade International (7.1%), Rainforest Alliance Certified (6.4%) and IFOAM - Organics International (3.1%)

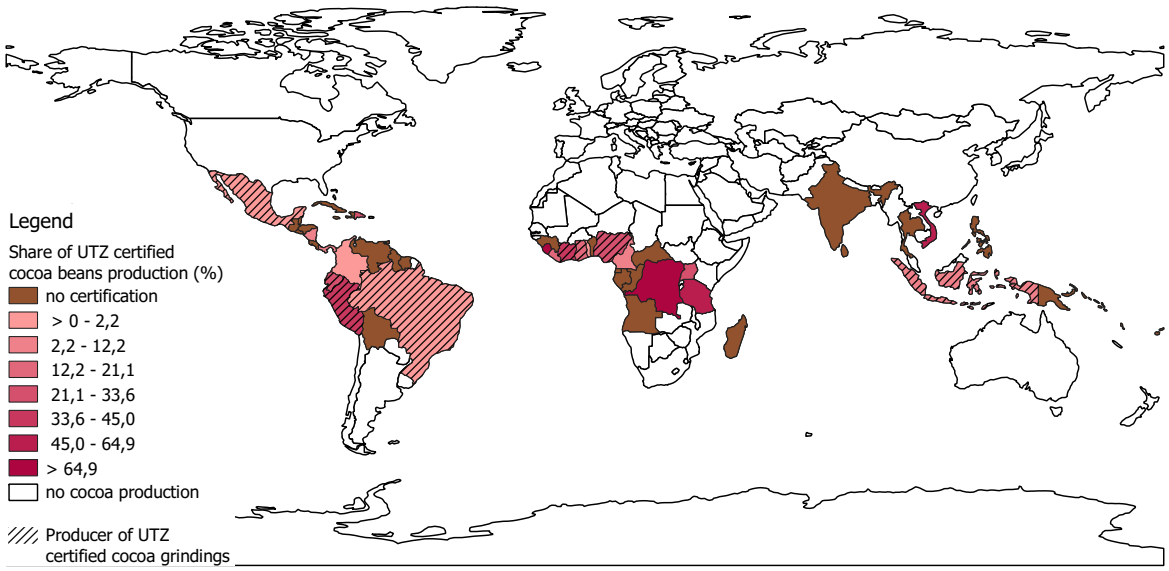
[2]Namely Barry Callebaut, ADM, Cargill, Olam, Ecom, Touton, Blommer and Continaf.

[3]Multiple certification has to be taken into account. Here, the average is calculated between the maximum (sum of the total area certified by each VSS in a given country) and the minimum area (the area of the VSS with the largest area in the country).

(Lernoud et al., 2018).

Since UTZ Certified is the leading VSS in the cocoa sector, the focus of this study is placed on this scheme.[4] UTZ certifies cocoa, coffee, tea and hazelnuts, of which cocoa holds the largest share (UTZ, 2016). In 2016, 1,188,166 tonnes of cocoa in twenty producing countries was certified by UTZ (see Figure 1). UTZ was founded in 2002 by a Guatemalan coffee grower and a Dutch coffee roaster. Although it is a relatively young VSS (IFOAM, Rainforest Alliance and Fairtrade were founded in 1972, 1987 and 1997, respectively), it quickly became the leading certification scheme for cocoa (Lernoud et al., 2018). The strong connection to the Netherlands - which was among the first governments to commit to sustainable cocoa consumption - is probably one of the reasons for this development. Apart from the Netherlands and other European Union (EU) countries, the following nine countries were important export destinations for UTZ Certified products during 2011 to 2016: Argentina, Australia, Japan, Malaysia, Mauritius, Singapore, South Africa, Thailand and the USA.[5] These countries and the EU accounted for approximately 86% of the world cocoa beans imports (UN Comtrade, 2017).

Figure 1: Average share of UTZ Certified cocoa beans production tonnes (2010-2016) and producer of UTZ Certified cocoa grindings



Source: UTZ (2016) and FAOstat, own map.

[4]For a more detailed market overview of the other three VSS, please see Lernoud et al. (2018).

[5]Data was provided by Phan Ha, Data analyst, Rainforest Alliance, Amsterdam, The Netherlands.

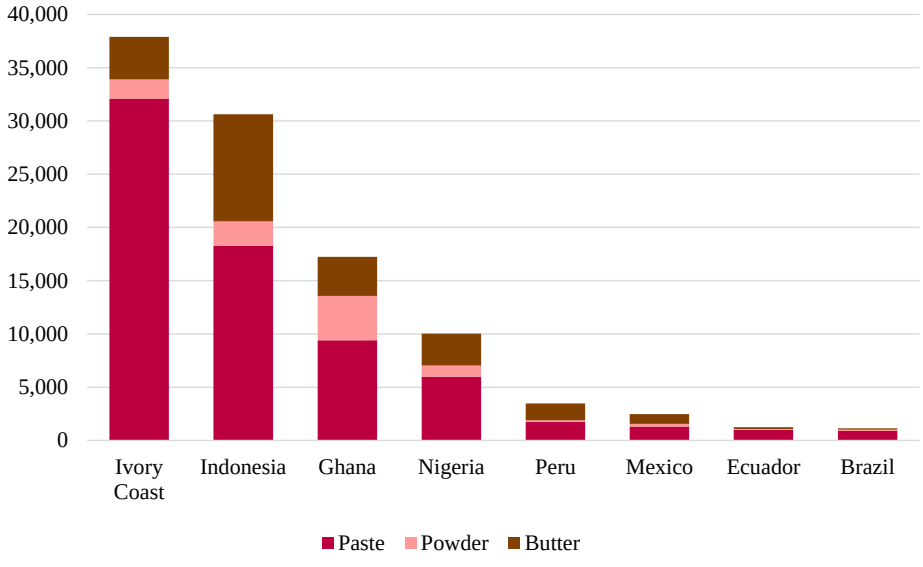
Table 1: Composition of cocoa grinding exports of top five grinding exporters (seven-year average, 2010-16)

Exporter	UTZ beans (% beans production)	Grinding exports (Mio. USD)	Paste exports (% grinding exports)	Powder exports (% grinding exports)	Butter exports (% grinding exports)
Ivory Coast	25.42	1509.010	62.74	8.56	28.70
Indonesia	5.11	908.636	26.50	15.69	57.81
Ghana	13.87	720.677	56.99	15.76	27.26
Brazil	0.64	253.180	15.65	39.11	45.24
Nigeria	13.42	122.010	25.08	0.30	74.62

Source: UTZ (2015), UTZ (2016), FAOstat and UNComtrade, own calculation.

Table 1 shows that all five of the largest cocoa-grinding exporters also produce UTZ Certified cocoa beans. Ivory Coast and Ghana both specialise in cocoa paste exports, while the three remaining countries show a large share of cocoa butter exports. The specialisation of Nigeria, Indonesia and Brazil in cocoa butter exports can be explained by the increasing domestic demand for chocolate products in these countries, which is accompanied by investments of large international chocolate manufacturers such as Nestle, Cadbury and Mars (Talbot, 2002; Janssen and Riera, 2016; Tamru and Swinnen, 2016). The high demand for cocoa butter in the domestic market also creates incentives for cocoa grinders to upscale cocoa butter production for sales in the domestic and foreign markets.

