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Abstract

In the EU, the 2017/18 sugar marketing year (MY) was the first with no production quota and most of the price support gone. The Uruguay round restrictions on sugar exports were also not binding anymore, making the EU a net exporter. In MY2018/19 the EU turned back into a net importer as domestic sugar production fell. Developments on the demand side have been much less dramatic as global sugar consumption kept growing. These market and policy trends lead to relatively low international prices between 2018 and 2020 before trending upwards in 2021. These low prices were at least partially transmitted to European markets.

In a net-export situation and without export restitutions, international export prices would be the anchor for intra-EU price formation. Under these circumstances, the still present interventionist side of the EU's sugar market policy could easily be viewed as irrelevant for price formation within the EU. However, in the more realistic scenario of the EU being a net-importer, price formation will continue to be strongly affected by the existing import restricting policies. There has been no change in the EU schedule of bound tariffs for sugar since the formation of the World Trade Organisation. Other external sugar market policies of the EU are unilateral market access to the common market (i.e., EPA, EBA), tariff rate quotas (e.g., the Balkan and CXL preferences) and preferences granted under bilateral agreements. This

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report assesses how effective the EU trade policies regarding sugar have been for EU sugar imports and sugar prices within the EU, followed by resulting policy recommendations.

Using structural gravity estimations, we observe that the EU's tariff and quota preferences for sugar are effective. Trade flows from preferred countries are higher than the no-preference group. The preferences increase overall sugar exports to the EU by 270%, raw sugar exports by 400% and white sugar exports by 110%. The different preference regimes each enhance EU sugar imports of raw and white sugar but there exists substantial heterogeneity across them. Custom tariffs decrease EU sugar imports, yet, measured as trade values, the trade enhancing effects of preferential treatment outweigh the trade reducing effects of customs tariffs. We also analyze the price transmission processes on the EU sugar market. We use an asymmetric price transmission model to estimate the dynamics that arise in the relationship between the reported factory price for white sugar in the EU on the one hand and the world market price, the ACP import price and the EU spot market price on the other. Results show that the EU price is decoupled to a large extent from the world market price and that movements in the world market price affect the reported factory price in the EU only in one direction. This may be explained by effective price insulation through EU market intervention and by market power among sugar producers. Finally, using a set of policy scenarios, the report simulates future developments in the European sugar sector along various dimensions. Even moderate increases in world prices will raise EU prices. If world prices increase to a high degree, it would turn the EU from a net importer to a net exporter. The outcomes of a complete unilateral elimination of the EU's import tariffs depend on its net trade position. If EU prices were below world prices, a drastic reduction of the import tariff on sugar would not cause any measurable consequences. However, if EU prices are above world prices, an abolishment of the MFN tariff would cause EU prices to decrease. The complete abolition of import duties would lead to an increase of sugar supply to the EU of 0.5%, ceteris paribus. Increased inflows of raw sugar via preferential trade is likely to reduce the ACP import price, which in turn will be transmitted to the EU price.

In conclusion, this report shows that in the past the political target to shield EU sugar producers from competition from the rest of the world has been effective, with the tariffs in place preventing almost any inflow of sugar into the European Union from non-preferred sugar exporters. Therefore, the vast majority of sugar imports to the EU occurred under preferential trade agreements, leading to a close integration and corresponding transmission of price signals between the European sugar market with the sugar markets in ACP countries. With the world market, however, there is only limited integration - price shocks that occur on the international market are only partially transmitted, and some evidence for asymmetry was found.

The higher probability of a net import situation in the future suggests an urgent need for revision of the Common Agricultural Policy for sugar. The current difficulties in revitalizing multilateral trade negotiations make bilateral and regional trade agreements attractive substitutes to stabilize the sugar market. Increased preferences would increase preferentially treated imports and correspondingly reduce prices for EU consumers in the net import situation. An additional option would be the introduction of "reverse safeguards", i.e., adjustments of the import tariff not only upwards when imports rise, but also downwards when import prices rise.

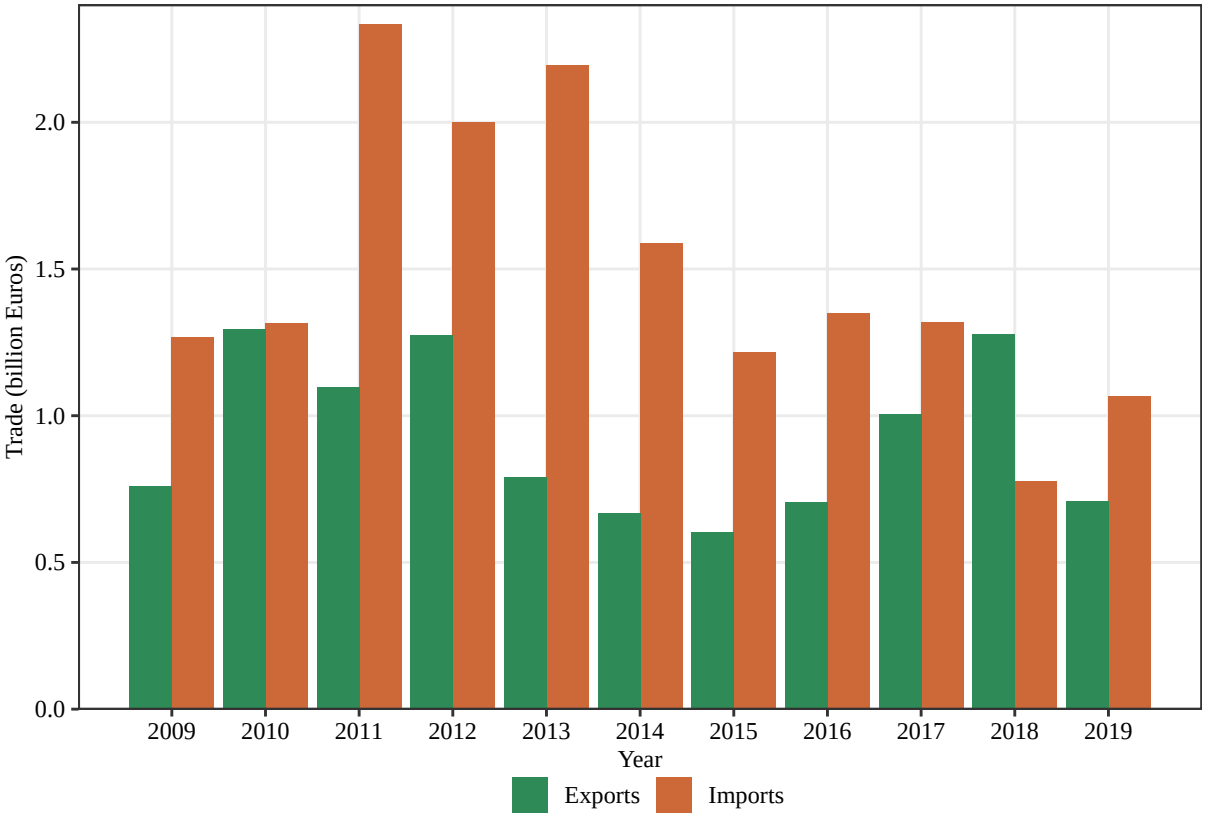
1 Introduction

International sugar markets are currently experiencing substantial structural changes. Since a historical low in 2018, mainly caused by important supply side changes in major exporting countries that are mostly driven by substantial policy adjustments, prices fluctuated at relatively low levels throughout 2019 and 2020. Since the beginning of 2021, international prices have followed a stronger upward trend, and have reached 4-year highs in February 2021. In the EU, the sugar marketing year (MY) 2017/18 was the first without any production quota and without most of the price support of the past – although in a number of member states, partial coupling of direct payments to sugar beet production is still common. At the same time, the Uruguay round restrictions on sugar exports were no longer relevant, turning the EU back into a major net exporter in MY 2017/18 (rank number four in net export terms after Brazil, Thailand, and Australia). As EU sugar production decreased substantially in the MY 2018/19, it fell back to rank six in international export quantity, becoming a net importer, again. The developments in major sugar exporting countries were mainly driven by changes in their domestic production. Low international sugar prices relative to crude oil prices have triggered a substantial shift towards ethanol production in Brazil, with close to two thirds of the cane harvest now being processed into ethanol. The reduction of sugar production in Brazil turned India back into becoming the world's largest sugar producer for the past two marketing years, supported by substantial policy interventions, e.g., marketing subsidies were put into place at the end of 2018 and have been extended in 2019. More recently, the weakening of the Brazilian Real has improved the competitiveness of Brazilian exports.