Figure 2: UTZ Certified paste, powder and butter on total UTZ Certified cocoa grindings, cocoa beans equivalents, tonnes (five-year average, 2012-2016)



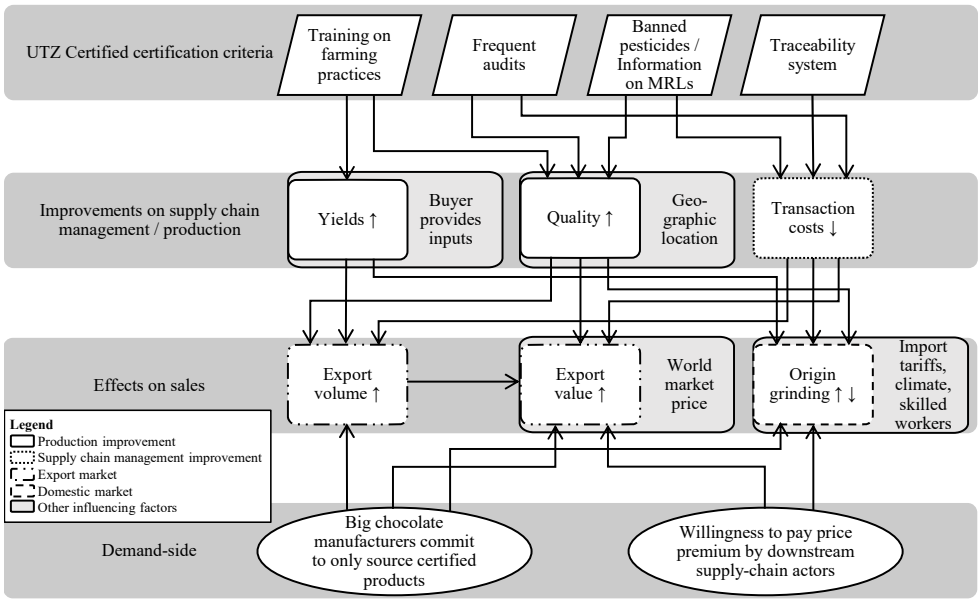
Source: UTZ data, own elaboration.

Figure 2 above shows that eight of twenty cocoa-producing countries with UTZ Certified cocoa beans also process them into UTZ Certified cocoa grindings. Among them are all five of the largest cocoa-grinding exporters, although Brazil does not belong to the five countries producing the most UTZ Certified cocoa grindings. One factor that possibly drives this is that most Brazilian cocoa grindings exports are sent to Latin America, while UTZ Certified cocoa grindings from the other four countries mainly go to Europe.[6] They all specialised in producing UTZ Certified cocoa paste (above 50%). Indonesia, Nigeria, Peru and Mexico further process more than one-third of UTZ Certified cocoa beans into UTZ Certified butter.

3 The effect of voluntary sustainability standards on exports and domestic sales of cocoa beans

We want to answer two research questions in our empirical setting: How do VSSs (here UTZ Certified serves as an example) affect cocoa beans exports (RQ1)? Can we observe spill-over effects along the value chain on cocoa paste, butter and powder exports (RQ2)? In this section, we conceptualise different pathways that may moderate the effects.

Figure 3: Simplified overview of potential pathways of the effect of VSSs on exports and domestic sales of cocoa beans



Source: own elaboration

[6] In the case of Indonesia, Australasia is the largest export destination, followed by Europe with a considerable quantity, on average of 94,552 tonnes cocoa grindings per year.

3.1 Improvements in supply chain management and cocoa beans production

Figure 3 above illustrates the channels through which VSSs may affect exports and domestic sales of cocoa beans. We identified four UTZ certification criteria that could be potential drivers for improvements in supply chain management and/or cocoa beans production.[7]

Increasing yields

Training in good agricultural practices is mandatory for certified producers; for instance, training on the correct use of agrochemicals, better soil management and fertilisation as well as fermentation and drying. Since the cocoa plant is very sensitive to pest and diseases (e.g. witches broom, frosty pod rot or cocoa pod borer (Bateman, 2015)), knowledge on their identification, prevention and control can increase cocoa yields (Deans et al., 2018). However, the empirical evidence on whether the training offered by UTZ results in increased cocoa yields is rare and mixed. Ingram et al. (2018) find no significant increase in cocoa productivity for UTZ Certified farmers compared with non-certified farmers in Ghana, whereas in Ivory Coast such an increase was found for farmers who received additional services such as input provision. This might also explain the positive results found by Deans et al. (2018) for UTZ Certified cocoa farmers selling to Armajaro, a Licensed Buying Company (LBC) that provides inputs to its suppliers in Ghana. Sellare et al. (2020) find a significant increase of cocoa yields for Fairtrade certified farmers in Ivory Coast, but no additional effect if these farmers are Fairtrade-UTZ double certified.

Quality improvement

The proper fermentation and drying procedure of cocoa beans is an important determinant for high-quality cocoa paste and powder (Fold, 2001; Lemeilleur et al., 2015; Beg et al., 2017). Training offered by UTZ could help farmers to achieve this quality. However, geographical characteristics of the cocoa beans production location can limit the potential of quality improvements (Fold, 2001). Two other certification criteria can potentially increase the quality of cocoa beans, namely frequent audits and compliance with the list of banned pesticides. UTZ requires annual audits conducted by third-party auditors during a four-year certification cycle (UTZ Certified, 2009), whereby the auditor checks whether

[7]We refer to the "UTZ Certified Good Inside Code of Conduct - For Cocoa. Version 1.0" (UTZ Certified, 2009), because it was valid from 2009 to 2015 and therefore covers most of the years included in our study.

the farmers fulfil the critical criteria imposed by UTZ. These frequent controls can increase the consistency of the cocoa beans quality, which is especially important for large chocolate manufacturers to guarantee the specific flavour of their chocolate products (Fold, 2001; Millard, 2011). The UTZ list of banned crop protection products 2012 (UTZ Certified, 2012) included 110 pesticide components mainly based on the US, EU and Japanese legislation on Maximum Residue Levels (MRLs) which are a substantial component of the quality control at US, EU and Japanese borders (Jonfia-Essien, 2012). Therefore, compliance with the list of banned crop protection products can have a positive effect on the quality of cocoa beans export, especially to the US, EU and Japanese markets.

Reduction of transaction costs

Frequent audits and the list of banned crop protection products can also reduce transaction costs through several pathways. First, if a certified farmer wants to sell its cocoa beans to a new intermediary that exports to the US, EU or Japan, adjustment costs are low because the food safety requirements of these export destinations are similar to the certification requirements. Second, UTZ not only provides a list of banned crop protection products but also information on MRLs of destination markets (UTZ Certified, 2012), which reduces information costs and the risk of border rejections. Frequent audits ensure that these requirements are met and therefore they reduce the monitoring costs of supply chain actors (Banterle et al., 2013). Additionally, every UTZ Certified supply chain actor has to participate in the traceability system, which reduces the search costs of buyers because they can easily access the list of all certified producers in the region (Terlaak and King, 2006). In global and fragmented supply chains, traceability systems can substantially reduce asymmetric information because processes are standardised, transparency is increased and rapid detection of non-compliance is possible. Hereby, bargaining costs can be reduced because less complex contract structures are needed to safeguard both parties against potential fraud (Millard, 2011). However, aside from reducing asymmetric information between producers, traders, grinders, manufacturers and retailers, consumers also benefit from the additional information provided through the placement of the UTZ Certified seal on the final chocolate products (Banterle et al., 2013).

3.2 Effect on sales

Export volume

The above-discussed improvements in production (increasing yields and quality) and supply chain management (reduced transaction costs) can have a positive effect on the export

volume. The mass balance programme of UTZ only allows mixing of conventional and certified cocoa beans if "100% of the cocoa content needed for [the final product are] covered with purchases of UTZ Certified cocoa" (UTZ Certified, 2015, p.15). Therefore, UTZ Certified cocoa processors need high quantities of certified cocoa beans to benefit from the production of certified cocoa grindings and satisfy the demand of large chocolate manufacturers (Ingram et al., 2018). Higher production quantities of certified cocoa beans give farmers the opportunity to provide sufficient supply and negotiate high-volume contracts (Fenger et al., 2017). They can expand existing trading relationships or find additional trading partners. The latter can be reinforced due to quality upgrading. Higher quality products offer the opportunity to enter new export markets. For instance, Esco Uganda Ltd - a cocoa processor, trader and exporter in Uganda - only buys cocoa beans "that had been fully fermented and properly dried" (Jones and Gibbon, 2011, p.1599). Lower transaction costs - especially through search costs - can increase the quantity sold to traders because they prefer to buy quickly following the principle of "first come - first serve" (Fold, 2001). This can increase the quantity of certified cocoa beans sold, even if they will not be processed by a certified grinder. In the situation of oversupply of certified cocoa beans, this is how certified farmers can nevertheless benefit (Fenger et al., 2017). Between 2011 and 2016, the share of UTZ Certified cocoa beans that were sold as certified increased from 20% to 54% (UTZ, 2016).

Export value

UTZ does not officially require the first buyer to pay a price premium for certified cocoa beans. Nevertheless, some supply chain actors incentivise the production of certified cocoa beans by offering a price premium to guarantee a constant supply of certified cocoa grindings and chocolate. For instance, Ansah et al. (2020) ascertain that the local LBCs in Ghana negotiate price premiums with cocoa processors even before starting the certification process. This is also confirmed by Deans et al. (2018), who find that Armajaro - a Ghanaian LBC - receives price premiums at the world market for certified cocoa beans and partially passes it on to its producers. Moreover, Borsky et al. (2018) highlight that in the case of VSSs, the sustainable product quality effect (supply side) and preferences of consumers for sustainable products (demand side) play a crucial role in increasing export values.

Additionally, we could expect higher export values resulting from quality upgrading and lower transaction costs. Many cocoa processors have developed technologies that enable them to produce good quality grindings out of low-quality cocoa beans, and thus they are unwilling to pay a price premium for high-quality cocoa beans. Nevertheless, some processors are willing to pay a price premium if the manufacturing cost reduction through the use of high-quality beans is higher than the additional price premium they have to pay

for high-quality cocoa beans (Fold, 2001; Lemeilleur et al., 2015). Some buyers pay a price premium for certified products to compensate producers for their additional costs, e.g. costs for external auditing, while benefiting from lower monitoring costs (Millard, 2011; Rueda and Lambin, 2013). Evidence on paid price premiums to UTZ Certified farmers remains mixed. Deans et al. (2018) show that UTZ Certified farmers generate on average an income of 355 USD per hectare of cocoa beans compared with only 217 USD for conventional farmers. In the study conducted by Marie-Vivien et al. (2014), UTZ Certified coffee farmers received a small price premium, albeit which was not sufficient to cover certification costs, which were fully paid by traders. Vanderhaegen et al. (2018) and Snider et al. (2017) confirm these results. Comparing six voluntary coffee certification schemes in Costa Rica, Snider et al. (2017) find the lowest price premium for UTZ Certified coffee and when world market prices are high buyers are hardly willing to pay the price premium.
Not only the per unit price will increase a country's export value, but also an overall increase in the export volume, as discussed above. Taking this and all discussed potential improvements on production and supply chain management through requirements of VSSs into account, we posit the following hypothesis:

> *H1:* A country's export value of cocoa beans increases if a higher volume share of cocoa beans among total cocoa beans is certified.

Origin grinding

The improvements in production and supply chain management can not only increase sales of cocoa beans to foreign markets but also domestic markets. The quality and flavour of cocoa grindings can vary by cocoa bean variety. Cocoa grinders are dependent on high quantities of cocoa beans with the same quality. Higher certified quantities of cocoa beans in a producing country increase the probability that a cocoa grinder sets up a factory in the same country (Fold, 2001). Quality upgrading - especially through correct drying and fermentation of certified cocoa beans - reduces the risk of cocoa beans being rejected for grinding and therefore increases the origin grinding volume (Beg et al., 2017). The UTZ traceability system not only helps domestic grinders to find suppliers but it also helps - once they have received CoC certification - to find potential chocolate manufacturers to export to. This especially facilitates market access for local firms that have low export experience compared with the large transnational cocoa processors (Talbot, 2002).
The commitment by chocolate manufacturers to sourcing only certified cocoa products increases supply risk because supply shortages cannot be compensated by uncertified cocoa beans (Millard, 2011). This provides an additional incentive for origin grinding because it shortens the supply chain and thereby supply risk. As discussed above, another way to in-

centivise a constant supply of certified products is to pay a price premium. Price premiums paid by chocolate manufacturers for certified cocoa powder, butter and paste can create net benefits in otherwise non-profitable origin grinding locations. Fold (2001) highlights four factors that might make origin grinding unprofitable and could be compensated by a price premium. First, cocoa grinders located in humid regions have to invest in specific facilities that prevent cocoa products from mould and other bacterial problems that would lead to the rejection of the product, especially at the EU border. Second, contrary to cocoa bean production, cocoa grinding is capital-intensive and requires skilled workers who can be scarce in some cocoa-producing countries. Third, cocoa butter is usually shipped in solid form, which requires an additional processing step by the chocolate manufacture before it can be processed into chocolate. Fourth, the cocoa market faces the problem of tariff escalation, i.e. the higher the processing level of the cocoa product, the higher the import tariff. However, in recent years major importing regions such as the EU and the USA have provided preferential market access to Least Developed Countrys (LDCs) or African, Caribbean and Pacific (ACP) countries through the Generalized System of Preferences (GSP) or the European Partnership Agreements (EPAs) (Fold, 2001; Mohan et al., 2013). We therefore hypothesise:

> *H2:* A country's export value of cocoa grindings increases if a higher volume share of cocoa beans among total cocoa beans is certified.