Developments on the demand side in the past years have been much less dramatic. Global sugar consumption continues to grow, with most increases in per capita demand in Asia. Health related aspects, which tend to dampen demand growth, are mainly operational in industrialised countries, although awareness for negative side effects of excessive sugar consumption is increasing in emerging economies, too. International import demand growth is led by China and Indonesia, which alone account for about a sixth of global imports. Aggregate African import demand grew in importance, driven mainly by annual growth rates of 3% and above in domestic consumption over the past two decades.

Because of these market and policy trends, international sugar prices were mostly at relatively low levels over the past four years, and started to gain in momentum only from 2021 onward. These low prices were at least partially transmitted to European markets while the EU had turned temporarily from a net importer to a net exporter in 2018 (Figure 1). In the absence of policy instruments like export restitutions, this implies that at the margin, international export prices are the anchor for intra-EU price formation. Under these circumstances, the still present interventionist side of the EU's sugar market policy could easily be viewed as irrelevant for price formation within the EU. However, it is expected that the EU's net trade position remains at a net import situation due to the drop in production quantities (Haß, 2020). While output started to decrease already in MY 2018/19, prices remained low because of high stocks. However, once the EU price rises again (as in the first quarter of 2021), price formation will reverse to the previous state and be most likely affected heavily by the existing import related policies. There has been no change in the EU schedule of bound tariffs for sugar since the implementation of the Agreement on Agriculture from the Uruguay Round of the General Agreement on Tariffs and Trade (GATT), more than two decades ago, although the EU has been making use of discretionary adjustments to applied tariffs during the episodes of extremely high sugar prices back in 2012 and 2013.

Figure 1: Evolution of EU total imports and exports of sugar (HS1701)



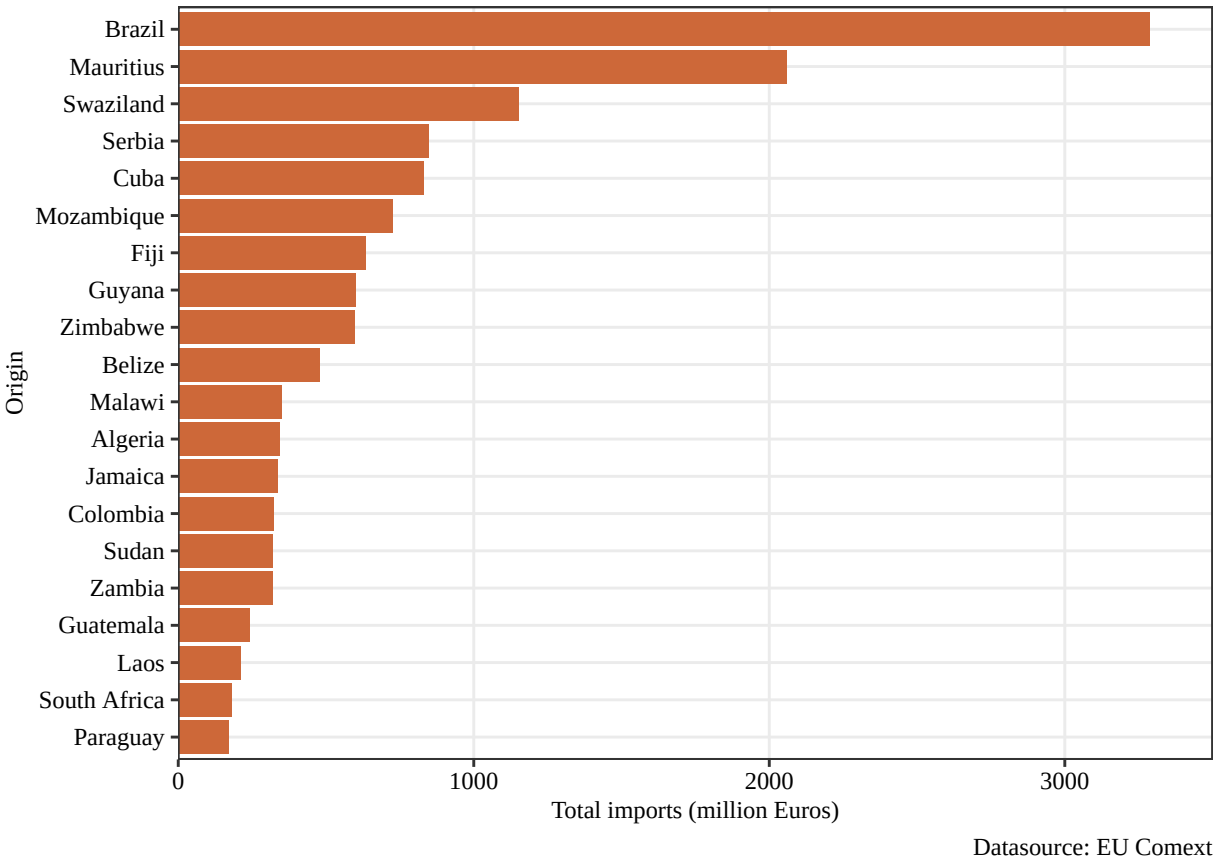
Datasource: EU Comext

Another important element of the EU's external sugar market policies is the presence of preferential market access for African, Caribbean, Pacific (ACP) countries, under the Economic Partnership Agreements, and for the Least Developed Countries (LDCs), under the Generalised System of Preferences in form of the Everything but Arms initiative. In addition to these development-motivated import channels, a number of tariff rate quotas are still in place, e.g., the Balkan quota (mainly for Serbia), the CXL quota (mainly for Brazil and Cuba), and some sugar preferences granted under bilateral Free Trade Agreements (FTAs). Due to the preference erosion[1] caused by the past reforms, these tariff rate quotas are currently not fully used. Figure 2 displays the 20 countries with the largest quantities of sugar exports to the EU over the last ten years and illustrates that next to the leading position of Brazil, countries in the ACP region and other beneficiaries of preferential access play an important role for the European market.

The effects of the current EU sugar policies on domestic price formation are thus strongly dependent on the net trade position of the European Union. This report assess how effective the EU trade policies regarding sugar, such as trade preferences and tariffs, have been for EU sugar imports based on quantitative trade flow modelling and price transmission analyses. The report is structured as follows. An overview on the current trends in domestic and border-related sugar policies in the EU and major exporting countries sets the basis for the subsequent econometric analyses. Trade flows are modelled based on a gravity approach. The following analysis of market integration between global and EU sugar markets is based on a price transmission analysis. The parameterised models are used for the simula-

[1] "Preference Erosion" describes the situation in which existing preferences decrease in value, for example because of a smaller difference between the preferential tariff and the regular, Most Favourite Nation (MFN) tariff (Kopp et al., 2016).

Figure 2: Top 20 exporting countries to the EU (2009 – 2019)



Trade values aggregated over the years 2009-2019.

tion of a number of counterfactual scenarios regarding future policy changes and supply side shocks. The concrete scenarios include the consequences of a) positive shocks to world sugar prices, b) further liberalisation of major distortive policies that are currently still in place in the European Union, and c) increases of sugar supply from preferentially treated countries, either from quota increases or expansion of production capacities. A subsequent qualitative analysis conceptualises the effects of uncertain potential "game-changers", such as different scenarios of Brexit, the intermediate- and long-term effects of the SARS-CoV-2 pandemic, and the pending policy changes in the EU, including Green Deal, Farm-to-Fork and Biodiversity strategies, and CAP reform.