4 Model specification and data

4.1 Gravity model

An extended gravity model is used to estimate the effects of UTZ Certified cocoa beans production on cocoa beans and cocoa-grinding exports. In recent decades, the gravity model of trade has become the most popular model to ex-post analyse trade policy effects. Recently, it has also been preferably used by agricultural economists to analyse the effect of private food standards on agricultural trade flows (e.g. Andersson, 2019; Ehrich and Mangelsdorf, 2018; Fiankor et al., 2019). The traditional log-linearised form of the gravity model looks as follows:

$$\ln X_{ijt} = \ln E_{jt} + \ln Y_{it} - \ln Y_t + (1-\sigma)\ln\tau_{ijt} - (1-\sigma)\ln P_{jt} - (1-\sigma)\ln\Pi_{it} + \epsilon_{ijt} \quad (1)$$

where X_{ijt} denotes export values (in current USD) from country i to country j in year t. To proxy the importer purchasing power, the nominal Gross Domestic Product (GDP) of country j in year t (E_{jt}) is included. Y_{it} is usually the GDP of country i, which proxies the

exporting country i's supply potential. We instead include agricultural value added (in current USD), because we argue that it is a good proxy for a country's agricultural supply capacity. Y_t is the aggregated worldwide supply and σ_t is the elasticity of substitution. $\epsilon_{ij,t}$ are robust standard errors clustered at the country-pair level. Π_{it} and P_{jt} are the outward and inward multilateral resistance terms, respectively, which control for the remoteness of the trading partners. Controlling for multilateral resistance is crucial because not only distance to trading partners matters but also the distance to all other potential trading partners. Thus, trade flows are not only affected by absolute but also relative trade barriers (Anderson and van Wincoop, 2003). However, the multilateral resistance terms are not observable. A common approach to account for them in a panel dataset is to use exporter-time and importer-time fixed effects (Feenstra, 2004). τ_{ijt} are trade costs, which we define as the following log-linear function:

$$\begin{aligned} \ln\tau_{ijt} =& \beta_1 \text{UTZ volume share}_{it} + \beta_2 \text{Export procedures}_{it} + \beta_3 \text{RTA}_{ijt} \\ &+ \beta_4 \ln(1+\text{Tariff}_{ijt}) \end{aligned} \tag{2}$$

We include our variable of interest - *UTZ volume share*$_{it} \in [0, 100]$ - in our trade-cost function because we argue that a higher share of certified cocoa beans among the total cocoa beans production volume reduces transaction costs and thereby trade costs (see Section 3). As we are unable to include exporter-time fixed effects because they would absorb all variation in our variable of interest, we add the variable *Export procedures*$_{it} \in [0, 100]$ to control for other time-variant exporter-specific trade costs. Specifically, it is a score value that captures the ease of trading across borders and includes e.g. the time to export and costs to export. Time-varying bilateral trade costs are proxied by $Tariff_{ijt}$ and RTA_{ijt}. $Tariff_{ijt}$ is the applied tariff rate charged by country j on imports from country i in year t. RTA_{ijt} is a binary variable that takes the value one if both countries are members of the same Regional Trade Agreement (RTA) and zero otherwise.

4.2 Estimation issues

We face two major estimation issues. First, as discussed above, our variable of interest is exporter-time-specific and would be absorbed by exporter-time fixed effects when controlling for outward multilateral resistance (dependence of country i's exports to country j on trade costs across all possible export destinations). Therefore, we only include exporter-fixed effects in our cocoa beans and exporter-product-fixed effects in our cocoa-grinding model specifications. This might lead to a potential bias in our trade-cost estimates because the omitted terms are correlated with the trade-cost term (Baldwin and Taglioni, 2007). This has to be considered when interpreting the results. However, we argue that

this bias is small because we include the variable *Export procedures*$_{it}$, which captures most of the outward multilateral resistance. Furthermore, most importers did not change their trade measures regarding cocoa products during our period of study and this time-invariant outward multilateral resistance is captured by exporter-fixed effects.
Second, agricultural trade data contains many zeros or missing trade flows. This dataset contains 79.6% and 86.0% observations with zero trade value for cocoa beans trading partners and cocoa-grinding trading partners, respectively. Furthermore, trade data suffers from heteroskedasticity due to Jensen's inequality. To account for both, we use the Poisson Pseudo Maximum Likelihood (PPML) estimator, which allows us to estimate the non-linear form of the gravity equation and include zero trade flows.[8]
We insert Equation 2 into Equation 1, include fixed effects to account for multilateral resistance and estimate the multiplicative form of the received equation, as suggested by Santos Silva and Tenreyro (2006):

$$\begin{aligned} X_{ijt} =& \exp(\pi_i + \eta_{jt} + \theta_{ij} + \beta_0 + \beta_1 \text{UTZ volume share}_{it-1} + \beta_2 \ln \text{ Agricultural GDP}_{it} \\ &+ \beta_3 \text{Export procedures}_{it} + \beta_4 \text{RTA}_{ijt} + \beta_5 \ln(1+\text{Tariff}_{ijt}))\epsilon_{ijt} \end{aligned} \tag{3}$$

where π_i denotes exporter-fixed effects, θ_{ij} country-pair fixed effects and η_{jt} importer-time fixed effects. The latter not only control for inward multilateral resistance, but also for other time-variant importer-specific factors such as purchasing power and unilateral non-tariff measures. We use a one-year lag of the variable *UTZ volume share*$_{it-1}$ in the model specification to overcome endogeneity due to reverse causality. As discussed in Section 3, certification might increase trade flows. At the same time, exporters that have strong trading relationships with destinations that require certification might be more likely to become certified. By using the lag of *UTZ volume share*, we are able to avoid reverse causality because current trade relationships cannot influence previously-certified cocoa production quantity. In order to estimate the time-invariant part of the variables RTA_{ijt} and $Tariff_{ijt}$, we re-estimate model specification 3 while excluding country-pair fixed effects and adding observable time-invariant bilateral trade costs:

$$\begin{aligned} X_{ijt} =& \exp(\pi_i + \eta_{jt} + \beta_0 + \beta_1 \text{UTZ volume share}_{it-1} + \beta_2 \ln \text{ Agricultural GDP}_{it} \\ &+ \beta_3 \text{Export procedures}_{it} + \beta_4 \text{RTA}_{ijt} + \beta_5 \ln(1+\text{Tariff}_{ijt}) + \beta_6 \ln \text{ Distance}_{ij} \\ &+ \beta_7 \text{Contiguity}_{ij} + \beta_8 \text{Language}_{ij})\epsilon_{ijt} \end{aligned} \tag{4}$$

where $Distance_{ij}$ measures the population-weighted distance[9] between country i and country j. $Language_{ij}$ and $Contiguity_{ij}$ are binary variables that take the value one if both

[8]For a detailed discussion of the advantages and disadvantages of the PPML estimator, see Santos Silva and Tenreyro (2006).

[9]This variable is time-invariant because the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) dataset uses population data from 2004 to weight bilateral distances and applies it to all following years.

countries speak the same language or share a common border, respectively. Equations 3 and 4 describe our one-product model specifications for raw cocoa beans exports.
As discussed before, we also want to estimate the effect for cocoa-grinding exports that comprise cocoa paste, cocoa powder and cocoa butter. Therefore, we include product-specific tariff rates, exporter-product fixed effects, country-pair-product and importer-product fixed effects. To account for possible product heterogeneity, we estimate a model specification in which we interact product dummies (i.e. cocoa powder and cocoa butter) with the *UTZ volume share*$_{it-1}$ variable. The resulting estimation equation is:

$$\begin{aligned} X_{ijkt} =& \exp(\lambda_{ik} + \psi_{jkt} + \gamma_{ijk} + \beta_0 + \beta_1 \text{UTZ volume share}_{it-1} + \beta_2 \text{UTZ volume share}_{it-1} \\ & * \text{Powder dummy}_k + \beta_3 \text{UTZ volume share}_{it-1} * \text{Butter dummy}_k \\ & + \beta_4 \ln \text{ Agricultural GDP}_{it} + \beta_5 \text{Export procedures}_{it} + \beta_6 \text{RTA}_{ijt} \\ & + \beta_7 \ln(1+\text{Tariff}_{ijkt}))\epsilon_{ijkt} \end{aligned} \tag{5}$$

where λ_{ik}, ψ_{jkt} and γ_{ijk} are exporter-product, importer-product-time and country-pair product fixed effects, respectively. ϵ_{ijkt} are standard errors clustered at the country-pair-product level.

4.3 Two-step procedure

Finally, to check the robustness of our results to the choice of fixed effects, we apply the two-step procedure suggested by Head and Mayer (2014). In the first stage, we re-estimate model specification 3 but include exporter-time fixed effects to control for outward multilateral resistance. These absorb all exporter-time varying variables (including our variable of interest) and only RTA_{ijt} and $ln(1 + Tariff_{ijkt})$ remain to be estimated:

$$X_{ijt} = \exp(\phi_{it} + \eta_{jt} + \theta_{ij} + \beta_0 + \beta_1 \text{RTA}_{ijt} + \beta_2 \ln(1+\text{Tariff}_{ijt}))\epsilon_{ijt} \tag{6}$$

where ϕ_{it} are exporter-time fixed effects. We save the predicted exporter-time fixed effects from estimation 6 and regress them on *UTZ volume share*$_{it-1}$ and the remaining exporter-time-varying controls to assess their impact on the exporter's market access. To control for other time-invariant exporter-specific confounding factors, we also include exporter-fixed effects. The second-stage estimation takes the following form:

$$\begin{aligned} \widehat{\phi_{it}} =& \pi_i + \beta_0 + \beta_1 \text{UTZ volume share}_{it-1} + \beta_2 \ln \text{ Agricultural GDP}_{it} \\ & + \beta_3 \text{Export procedures}_{it} + (\kappa_{it} + \nu_{it}) \end{aligned} \tag{7}$$

where ν_{it} is the error contained in $\widehat{\phi_{it}}$ from the first-stage regression and κ_{it} is the error term from the second-stage regression.

4.4 Data

The dataset provided by UTZ covers the period from 2010 until 2016. Since we use the lag of certified cocoa beans, we include bilateral imports in current USD of cocoa beans (HS 1801), cocoa paste (HS 1803), cocoa butter (HS 1804) and cocoa powder (HS 1805) for 2011 until 2017 retrieved from the UN Comtrade database - at the four-digit level of the Harmonised System (HS)-2007 classification. We include 42 cocoa bean-producing countries[10] as exporters and the 38 largest importers[11] according to their average import value of cocoa beans during the study period from 2011 to 2017 (see Table A1 and Table A2 for an overview of all exporting and importing countries considered in this study). Thus, the raw dataset contains N = 11,088 observations (excluding intranational trade). We exclude eight exporters from our cocoa-grinding analysis because they neither produce nor export any types of cocoa grindings. Therefore, our raw dataset for cocoa grinding contains N = 26,880 observations (excluding intranational trade). The final datasets reduce to N = 3,733 and N = 6,611 because we exclude all observations that are either singletons or separated by a fixed effect.

Data for agricultural value added in current Mio. USD and Ease of Doing Business indicators were retrieved from the World Bank. Cocoa beans production data was taken from FAOstat. Data on applied tariff rates at the four-digit level of the HS 2007 classification was downloaded from the United Nations Conference on Trade and Development (UNCTAD) Trade Analysis Information System (TRAINS). Following Fernandes et al. (2015), we interpolate observations to fill in missing tariffs. For cases where applied tariff data is not available for a given importer-exporter-time combination, we replace the missing values with Most Favoured Nation (MFN) tariffs of the corresponding importer-time combination or with preferential tariffs of the given importer-exporter-time combination if they have a preferential tariff agreement. We replace the remaining missing values with the value of the closest non-missing year. The time-invariant bilateral standard gravity covariates - distance, common border and common language - were obtained from the CEPII website (Head et al., 2010; Head and Mayer, 2014). Furthermore, data on RTAs was obtained from Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008). See Table 2 below for descriptive statistics of the data used.

[10]The following ten producers are excluded due to limited data availability: Guadeloupe, Micronesia, Timor-Leste, Solomon Islands, Cuba, the Democratic Republic of Congo, Sierra Leone, American Samoa, Vanuatu and Venezuela. Following Ferro et al. (2015) we also exclude the following five producers because they only exported to one destination: Angola, Central African Republic, Comoros, Guyana, Saint Vincent and the Grenadines and Suriname. Additionally, we exclude Malaysia, because although it is still producing cocoa beans it became a net importer of cocoa beans (Fold and Neilson, 2016).

[11]We include the EU27 as one country.

Table 2: Descriptive Statistics

	Cocoa beans				Cocoa grindings			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
Export value (Mio. USD)	5.56	69.01	0	2497.20	1.00	14.10	0	649.30
UTZ Certified volume share (%)	5.38	13.29	0	69.68	6.56	14.48	0	69.68
Log (1+Tariff)	0.97	1.19	0	3.61	1.60	1.19	0	3.61
Log Agricultural GDP (Mio. USD)	7.84	2.23	3.30	12.93	8.38	2.04	3.55	12.93
Export procedures (Index 1-100)	64.08	16.40	9.37	92.09	65.85	15.17	15.99	92.09
Log Distance (weighted, km)	8.99	0.66	5.31	9.89	8.98	0.69	5.31	9.89
RTA	0.25		0	1	0.31		0	1
Common Language	0.20		0	1	0.21		0	1
Contiguity	0.02		0	1	0.02		0	1
Observations	11088				26880			

Notes: The standard deviation for dummy variables is not reported since it is one-to-one mapping of the mean.

5 Results and discussion

This section shows the estimation results from equations 3- 7 and discusses their interpretation. We computed the regression coefficients using the statistical software StataSE 15 and the user-written command ppmlhdfe version 2.0.1 05mar2019 (Correia et al., 2019). Ordinary Least Squares (OLS) estimates are generated using the command xtreg.