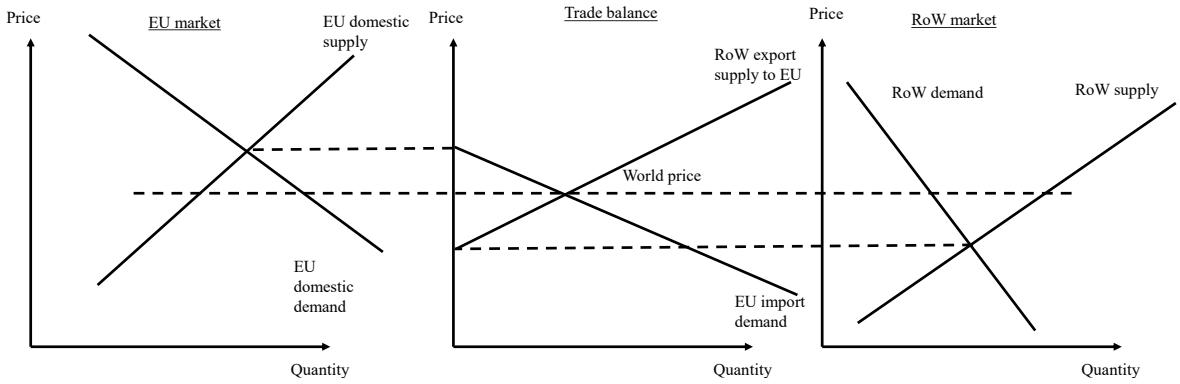
2 Background: historical development of the European Union's Sugar Market Organisation

The European Union looks back at a long tradition of intervention on agricultural markets, involving substantial trade policy components. At the time of their first implementation, after the experiences of severe food shortages during World War II, the desire to become self-reliant on food motivated the EU's Common Agricultural Policy (CAP). For sugar, this was most importantly realised via a complex system of financial support of the European farmers and protection from outside competition, bundled in the Sugar Market Organisation (SMO). The SMO defined the political target in the form of a reference price

which was to be achieved by a prohibitively high import tariff, as well as a production quota for European sugar farmers. Figure 3 shows a hypothetical situation in the absence of any policy interventions in the EU. The left panel depicts the situation on the EU's internal market, the right panel shows the situation for the aggregate supply and demand in the Rest of the World (RoW), and the middle panel illustrates the trade equilibrium for the EU, i.e., quantities refer to traded quantities between the EU and the RoW. The base scenario starts from a free market situation in which the EU would have been an economically large net importer because the autarky price in the EU is substantially above the price in the RoW. The middle panel displays the price formation process based on the export supply from the RoW to the EU and the EU's import demand from the RoW. Both are derived from the outer diagrams (constructed by the help of the short, dashed lines that represent the autarky price in the respective equilibria and lead to the beginning of the import demand and export supply curves in the middle diagram). The resulting world price in the absence of any policy intervention would be represented by the long, dashed line at the intersection of the export supply curve of the RoW and the EU import demand. This price level would be faced by the EU and the RoW in the absence of any intervention.

Figures 4 and 5 display the results of the introduction of import tariff and production quota, respectively, namely the achievement of the reference price, as targeted. The (prohibitive) EU import tariff applied is illustrated in Figure 4 by a vertical shift of the RoW export supply curve faced by the EU , which makes it unattractive for EU users to import sugar from the RoW. As a result the EU price level rises back to the autarky price level. Figure 5 illustrates the introduction of a production quota that causes the EU supply to become perfectly inelastic beyond the quota level, causing a kink in the EU supply curve. Since the competition from the RoW is locked out by the high import tariff, this directly translates into an increase of European prices.

Figure 3: No intervention, EU is net importer



In parallel, a system of preferential trade agreements co-evolved. Preferences were first granted to former colonies of European countries, the so-called "African, Caribbean, Pacific Countries" (ACP countries). Later, additional preferences were granted to other countries, such as the Balkans and Brazil[2]. From 2009, within the framework of the Everything But Arms Agreement, the 50 Least Developed Countries (LDCs) were granted unlimited, duty free access; their export quantities were thus merely bound by their production capacities. A detailed summary over the development programs that are summarised within the Generalised System of Preferences (GSP) is provided in Kopp et al. (2016). These

[2]Details of these agreements are discussed in the next section.

Figure 4: Prohibitive tariffs

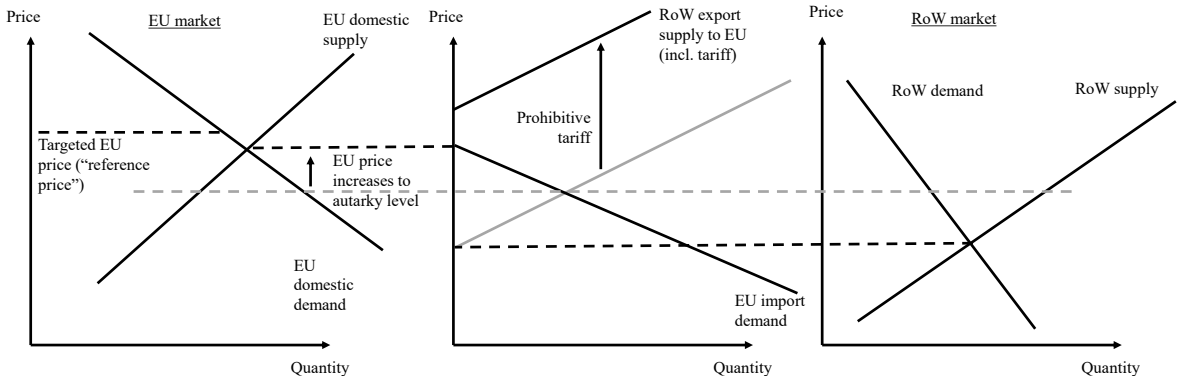
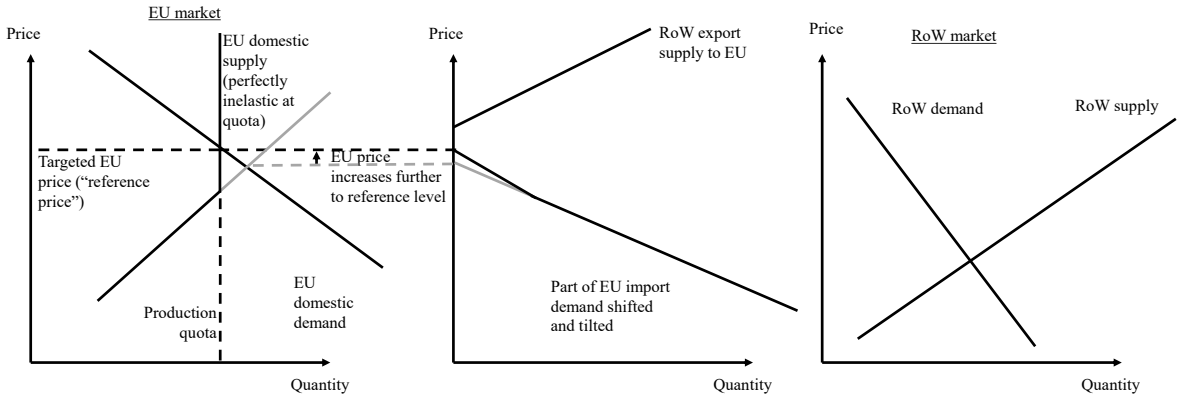


Figure 5: Prohibitive tariffs and production quota



preferences had the potential to cause a reduction of the European price below the reference level, as illustrated in Figure 6. This was achieved by a transformation of the RoW export supply into a step function with the preferential exports to the EU being exempted from tariffs, i.e., returning to the initial curve from Figure 3.

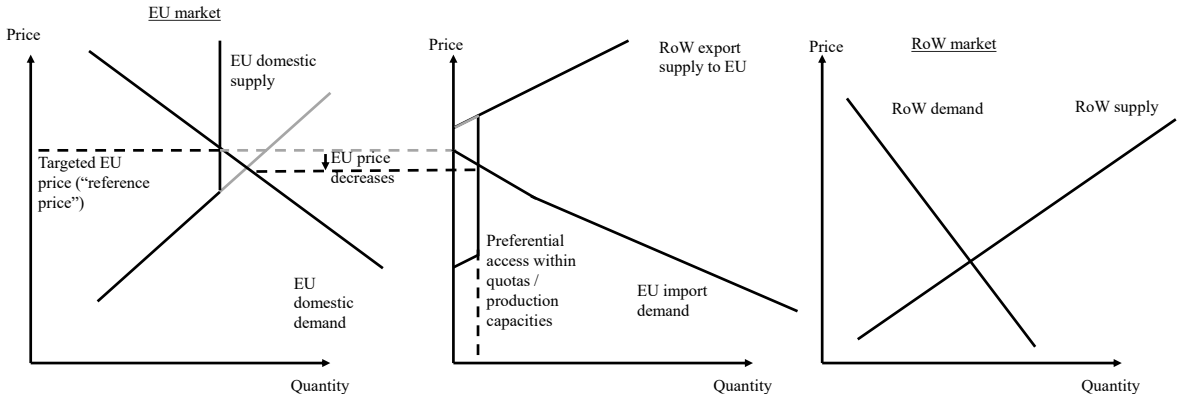
The level of the quota was set to the level that achieved the envisaged reference price given the technical progress and trade political circumstances at the time of its introduction. However, over the years, sugar production in the EU became more productive, causing a shift of the EU domestic sugar supply. The price was further put under pressure through the increase of preferential imports. To keep prices high, the EU introduced export restitutions that bridged the gap between the high EU price and the low world market price for both re-exporting the sugar that was imported through preferences and exporting the increasing surplus of EU producers. Given that the EU is a "large country" in the sense that its actions affect international markets, this caused international prices to decrease.