5.1 Effects on cocoa beans exports

Table 3 below shows parameter estimates from the PPML model specifications (see Equations 3 and 4). It allows us to answer our first research question: How do UTZ Certified cocoa beans affect cocoa beans exports? The results for model specification 3 are shown in column (1). The variables RTA_{ijt} and $Export\ procedures_{it}$ show the expected positive sign, although only the latter has a statistically significant effect. Bilateral export values increase when both trading partners are members of an RTA or the ease of trading across borders in the exporting country is high. Specifically, if the exporter's trading across borders score increases by one point, cocoa beans export values increase on average by 0.5%. We find that tariffs and agricultural value added have no statistically significant trade effect. To check whether these results remain once we also estimate the time-invariant part, we estimate model specification 4. Column (2) shows the results and reveals the expected trade-impeding effect of applied tariffs. The directional effects of the other variables remain the same. Nevertheless, column (1) is our preferred model specification and we will return to interpret these estimates in more detail because the model specification in column (2) does not pass the RESET test (p-value < 0.01). Another unexpected result is the negative but statistically insignificant effect of agricultural value added on cocoa beans export values, this suggests that this variable might not adequately reflect the supply-side

Table 3: The effect of voluntary sustainability standards on cocoa beans exports

	(1)	(2)
Estimation method	ppml	
Dependent variable	Export value	
UTZ volume share$_{it-1}$	0.012***	0.013***
	(0.003)	(0.004)
Log Agricultural GDP$_{it}$	−0.168	−0.316
	(0.180)	(0.303)
Export procedures$_{it}$	0.005**	0.005*
	(0.002)	(0.003)
RTA$_{ijt}$	0.055	0.341**
	(0.087)	(0.140)
Log (1+Tariff$_{ijt}$)	0.124	−0.069
	(0.098)	(0.207)
Log Distance$_{ij}$		−1.166***
		(0.155)
Common Language$_{ij}$		−0.331
		(0.281)
Contiguity$_{ij}$		0.353
		(0.419)
Observations	3,733	
RESET test (p-value)	0.337	0.009

Notes: Standard errors are clustered at the country-pair level in parentheses; The estimation in column (1) includes exporter, importer-time and country-pair fixed effects; The estimation in column (2) includes exporter and importer-time fixed effects; *** p<0.01, ** p<0.05, * p<0.1; Intercepts included but not reported.

capacity of cocoa beans.[12] Ideally, we would have used cocoa beans production quantity, but as we already use it to rescale our variable of interest (UTZ Certified cocoa beans) it would have caused multicollinearity issues and makes interpretation difficult.

Our variable of interest - *UTZ volume share*$_{it-1}$ - shows the expected trade-enhancing effect ($\beta_1 > 0$) and is statistically significant at the 1% level. Specifically, a one percentage point increase in the share of UTZ Certified cocoa beans among total cocoa beans production increases cocoa beans export values on average by 1.2%. This result confirms our first hypothesis, namely that a country's export value of cocoa beans increases if a higher volume share of cocoa beans among total cocoa beans is certified.

[12]Other proxies of supply-side capacity - i.e. exporter's GDP or exporter's GDP per capita - showed the same pattern.

2-stage estimation results

As discussed in Section 4.1, model specification 3 does not allow us to control for outward multilateral resistance, and therefore we apply a two-step procedure (see Equations 6 and 7). The results for the first stage are shown in column (1) of Table 4. The coefficients show the expected signs. The second-stage results shown in column (2) do not confirm the trade-enhancing effect of UTZ Certified cocoa beans.

Table 4: Two-stage estimation results

	(1)	(2)
Estimation method	ppml (1st stage)	OLS (2nd stage)
Dependent variable	Export value	Exporter-year fixed effects
UTZ volume share$_{it-1}$		−0.0003
		(0.0038)
Log Agricultural GDP$_{it}$		0.237
		(0.560)
Export procedures$_{it}$		−0.010
		(0.008)
RTA$_{ijt}$	0.219*	
	(0.119)	
Log (1+Tariff$_{ijt}$)	−0.084	
	(0.102)	
Observations	3,733	294

Notes: Standard errors in column (1) are clustered at the country-pair level and in column (2) at the country level in parentheses; The estimation in column (1) includes exporter-time, importer-time and country-pair fixed effects; The estimation in column (2) includes exporter-fixed effects; *** p<0.01, ** p<0.05, * p<0.1; Intercepts included but not reported.

5.2 Effects on cocoa-grinding exports

To answer our second research question - Can we observe spill-over effects of UTZ Certified cocoa beans along the value chain on cocoa grindings? - we estimate our model specifications 3 and 5 with cocoa grinding (paste, powder and butter) export values as the dependent variable, product-specific tariffs, exporter-product fixed effects, country-pair-product and importer-product fixed effects. The results are shown in Table 5 below. Column (1) presents our results from the baseline model including country-pair-product fixed effects. The ease of trading across borders also plays a significant role in the case of cocoa grindings. A one unit increase in the trading across borders score increases exports of cocoa grindings on average by 0.6%. All other control variables do not have a statistically significant effect, but RTA_{ijt} and $Tariff_{ijkt}$ show the expected positive and

Table 5: The effect of voluntary sustainability standards on cocoa-grinding exports

	(1)	(2)
Estimation method	ppml	
Dependent variable	Export value	
UTZ volume share$_{it-1}$	0.006	0.020***
	(0.004)	(0.005)
Powder dummy$_k$*UTZ volume share$_{it-1}$		−0.018**
		(0.008)
Butter dummy$_k$*UTZ volume share$_{it-1}$		−0.024***
		(0.008)
Log Agricultural GDP$_{it}$	−0.067	−0.041
	(0.281)	(0.272)
Export procedures$_{it}$	0.006**	0.004*
	(0.003)	(0.003)
RTA$_{ijt}$	0.099	0.114
	(0.112)	(0.114)
Log (1+Tariff$_{ijkt}$)	−0.145	−0.189
	(0.167)	(0.167)
Observations	6,611	
RESET test (p-value)	0.052	0.929

Notes: Standard errors are clustered at the country-pair-product level in parentheses; All estimations include exporter-product, importer-product-time and country-pair-product fixed effects; *** p<0.01, ** p<0.05, * p<0.1; Intercepts included but not reported.

negative signs, respectively. The insignificance of the estimated coefficient for tariffs is unsurprising. As already argued above, the inclusion of country-pair-product fixed effects absorbs most of the variation in tariffs. Not controlling for country-pair-product fixed effects yields significant coefficients for tariffs and increases their magnitude (see Appendix Table A3).

The positive coefficient of *UTZ volume share*$_{it-1}$ in column (1) confirms our second hypothesis, namely that a country's export value of cocoa grindings increases if a higher volume share of cocoa beans among total cocoa beans is certified, but it is not statistically significant at any conventional level. To check for product heterogeneity of this effect, we interact the variable with product dummies for cocoa powder and butter. The results are shown in column (2). We use cocoa paste as the base category because it is the product obtained from the first cocoa-grinding step.[13] Model specification 5 reveals the statistically significant heterogeneous product effect of *UTZ volume share*$_{it-1}$ on cocoa-grinding exports. Specifically, a one percentage point increase of the share of UTZ

[13]Cocoa butter - as well as cocoa cake - is extracted through the hydraulic pressing of cocoa paste. Cocoa powder is produced as a by-product during this second grinding step.