3 Analysis of recent changes

3.1 Market and policy situation

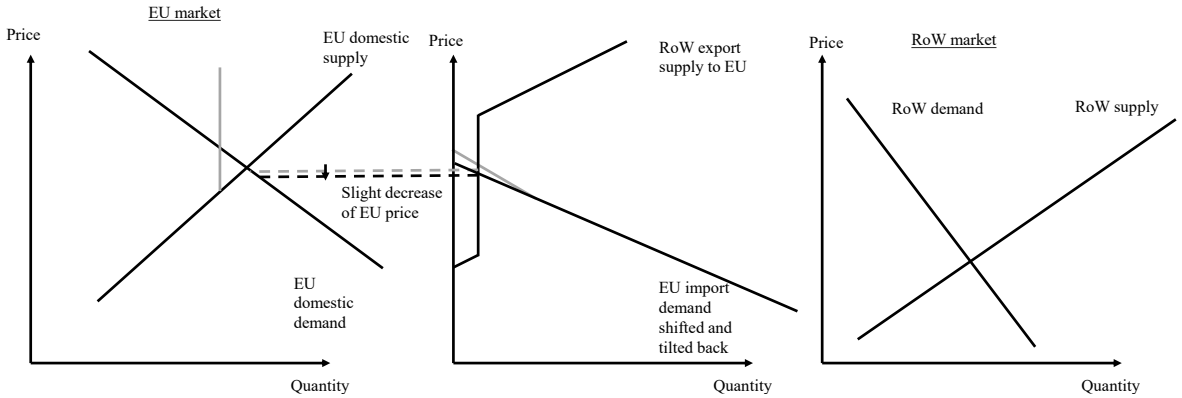
The price for the interventions on the European sugar market was paid by European consumers and manufacturers of sugar containing products, who paid a higher price for sugar than they would have with

Figure 6: Prohibitive tariffs, production quota, preferences



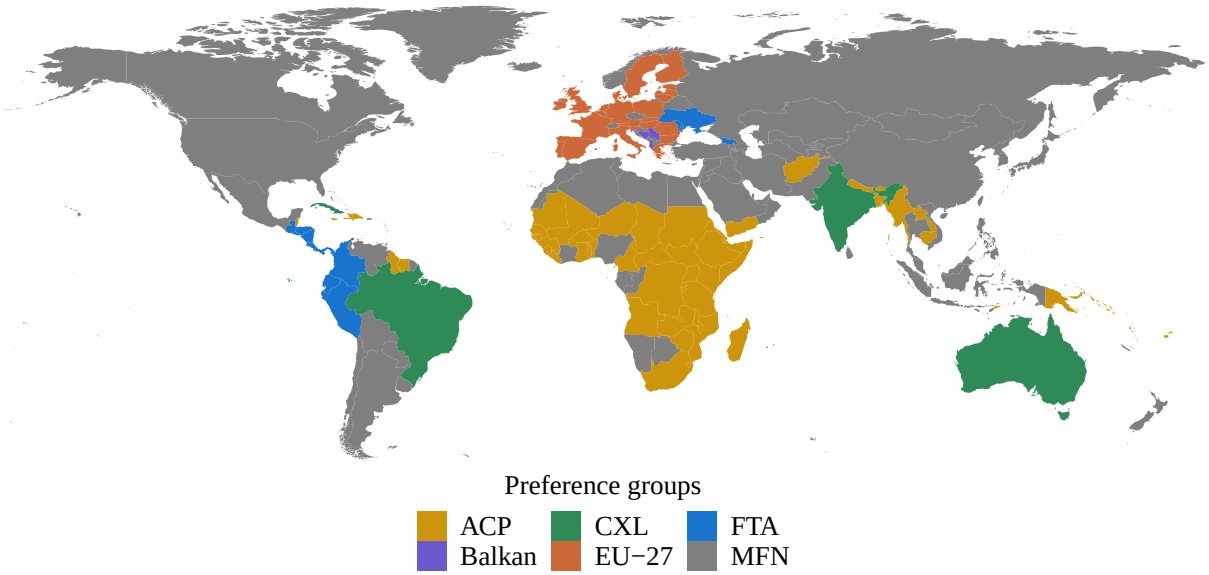
fewer interventions, as well as other sugar producing countries who faced world market prices which were pushed downwards by the cheap European exports. Coming under pressure, the European Union committed itself to a reduction of the intervention system during the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) negotiations. In 2004, however, an event in Geneva shocked the European Union's sugar policy: the World Trade Organization's (WTO) dispute settlement body ruled against the Union. Three countries, Australia, Brazil, and Thailand, had accused the EU of exporting more subsidised sugar than they had committed themselves to in the Uruguay Round. This verdict led to an adjustment of the SMO, including a reduction of the EU's reference price, a limit on the quantities that were exported with subsidies, and a restructuring of EU sugar production and processing. In 2017, the quota policy and the associated export subsidies were eventually abandoned completely. Figure 7 illustrates the new situation without the quota which puts more pressure on the EU domestic price as production is not cut off any more, and EU producers face competition from the sugar that is imported to the Common Market under preferential treatment. For the future it is assumed that the international price will continue to remain at low levels, while the EU production will decrease further, solidifying the EU's position as a net importer. This diagram represents that market situation and serves as a baseline scenario for the scenario analyses below.

Figure 7: Prohibitive tariffs, preferences, abolishment of production quota = reference scenario in scenario analyses



The core element for sugar price formation that remains in the SMO is a prohibitively high MFN tariff,

Figure 8: EU sugar preferences in 2019



which is moderated by the presence of preferential access to the European sugar market. As the middle panel in figure 7 shows, adjustments in the preferential sugar import regimes carry over to price changes within the EU. Furthermore, depending on the level of the international sugar price, the import tariff on EU price formation might lose its prohibitive character.

3.2 EU Sugar Import Preferences

The EU has a long history of development cooperation, which include trade preferences. Aside from being a signatory to the GATT/WTO multilateral trading system, the EU has several unilateral and bilateral agreements with different countries and regions that cover all or selected sectors. The sugar sector is one where the EU has imported under various preferential schemes. The current geographical representation of the various preference beneficiaries are shown in Figure 8 while Table 1 specifies the tariff and capacity levels granted under each of the preference regimes.

The EU's Generalised System of Preferences (GSP) is the pioneer trade agreement between the EU and its partner countries in the ACP region. It dates back to the year 1971, following up on discussions within the UNCTAD about using trade preferences to strengthen economic development in the Global South. Specific rules and preferences for the sugar sector go back to the Lomé Convention of 1975, where the trade relations between the EU and the ACP countries were laid out. Today, the GSP agreement is subject to the "Enabling Clause" of the WTO which allows for an exception to the "Most Favoured Nation" principle thus allowing preferential access of specific developing country products into the EU without reciprocal liberalization. The EU GSP consists of three arrangements: standard GSP, GSP+, and the Everything But Arms (EBA) agreement. Relevant for the EU sugar market is the EBA preferences which have allowed LDCs duty-free and quota-free access to EU markets since 2001 for all products but arms and ammunition, without reciprocity. Hence, in its current form, the 47 LDCs in the world can export unlimited amounts of sugar to the EU tariff-free[3].

[3]Safeguard measures are still possible within the EBA agreement.

The system of unilateral preferences granted within the GSP/EBA is not the only mechanism for supporting trade relations with developing countries. In particular the relation to the former EU colonies in the ACP group of countries required a different approach, comprising more reciprocity in the trade agreements in order to be compatible with WTO rules[4]. This led to a new trading regime with the ACP block which is regulated by the Cotonou Agreement. Under this regime, the EU, and its ACP partners agreed to maintain the Lomé Convention until the end of 2007 and to replace them with Economic Partnership Agreements (EPA). To ensure consistency with WTO regulations, EPAs are reciprocal, and signatory ACP countries must gradually open up their markets to EU imports. Unlike many Caribbean states who signed full EPAs in 2008, getting to the end of 2007, negotiations to initialize full EPAs were still not finalized in Africa. Thus, interim EPAs were concluded by some African countries on mostly bilateral or sub-regional levels[5]. EPAs offer unlimited duty-free quota-free export access into the EU[6] from countries which have initialled the agreement. As a result, the (full or interim) regional EPAs are relevant for the EU sugar market. Since some LDCs in the ACP region — e.g., Lesotho, Rwanda, Madagascar, Mozambique — are also part of EPA negotiation blocs they are also eligible for EPA preferences. Non-LDC ACP countries that failed to initialize the interim EPAs, reverted to the standard GSP. EBA and EPA preferences both grant tariff-free and quota-free access to the EU market for sugar exports from ACP countries. In the empirical analysis, we combine these two groups into one composite group called ACP preferences as they face the same conditions when exporting sugar to the EU.

Other forms of preferences are sugar imported at reduced or zero duty under various tariff rate quotas (TRQs). Under TRQs, lower tariffs are levied on imports below a set quantity (the in-quota tariff rate) and higher, usually prohibitive, tariffs are charged on imports above the set quantity. These preferences include specific TRQs the EU has created for Balkan countries as part of its "Stabilisation and Asso-

Table 1: EU sugar reference groups and allocated quantities – 2019/20 marketing year

Preference group	Tariff level	Capacity (1000 tonnes)
ACP (EBA/EPA)	Zero tariff, zero quota	Unlimited
FTA	TRQs, zero tariffs	531
CXL	TRQ, Euros 98/tonne	791[a]
Balkans	TRQ, zero tariffs	202

Datasource: European Commission (2020b)
[a] Including 78,000 tonnes that can be imported at Euros 11/Tonne from Brazil.

[4]Granting preferential market access to least developed countries is allowed within the GATT/WTO framework. What is forbidden is to discriminate within the group of all developing countries. The number of non-least developed countries that are part of the ACP has increased over the years. To ensure that the preference granted this group of non-LDC countries comply with the WTO/GATT regulations, the ACP agreements had to be transformed into reciprocal regional trade agreements (Kopp et al., 2016).

[5]EPAs are worked out in regional negotiations to ensure they take note of regional and country needs and sensitivities. The EPA process involves seven regional configurations. (1) CARIFORUM: Antigua and Barbuda, Bahamas, Barbados, Belize, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St. Christopher and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, (2) Pacific: Fiji, Papua New Guinea, Samoa, (3) Central Africa: Cameroon, (4) West Africa: Ghana and Côte d'Ivoire, Southern African Development Community (SADC): Botswana, Lesotho, Mozambique, Namibia, Swaziland, South Africa, and (5) Eastern and Southern Africa (ESA): Comoros, Kenya, Madagascar, Mauritius, Seychelles, Zimbabwe.

[6]Subject to be capped in case safeguard measures are applied.

ciation Process". This arrangement grants the Western Balkans (i.e., the former Yugoslav Republic of Macedonia, Bosnia and Herzegovina, Albania and Serbia and Montenegro) preferential access to the the EU sugar market. Since 2005, annual duty-free TRQs have been in place for imports of sugar from the countries in this region (Reg. 891/2009) (IEG Policy, 2019). There are also TRQs established for various WTO member countries (i.e., the CXL quota), specifically Australia, Brazil, Cuba and India. The in-quota tariff for raw sugar — the so-called CXL duty — is 98 Euros per tonne on a quantity of up to 713 thousand tonnes and then a further 78 thousand tonnes with a reduced tariff of 11 Euros per tonne. The out-of-quota import tariffs on white and raw sugar are 419 Euros per tonne and 339 Euros per tonne respectively. India, on the other hand, faces zero import duty under the CXL arrangement due a carryover from the previous ACP Sugar Protocol arrangements (IEG Policy, 2019).

There are also import tariff-preferences available under bilateral free trade agreements that the EU has with selected countries which may be monitored under anti-circumvention mechanisms. These include (i) the Deep and Comprehensive Free Trade Areas established between the EU, and Georgia, Moldova and Ukraine, (ii) the EU-ANDEAN Trade Agreement with Colombia, Peru and Ecuador (iii) the FTA with South Africa which was later replaced by the SADC EPA in 2016, and also (iv) the EU-Central America Association Agreement with Honduras, Nicaragua, Panama, Costa Rica, El Salvador, and Guatemala.

3.3 Data

This report is based on secondary data on prices, and on trade values measured in Euros. The EU sugar imports are measured on an annual (calendar year) basis. We focus on all HS6 digit sugar products that fall within the HS4 group 1701 (i.e., cane or beet sugar and chemically pure sucrose, in solid form). We further separate the sugar types into raw and white sugar using the definitions provided in Table A3 of the Appendix. Data on sugar imports from 2009 to 2019 by each of the EU-27[7] member states are measured in Euros and are assessed from EU Comext (European Commission, 2020a). The sample of exporting countries consists of all sugar producing countries, including member states of the EU-27. However, for each HS6 sugar product, we maintain only country pairs that had at least one trading relationship over the period 2009 to 2019. As a result we exclude structural non-traders[8]. Data on sugar production are provided by the FAOStat database of the Food and Agricultural Organisation. We access applied bilateral tariff data from the United Nations Conference on Trade and Development (UNCTAD) via the World Integrated Trade Solution (WITS) database. Sugar production and tariff data are both only available until 2018. As a result, in the empirical analysis where we will match trade data to production and tariff data, we limit our analysis to the period 2009 – 2018. However, all trade related descriptive analyses extend to the 2019 calendar year. Information on the EU sugar preferences are derived from consulting various publications of the EU commission. Summary statistics on the sugar preferences are presented in 2. They show that 21% of EU sugar imports from outside the EU-27 region enter the common market under some preference form[9]. The region that benefits the most from the preferences is

[7]Our analysis excludes Croatia — who joined the EU in 2013 — but includes the United Kingdom — which exited the EU in 2020 — thus keeping our sample of importing countries at 27.

[8]This reduces our dataset from 154,440 observations to 33,210 observations. However, this data cleaning step has no implications for our findings.

[9]This percentage increases to 71% if we consider intra-EU trade.

Table 2: Summary statistics for preference dummies and price series

Variable	Mean	Std. Dev.	Min.	Max.
Preference Dummies (N = 33210)				
ACP	0.109	0.312		
FTA	0.035	0.184		
CXL	0.052	0.223		
Balkan	0.018	0.133		
Preference	0.215	0.411		
Sugar Prices (N = 114)				
EU (ex-work)	505.070	128.619	312.000	738.000
EU (spot market)	580.784	155.988	326.125	895.000
London No. 5	388.993	83.059	272.806	586.519
ACP	454.322	84.346	286.000	677.000

the ACP group (see also Figure 2).

For the price analysis in this report different monthly averages for sugar from March 2010 until the end of MY[10] 2018/19 were used. All prices are quoted in Euro per tonne. The dependent variable is the EU price which is given by an average ex-work[11] price for white sugar over different regions within the EU which is reported by the European Commission (2020b). Additionally, we use the spot market price (delivered) for EU white sugar as one explanatory variable which is quoted by Platts Kingsman and is not publicly available. However, since most of the sugar in the EU is sold under supply contracts the ex-work price represents a large part of the sugar sold in the EU. The spot price, in contrast, reflects the price for the remaining quantities, which are traded free of supply contracts. Other explanatory variables are i) the world market price for white sugar, represented by the monthly average of the London No.5 (continuous, nearest future) which was retrieved from Datastream (2020) and ii) the monthly average price (CIF) of preferential raw sugar[12] imports from ACP countries to the EU as reported by the European Commission (2020b). Table 2 reports the summary statistics of these prices.

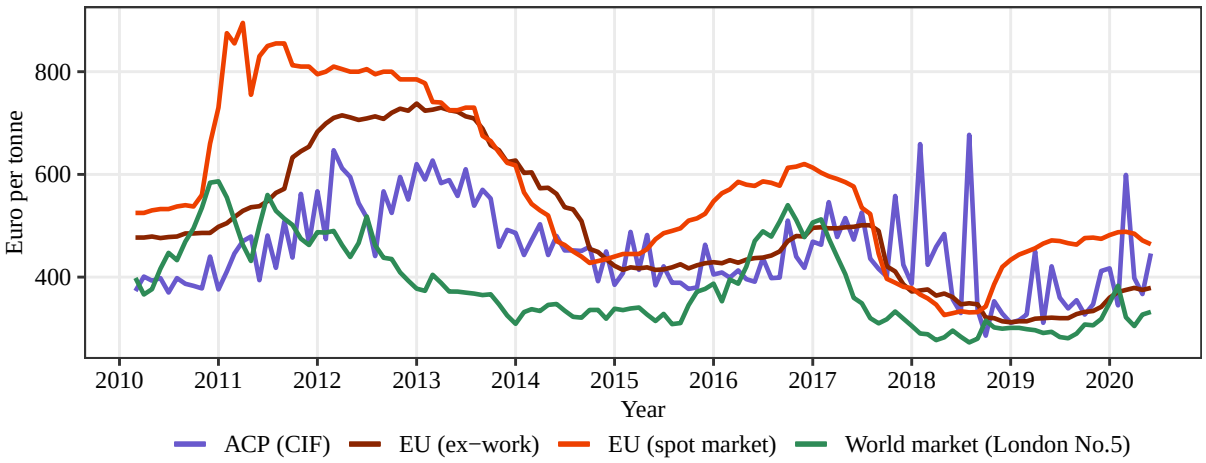
Figure 9 depicts the prices series in question over the observed period. Most of the time the EU prices are substantially above the world market price and the plot already indicates that the difference (margin) between the EU and the world market is fluctuating over time. As reported in Table 2 the prices are distributed with means of different levels, which illustrates the findings of Figure 9. The ACP and the world market prices have similar standard deviations while the standard deviation of both EU prices is considerably higher. In the econometric analysis all prices are expressed in logarithms.