Certified cocoa beans among total cocoa beans production increases the export value of cocoa paste on average by 2%. However, this trade-enhancing effect reduces to 0.2% ($\hat{\beta}_1 + \hat{\beta}_2 * \text{Powder dummy}_k$) in the case of cocoa powder and even turns negative (-0.4%) for cocoa butter. To check the robustness of our results, we split the sample by product group and use the one-product model specifications 3 and 4 to estimate the effect of *UTZ volume share*$_{it-1}$ for each cocoa-grinding product separately (see Table A4 in the Appendix). The results confirm the positive effect of UTZ Certified cocoa beans on cocoa paste exports. Moreover, the coefficient estimates for cocoa powder and butter show the same signs as in Table 5 column (2), but are insignificant.

5.3 Discussion

The results shown in Table 3 confirm the expected positive trade effect of UTZ Certified cocoa beans. However, applying the two-step procedure (see Equations 6 and 7) no longer yields any positive significant effect. One possible reason might be that we lose our bilateral data structure and are only able to estimate the effect on the exporters' market access, assuming that it is equal for all trading partners. As discussed in Section 3, the trade effect of UTZ certification is not only determined by the supply side but also by import demand. Kinzius et al. (2019) highlight that including all importers as treated leads to an underestimation of the treatment effect. Furthermore, the second-stage results only show how UTZ Certified cocoa beans affect outward multilateral resistance. We argue that in the case of cocoa beans trade, this type of multilateral resistance only plays a minor role because the production of cocoa is concentrated in the Global South and these exporters face low trade costs in most import regions. A trade policy change for a bilateral country-pair might have a low impact on all other exporters.

Turning to our results shown in Table 5, the stronger positive effect of UTZ certification on cocoa paste exports than cocoa powder and butter is unsurprising. Cocoa paste accounts for by far the largest share of certified cocoa grindings, ranging from 50% to 85%, followed by cocoa butter (11% - 46%) and cocoa powder (4% - 24%). As shown in Table 1, among the five largest cocoa-grinding exporters are countries with a relatively low UTZ Certified cocoa beans production share (<13.5%) specialised in exports of cocoa butter, while large UTZ Certified countries like Ivory Coast and Ghana mainly export cocoa paste (>50% of grinding exports).

Product-specific characteristics may explain these differences. Cocoa paste is the first grinding step and it can be either directly sold to a chocolate manufacturer or further processed into cocoa butter and powder (ITC, 2001). The quality of cocoa paste is an important purchase criterion for chocolate manufacturers and the potential quality-improving effect of certification - as discussed in Section 3.1 - could therefore enhance cocoa paste

exports. Local processing plants might specialise in the production of cocoa paste only, e.g. FINMAC in Costa Rica (Haynes et al., 2012), because it is less sophisticated and less capital-intensive than the production of cocoa butter (ITC, 2001). Certification can increase the chance of local firms with low export experience to enter export markets (see Section 3.2).

Furthermore, chocolate manufacturers are the largest buyers of certified cocoa products and they mostly demand cocoa paste and butter, whereas the demand for certified cocoa powder - which is mainly used to produce drinking chocolates or bakery products - is rather low. Another factor that might explain the results is the transport requirements. Cocoa butter is usually transported in liquid form and very costly over a long distance. Therefore, for long distances, cocoa butter is shipped as a solid substance and requires an additional processing step once it arrives at the chocolate manufacturer's factory. The potential price premium for certified cocoa butter might be undone by these additional costs. Besides, the quality of cocoa butter depends less on the quality of the cocoa beans than cocoa paste or powder, which might reduce chocolate manufacturers' willingness to pay a price premium for quality (Fold, 2001). Besides chocolate manufacturers, the pharmaceutical and cosmetic industry is another large buyer of cocoa butter, which barely demands certified products.

Other time-varying country-specific trade characteristics might reinforce the negative effect of UTZ Certified cocoa beans on cocoa butter exports. Indonesia and Brazil - two of the five largest cocoa-grinding exporters that specialised in cocoa butter (see Table 1) - export most cocoa butter to the EU and Northern America but also a large share to countries in Latin America and Asia[14] that do not demand UTZ certification (UN Comtrade, 2017).

5.4 Limitations

We face three main limitations concerning the data used. First, given that we do not have data on certified trade flows, we use total cocoa trade flows (which include certified and uncertified cocoa products). This might lead to an upward bias of our results, if countries with a high share of certified cocoa beans in reality export only few certified cocoa products to their major trading partners, and vice versa. At present, the exact data of UTZ Certified export flows is not available.

Second, we do not have country-specific data on the overall production quantity of cocoa paste, powder and butter. We are unable to calculate the share of certified cocoa grindings among total cocoa grinding production. Thus, we use the share of certified cocoa beans and assume that certified cocoa beans are processed to the same extent as uncertified

[14]Data on importers of UTZ Certified products was provided by Phan Ha, Data analyst, Rainforest Alliance, Amsterdam, The Netherlands.

cocoa beans. In reality, cocoa farmers are sometimes unable to sell their cocoa beans as certified, which results in a lower share of certified cocoa beans being processed into certified cocoa grindings. In the case of UTZ Certified, on average only 41% of certified cocoa beans production quantity during the study period (2011-2016) was sold as certified (UTZ, 2016). This might lead to an upward bias in our results.
Third, we do not have data on multiple certifications, so we cannot control for additional effects caused by other certification schemes. In 2015, 13% of cocoa certificates were multiply certified, of which 58% were a combination of UTZ Certified and Rainforest Alliance Certified. The highest concentration of multiple certified cocoa certificates was found in Peru (43%), while all other countries showed a concentration rate of multiple certifications lower than 20% (ISEAL Alliance, 2018). Since UTZ and Rainforest Alliance require similar certification criteria and Peru neither belongs among the five largest cocoa beans exporters nor cocoa-grinding exporters, we only expect a low bias from double certification in our dataset.

6 Conclusion

With growing global demand for ethically- and sustainably-produced cocoa products by consumers and chocolate manufacturers, VSSs are becoming increasingly important. Nonetheless, their effect on international trade flows - especially on processed goods - remains unclear. This paper has analysed the trade effect of one of the leading certification schemes in the cocoa sector, UTZ Certified. We not only studied the effect on raw cocoa beans but also on the different cocoa grindings, namely cocoa paste, cocoa powder and cocoa butter to find possible spill-over effects along the supply chain.
Our results show that UTZ certification enhances the export values of cocoa beans and paste. This confirms our first hypothesis, namely that a country's export value of cocoa beans increases if a higher volume share of cocoa beans among total cocoa beans is certified. Our second hypothesis that a country's export value of cocoa grindings increases if a higher volume share of cocoa beans among total cocoa beans is certified is only confirmed for first-stage grindings, i.e. cocoa paste. We find mixed and negative trade effects for second-stage cocoa grindings, cocoa powder and cocoa butter, respectively, which can be partially explained due to product- and country-specific characteristics.
This emphasises the need for further support for certified origin grinding - especially for second-stage grinding - to enable value-chain upgrading in the country of origin. As previously discussed, only eight out of twenty countries that produce UTZ Certified cocoa beans also host certified cocoa grinders. If there is no certified grinder in the country, the production of certified grindings is impossible. A first step could be to create incentives for Foreign Direct Investment (FDI) by certified grinders in the cocoa-producing countries,