[10] October - September.

[11] The term "ex-work" refers to a price officially reported by the sugar producers and does not include the costs for transportation.

[12] The monthly imported quantities of white sugar from ACP countries are rather small compared to raw sugar (24 thsd. tonnes against 108 thsd. tonnes monthly average) and have mostly been imported from Mauritius. Hence the average import price for white sugar from ACP countries is not representative for ACP imports.

Figure 9: EU and World Market Price for white Sugar and ACP raw Sugar Price



3.4 Trade flow analysis

3.4.1 Overview

To assess how the various EU sugar trade preferences discussed in Section 3.2 affect EU sugar imports (Fig. 1) we estimate a gravity model of international trade. Hence, the gravity theory will guide our empirical analysis and estimates. The gravity equation is one of the most successful empirical representation of bilateral trade relationships in international economics. In its basic form, the gravity model is: $X_{ij} = GM_iM_j\phi_{ij}$. It relates bilateral trade (X_{ij}) between exporting and importing countries to bilateral trade costs (ϕ_{ij}) and exporting (M_i) and importing (M_j) country characteristics. G is the gravitational constant which in our empirical applications end up in the intercept term. As a result, the model delivers a tractable framework for trade policy analysis in a multi-country environment. Over the years the model has developed into the preferred tool for trade policy analysis and has been used to assess the effects of different EU trade policies on EU agricultural trade (Scoppola et al., 2018; Cipollina and Salvatici, 2020), and also in the sugar market more specifically (Kopp et al., 2016; Stack et al., 2019). Following Anderson and Wincoop (2003), we estimate a demand-side gravity model that assumes a constant elasticity of substitution and product differentiation by place of origin. This means that in our model, each exporting country produces a variety of good that it trades with the rest of the world.

3.4.2 Methodology

For proper estimation of our gravity equations, some empirical challenges need to be addressed. First, is the issue of zero trade observations. Zeroes are a prominent feature of trade data. Even at aggregate levels, trade data often include many reported zeroes or missing trade flows. Some of these zeroes are rounding errors, but most reflect a true absence of trade between country pairs. Zeroes of the latter nature are informative and disregarding them gives up important information. Since we estimate our models at the HS6 digit level, 16,199 observations (i.e., 49% of our trade observations) out of our total sample of 33,210 observations are zeroes. Proper handling of these zeroes is important as excluding them creates a selection bias, while adding an arbitrarily small positive value — to allow for log transformation — introduces a measurement error. To properly account for these zero trade flows, we use the Poisson

pseudo maximum likelihood (PPML) estimator. This estimator adapts a count data framework that allows us to estimate the gravity model in its multiplicative form and use the dependent variable in levels rather than in logs (Silva and Tenreyro, 2006). In the presence of heteroskedasticity — which is inherent in trade data — taking logs of the dependent variable (i.e., trade flows) changes the properties of the error term and yields inefficient estimates. Besides providing a natural way of dealing with zeroes in the dependent variable, PPML is consistent under heteroskedasticity.

A second issue is how to measure trade preferences. Following earlier studies on trade agreements (e.g., Scoppola et al., 2018) and capture the existence of trade preferences between country pairs using dummy variables[13]. As we highlighted in Section 3.2, many developing countries enjoy multiple trade preferences offered by the EU. This is also the case for sugar preferences. LDCs that are part of regional EPAs can still enjoy the EBA preferences due to their LDC status. To deal with overlapping trade preferences, we assume that exporting countries will utilize the most beneficial preference scheme. In our case, this means preferences enjoyed under the EBA are better than under the EPA. Therefore, when a country is eligible for both EBA and EPA preferences we assume that it uses the former. In our case, this assumption is trivial since we group the EBA/EPA beneficiaries into a composite group which we call the ACP. Table A1 in the appendix provides a detailed list of the EU's import partners by preference group from 2009 to 2018.

Third, intra-EU sugar trade is substantial. Hence, for proper model identification and policy-making, it is important to allow domestic EU sugar producers and foreign exporting firms to be active in the sector. Following Cipollina and Salvatici (2020), our dataset includes both intra-EU and international trade flows. This key adjustment to gravity estimations that evaluates the effects of EU trade policies allows for possible diversion effects from intra-EU trade (Cipollina and Salvatici, 2020). This modelling approach is consistent with gravity theory and recent empirical literature has pointed out that estimates of trade agreements may be biased downwards in regressions that only rely on international trade flows (Yotov et al., 2016). Also, given that our importing country sample includes only members of the EU, variations in the importing country dimension are redundant whenever we consider the trade policy variables. To avoid any ambiguity, we drop the index j in the notations for the EU preferences and applied tariffs.

Taking the above estimation issues into account, our product-level gravity equation is the following:

$$X_{ijkt} = \exp\Big[\mathbf{FE}_{ik} + \mathbf{FE}_{jkt} + \mathbf{FE}_{kt} + \beta_0 + \beta_1 \ln \text{Production}_{it} + \theta \mathbf{Z}_{ij} + \beta_2 \ln(1 + \text{Tariff}_{ikt}) + \beta_3 \text{Preference}_{it}\Big] + \varepsilon_{ijkt} \tag{3.4.1}$$

where X_{ijkt} denotes exports in Euros from exporter i (i.e., 124 countries including the EU-27) to importer j (i.e., member states of the EU-27), of sugar product k (i.e., beet sugar, cane sugar or white sugar) in year t (i.e., 2009 – 2018). Production_{it} is the domestic production of sugar (cane and/or beet) in the exporting

[13] An alternative approach to capture the preference effect is to calculate preference margins (e.g., Kopp et al., 2016; Cipollina and Salvatici, 2020). However, the use of a dummy variable remains the most frequently used approach in the literature (Scoppola et al., 2018). The dummy variable approach we use has the advantage of allowing us to assess the overall trade effects of the preferences – including tariff rate quota preferences – and not just tariff preferences.

country[14]. $\mathbf{Z}_{ij}$ is a vector of traditional gravity variables including bilateral distance between the importing and exporting country (Distance_{ij}) and dummies for speaking a common language (Language_{ij}), sharing colonial ties (Colony_{ij}), and sharing a common border (Contiguity_{ij}). The βs are coefficients to be estimated. To confirm the robustness of our findings, we will in a latter step replace the vector $\mathbf{Z}_{ij}$ with a set of bilateral fixed effects. The Preference_{it} dummy is our variable of interest. It takes the value of 1 when the EU offers the exporting country i tariff and/or quota preferences for sugar. Thus, β_3 is the elasticity of trade with respect to preferences and is the parameter of interest in our analysis. We define the preference dummy to begin with the official start year of the (provisional) application of the preference. The exception is in cases where the official start date is after June. In such cases, we use the following year as the start of the preference dummy[15]. For proper identification of the preference effects we need to include a control group in the regressions, i.e., a set of countries that are not affected by the EU sugar preference policies. In our analysis, these are countries that traded consistently under the MFN regime. $\mathbf{FE}_{ik}$, $\mathbf{FE}_{jkt}$, and $\mathbf{FE}_{kt}$ are exporter-product, importer-product-time, and product-time fixed effects respectively. The inclusion of these fixed effects is standard in the gravity literature to account for a number of observable and unobservable country-specific and product-time varying variables that influence sugar trade, most notably in our case the effects of EU membership on intra-EU trade[16]. ε_{ijkt} is the standard error term of the model which we cluster at the country-pair product level.

In a second estimation step, we assess how the different preference regimes affect EU sugar imports. We split the Preference_{it} dummy into the different sugar preferences and specify a second estimation equation as follows:

$$X_{ijkt} = \exp\Big[\mathbf{FE}_{rk} + \mathbf{FE}_{jkt} + \mathbf{FE}_{kt} + \beta_0 + \beta_1 \ln \text{Production}_{it} + \theta \mathbf{Z}_{ij} + \beta_2 \ln(1 + \text{Tariff}_{ikt}) + \alpha_1 \text{ACP}_{it} + \alpha_2 \text{FTA}_{it} + \alpha_3 \text{CXL}_i + \alpha_4 \text{Balkan}_i + \delta \text{IntraEU}_i\Big] + \varepsilon_{ijkt} \tag{3.4.2}$$

ACP_{it} is a dummy variable that takes the value 1 if the exporting country enjoys preferences under the EBA or EPA regime. FTA_{it} is a dummy defined for countries that have a bilateral trade agreement with the EU that included tariff/quota preferences for sugar. CXL_i and Balkan_i are dummies for countries that enjoy access to the EU market under the CXL and Balkan tariff regimes. Once we start assessing preference group specific effects, there are no time variations in the CXL and Balkan group. Thus, including exporting country fixed effects as we did in equation 3.4.1 is not feasible if we want to assess CXL and Balkan preferences[17]. To allow for a source of variation we can exploit, we define our exporting country-fixed effects in this step at the exporting region level ($\mathbf{FE}_{rk}$). This also allows us to access the

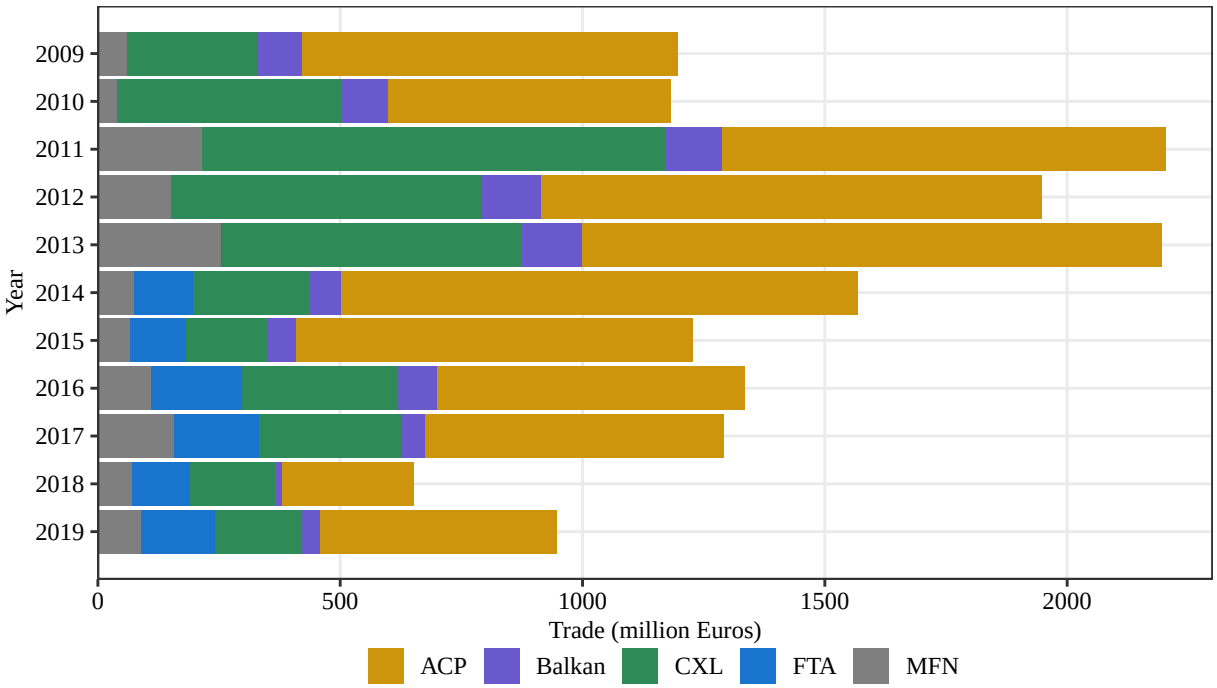
[14] In the traditional gravity literature, the Gross Domestic Product of an exporting country is usually used as a proxy for their masses, but we consider sector-specific sugar production as a better measure of the supply-side capacity in our model (Prehn et al., 2015; Fiankor et al., 2020). This variable captures adequately the effect of domestic production of sugar on exports.

[15] Take the case of the EU-Central America Association Agreement. The trade pillar of this agreement has been provisionally applied since 1st August 2013 with Honduras, Nicaragua and Panama, since 1st October 2013 with Costa Rica and El Salvador, and since 1 December 2013 with Guatemala. As a consequence, we begin the FTA dummy for this region in 2014.

[16] These fixed effect terms are also structural terms that are at the core of gravity equations. They bear the intuitive interpretation that, all else equal, two countries will trade more with each other the more remote they are from the rest of the world. Anderson and Wincoop, 2003 calls them "multilateral resistance". Accounting for the multilateral resistances is the key difference between the naive and theory-founded applications of the trade gravity model.

[17] If we run the preference-specific equations including exporting country fixed effects, our findings on the ACP and FTA preferences remain qualitatively the same. However, the other preference dummies drop out due to perfect collinearity with the exporting country fixed effects.

Figure 10: Sugar imports by preference groups



Datasource: EU Comext

effects of the EU membership on intra-EU sugar trade (δ Intra EU$_i$)[18]. All other variables remain as defined in equation 3.4.1.

3.4.3 Results

As an initial exploratory analysis, Figure 10 presents the sum of sugar imports by preference groups over the period 2009 – 2019. The general pattern we observe is that the EU imports higher values from preferred countries compared to the MFN group (i.e., countries with no tariff or quota preferences for sugar). In terms of preference-specific groups, EU sugar imports originate largely from the ACP group. This is consistent with Figure 2 where ACP countries feature prominently in the top 20 import origins for EU sugar. This is followed by the CXL group, the Balkan countries and specific countries that have bilateral free trade agreements with the EU. However, the higher trade volumes we see for preferred countries relative to the MFN group may be driven by one of two things. First, total EU sugar imports may increase due to increased flows from preferred countries at the expense of MFN countries. Second, we may see an overall increase in EU sugar demand — in which case EU sugar imports increased from all countries regardless of preferential status. To see if the EU sugar preferences influenced the trade flows from preferred countries, we follow-up this descriptive analysis with econometric models where the MFN groups in Figure 10 serve as the control group.

If EU import preferences for sugar are indeed effective, then trade flows from preferred countries should be higher and statistically and significantly different from trade flows originating from the no-preference group of countries. To confirm this, we turn to our econometric model specifications where we assess whether and to what extent the EU sugar trade preferences affect EU sugar imports once

[18] In equation 3.4.1, the effects of membership of the EU on intra-EU sugar trade is captured in the $\mathbf{FE}_{ik}$ term.

we account for other factors that affect developments in EU sugar trade. The results of the empirical estimations are presented in Table 3. In columns (1) and (2), we present the average effects for sugar. In columns (3) – (4) and (5) – (6), we assess how the effects vary across the two types of sugar: raw sugar (cane and beet) and white sugar.

The overall fit of the regressions are consistent with the agricultural trade literature. The standard gravity variables have their expected signs and are of reasonable magnitudes. A 10% increase in domestic sugar beet/cane production in the exporting country increases sugar exports to the EU by 5%, raw sugar exports by 7% and white sugar exports by 4%. EU sugar imports also decrease with increasing bilateral distance which is a proxy for transportation costs. A 10% increase in the bilateral distance between countries decreases sugar imports by around 11%. Distance related trade costs affect white sugar more