e.g. by providing tax incentives to companies with certification. Similar strategies have been successfully applied by Nigeria and Ghana to attract FDI in the area of cocoa processing, albeit without differentiating between certified and uncertified investors (Langan and Price, 2020). However, this strategy may suppress domestic firms. Second, importing regions could set a demand-side incentive by lowering the tariff rate for certified cocoa grindings. A similar procedure is described by Marx (2018), who proposes that certified imports receive a lower tariff compared with non-certified imports under the EU GSP scheme. A stricter procedure is already in place under the EU Forest Law Enforcement Governance and Trade (FLEGT) action plan, which only allows timber products that are proven to be legally produced - e.g. by a VSS - to enter the EU market (Overdevest and Zeitlin, 2014). Third, the standard-setting organisation could require a price premium that has to be paid by the chocolate manufacturer to the certified cocoa grinder. Accordingly, cocoa grinders could compensate for the extra costs that they incur due to audit costs and the UTZ programme fee that they have to pay per metric tonne of UTZ Certified cocoa beans (UTZ, 2019).

Our macroeconomic model has a pure focus on trade at the country level and we are unable to identify which supply chain actors gain from certification. In addition, we face several data limitations as discussed in Section 5.4 which should be overcome in future analyses. Moreover, empirical studies focusing on other food products and other VSSs are needed to provide more general conclusions on the trade effects of VSSs along the supply chain. These results are especially important for policy-makers for decisions regarding the further support or regulation of VSSs.

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A Appendix

Table A1: Exporting countries

UTZ Certified exporter	Non-UTZ Certified exporter	
Brazil	Belize	Sao Tome and Principe[1]
Cameroon	Bolivia	Sri Lanka
Colombia	Congo	Thailand
Costa Rica	Dominica	Trinidad and Tobago
Dominican Republic	El Salvador	
Ecuador	Equatorial Guinea	
Ghana	Fiji	
Indonesia	Gabon	
Ivory Coast	Grenada	
Liberia[2]	Guatemala	
Mexico	Guinea	
Nicaragua	Haiti	
Nigeria	Honduras	
Panama	India	
Papua New Guinea[4]	Jamaica	
Peru	Madagascar	
Tanzania, United Rep. of	Philippines	
Togo[3]	Saint Lucia[2]	
Uganda	Samoa[4]	

Notes: UTZ Certified exporter refers to a country that at least had one farmer certified during the whole study period from 2011 to 2016. Countries in italics produced UTZ Certified cocoa grindings at least once between 2011 and 2016. All countries also export all kinds of cocoa grindings, unless they are marked with a number referring to the type of grindings that a country exports: (1) only paste, (2) only powder, (3) no paste, (4) no butter.

Table A2: Importing countries

UTZ importer	Non-UTZ importer		
Argentina	Algeria	El Salvador	New Zealand
Australia	Armenia	Guatemala	Nigeria
EU27	Belarus	India	Norway
Japan	Bosnia and Herzegovina	Indonesia	Peru
Malaysia	Brazil	Iran	Russian Federation
Singapore	Canada	Israel	Sri Lanka
South Africa	China	Kazakhstan	Tunisia
Switzerland	Colombia	Korea	Turkey
Thailand	Costa Rica	Mexico	Ukraine
United States of America	Croatia		

Notes: UTZ importer refers to countries that imported at least one UTZ Certified cocoa product during the 2011 to 2016 period. All countries listed also imported all type of processed cocoa products.

Table A3: Robustness check: The effect of UTZ Certified on cocoa-grinding exports without country-pair fixed effects

	(1)	(2)
Estimation method	ppml	
Dependent variable	Export value	
UTZ volume share$_{it-1}$	0.001	0.021***
	(0.004)	(0.005)
Powder dummy$_k$*UTZ volume share$_{it-1}$		−0.023***
		(0.009)
Butter dummy$_k$*UTZ volume share$_{it-1}$		−0.033***
		(0.008)
Log Agricultural GDP$_{it}$	−0.198	−0.147
	(0.290)	(0.270)
Export procedures$_{it}$	0.006*	0.004
	(0.003)	(0.003)
RTA$_{ijt}$	0.156	0.188
	(0.143)	(0.146)
Log (1+Tariff$_{ijkt}$)	−0.722***	−0.741***
	(0.131)	(0.132)
Log Distance$_{ij}$	−0.988***	−0.976***
	(0.158)	(0.156)
Common Language$_{ij}$	0.185	0.173
	(0.247)	(0.244)
Contiguity$_{ij}$	1.314***	1.305***
	(0.383)	(0.381)
Observations	6,611	
RESET test (p-value)	0.197	0.225

Notes: Standard errors are clustered at the country-pair-product level in parentheses; All estimations include exporter-product and importer-product-time fixed effects; *** p<0.01, ** p<0.05, * p<0.1; Intercepts included but not reported.

Table A4: Robustness check: Trade effect of UTZ Certified on each cocoa-grinding product

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method			ppml			
Dependent variable			Export value			
	Cocoa paste		Cocoa powder		Cocoa butter	
UTZ volume share$_{it-1}$	0.021***	0.018***	0.006	0.002	−0.005	−0.014**
	(0.004)	(0.005)	(0.006)	(0.007)	(0.006)	(0.007)
Log Agricultural GDP$_{it}$	−0.078	−0.065	0.118	0.051	−0.131	−0.541
	(0.340)	(0.354)	(0.308)	(0.298)	(0.472)	(0.437)
Export procedures$_{it}$	0.002	0.004	−0.013**	−0.012**	0.010**	0.007
	(0.003)	(0.003)	(0.006)	(0.006)	(0.004)	(0.006)
RTA$_{ijt}$	0.392***	0.242	0.032	0.235	−0.043	−0.146
	(0.145)	(0.311)	(0.287)	(0.269)	(0.104)	(0.180)
Log (1+Tariff$_{ijt}$)	−0.094	−0.653***	−0.440**	−0.390	−0.317*	−1.688***
	(0.238)	(0.150)	(0.179)	(0.246)	(0.178)	(0.358)
Log Distance$_{ij}$		−0.402		−1.459***		−1.525***
		(0.271)		(0.253)		(0.260)
Common Language$_{ij}$		−0.116		0.377		0.163
		(0.368)		(0.238)		(0.330)
Contiguity$_{ij}$		3.074***		0.457		0.123
		(0.454)		(0.600)		(0.772)
Observations	1,926		2,671		2,014	
RESET test (p-value)	0.690	0.768	0.744	0.004	0.009	0.0001

Notes: Standard errors are clustered at the country-pair level in parentheses; The estimations in columns (1), (3) and (5) include exporter, importer-time and country-pair fixed effects; The estimations in columns (2), (4) and (6) include exporter and importer-time fixed effects; *** p<0.01, ** p<0.05, * p<0.1; Intercepts included but not reported.