Table 3: EU trade policies and sugar imports

	Sugar		Raw sugar		White sugar	
	(1)	(2)	(3)	(4)	(5)	(6)
Log Production$_{ikt}$	0.479***	0.339***	0.710***	0.470***	0.418***	0.300***
	(0.128)	(0.080)	(0.248)	(0.077)	(0.149)	(0.093)
Log Distance$_{ij}$	−1.111***	−0.704***	−1.012***	−0.540**	−1.150***	−0.680***
	(0.143)	(0.141)	(0.156)	(0.240)	(0.180)	(0.172)
Border$_{ij}$	1.410***	1.712***	1.728***	1.531***	1.365***	1.804***
	(0.229)	(0.330)	(0.180)	(0.420)	(0.279)	(0.408)
Language$_{ij}$	−0.152	−0.149	0.061	0.065	−0.293	−0.208
	(0.137)	(0.178)	(0.185)	(0.216)	(0.196)	(0.243)
Colony$_{ij}$	1.040***	0.901***	0.693**	0.716*	1.337***	0.862
	(0.243)	(0.340)	(0.311)	(0.411)	(0.353)	(0.648)
Log(1 + Tariff$_{ikt}$)	−0.008	−0.070**	0.035	−0.005	−0.143***	−0.217***
	(0.029)	(0.034)	(0.032)	(0.036)	(0.039)	(0.050)
Preference$_{it}$	1.335***		1.630***		0.743***	
	(0.195)		(0.269)		(0.270)	
ACP$_{it}$		2.062***		3.348***		0.624
		(0.389)		(0.384)		(0.603)
FTA$_{it}$		0.887***		1.462***		0.645*
		(0.258)		(0.285)		(0.372)
CXL$_i$		1.867***		2.134***		1.534***
		(0.280)		(0.341)		(0.411)
Balkan$_i$		2.970***		0.279		2.875***
		(0.614)		(0.779)		(0.620)
Intra EU$_i$		3.174***		4.237***		2.512***
		(0.507)		(0.614)		(0.563)
Observations	33,146		14,126		19,020	

***, **, * denote statistical significance at 1%, 5% and 10% respectively. Robust country-pair-product clustered standard errors in parentheses. Importer-product-time, exporter-product, and product-time fixed effects included columns (1), (3) and (5). Importer-product-time, Exporter region-product, and product-time fixed effects included in columns (2), (4) and (6). Intercepts and fixed effects included but not reported. Raw sugar = HS170111, HS170112, HS170113, and HS170114. White sugar = HS170191 and HS170199

than raw sugar. Speaking a common official language has no statistically significant effect on EU sugar imports, however, sharing a common border or having past colonial ties have a positive and statistically significant effect on sugar imports. In many cases applied tariffs do not have a statistically significant effect on EU sugar imports once we control for exporting country fixed effects[19]. The exception is for white sugar where we observe in column (5) that a 10% increase in applied bilateral tariffs will decrease imports by 14%.

As an empirical confirmation of the descriptive analysis, the coefficients of the preference variables are all positive and statistically significant, reflecting the trade enhancing effects of tariff and quota preferences on sugar imports of the EU. In column (1), having a trade preference increases sugar exports to the EU by almost 270% relative to the MFN group[20]. Disaggregating by the type of sugar, EU sugar preferences enhance raw sugar imports by about 400% (column 3) and white sugar imports by almost 110%. If we replace the time-invariant bilateral variables (i.e., the vector $\mathbf{Z}_{ij}$ in equation 3.4.1) with bilateral fixed effects, our main findings on the tariff and preference variables remain qualitatively the same and close in economic magnitude to the ones reported here (see Table A2 of the appendix). What also becomes clear is that compared to international sugar imports, the EU member states trade a lot more among themselves. This also gives credence to our decision to include and control for intra-EU trade.

We begin to observe substantial heterogeneity once we focus on the different preference groups and the different forms of sugar. What is, however, clear is that the different preference regimes each have a positive — and in many cases statistically significant — effect on EU sugar imports of both raw and white sugar. In column (2) the economic magnitudes of the trade effects are biggest for the Balkan countries, followed by the ACP group, the CXL and least for countries with bilateral agreements with the EU that cover preferences for sugar. In columns (4) and (6) we see that the different preferences affect raw and white sugar imports differently. For raw sugar, the effects are largest for the ACP group, followed by the CXL and FTA groups. For the Balkans, we see a small and statistically insignificant effect of preferences on raw sugar exports. These results can be explained by EU sugar imports being mostly cane sugar from the ACP group and the world's LDCs, and that the Balkan preferences do not cover raw sugar. Comparatively, white sugar imports are enhanced by eligibility for the Balkan and CXL preferences, but have negligible effects for EU imports from the ACP and FTA groups. This reflects, in part, the low level of sugar processing that is happening in many developing countries that make up the ACP. Interestingly, we see that a lot of the sugar imported into the EU region is actually a result of intra-EU trade. Compared to all the other preference groups and relative to the MFN group, the trade effect of EU membership on EU sugar imports is very high.

Overall, what we see is that EU trade policy in the sugar sector has mixed effects. Imports of raw and processed sugar are enhanced by preferential treatment but are hindered by custom tariffs. Nevertheless, measured as trade values, the trade enhancing effects of preferential treatment outweigh the trade reducing effects of customs tariffs. Our findings also justify why focusing on different forms of sugar — i.e., raw and white — is important as the composite sugar group in columns (2) masks interesting

[19]This finding is not surprising given that for majority of the MFN group pf exporters there is little variation in their tariffs over time. As a result the tariff variable is in many cases collinear with the country-specific fixed effect.

[20]We transform the coefficients on the trade dummies into trade volume effects using the following transformation: $[\exp(\beta_3) - 1] \times 100\%$.

heterogeneous findings across the preference groups.

To offer further insights into our findings, we assess how the preference effects vary across member states depending on their sugar refining capacities (Table 4). Within the EU, the UK and Portugal especially have high processing capacities. For example, the American Sugar Holdings group — which in 2010 acquired the EU sugar refining businesses of Tate & Lyle PLC — operates two sugar refineries in the UK and Portugal, with a total annual processing capacity of 1.5 million tonnes[21]. Hence, we define two country groups: Portugal and the UK (columns 1 and 2 in Table 4) and the rest of the EU-25 (columns 3 and 4 in Table 4). We observe that in most cases, the sugar preference effects on raw sugar imports from the ACP and FTA groups — both with unlimited duty-free access — into the UK and Portugal are higher than on imports into the EU-25. This is not surprising since production capacities in the ACP and FTA regions are mostly raw sugar which are meant for processing. Aside from imports from other member states of the EU, sugar preferences have no statistically significant effects on white sugar imports into the UK and Portugal. The exception is for the Balkan preference where the effect is also negative. This result is also in part because capacities in the Balkans are mainly white sugar which are not that interesting for refineries in the UK and Portugal. However, for white sugar imports into the EU-25, the Balkan preferences have a positive and statistically significant effect.

Table 4: EU trade policies and sugar imports: sample split by refinery group

	UK and Portugal		EU-25	
	(1)	(2)	(3)	(4)
	Raw sugar	White sugar	Raw sugar	White sugar
Log(1 + Tariff$_{ikt}$)	0.010	−0.186	−0.017	−0.219***
	(0.063)	(0.123)	(0.039)	(0.052)
ACP$_{it}$	4.257***	0.803	2.306***	0.424
	(0.886)	(0.956)	(0.414)	(0.632)
FTA$_{it}$	2.09***	0.066	1.001***	0.612
	(0.581)	(0.818)	(0.354)	(0.400)
CXL$_i$	1.839**	1.446	2.522***	1.551***
	(0.733)	(1.227)	(0.326)	(0.412)
Balkan$_i$		−2.193*	0.286	2.943***
		(1.248)	(0.816)	(0.635)
Intra EU$_i$		2.745**	4.468***	2.561***
		(1.334)	(0.640)	(0.586)
Observations	1,390	1,470	12,736	17,550

***, **, * denote statistical significance at 1%, 5% and 10% respectively. Robust country-pair-product clustered standard errors in parentheses. Importer-product-time, exporter-product, and product-time fixed effects included columns (1), (3) and (5). Importer-product-time, Exporter region-product, and product-time fixed effects included in columns (2), (4) and (6). Intercepts and fixed effects included but not reported. Raw sugar = HS170111, HS170112, HS170113, and HS170114. White sugar = HS170191 and HS170199. Controls for production, bilateral distance, colonial ties, contiguity and language are included but not reported for brevity.

[21] https://www.tateandlylesugars.com/about-us/asr.

3.5 Price transmission analysis

3.5.1 Overview

Price transmission analysis is based on the spatial arbitrage condition which is also known as the *Law of One Price* (LOP) in its weak form. Spatial arbitrage means that in a situation of price differences for a specific good between two geographic areas (e.g. domestic and international), traders will move these goods between the two locations if the price difference (margin) is larger than the expected trade costs. This increases the demand at the location with the lower price level, which in turn increases the price. When selling, it increases supply at the location with the previously higher price, driving prices at this location down. As a result, the prices in the two regions converge. Hence, the LOP suggests that at any point in time the price of a commodity in one location should equal the market price in another location. Differences between those prices may only be credited towards the costs of trading the good between the two locations (including transportation costs, tariffs and others). However, the LOP has to be interpreted as a long-run relationship while short-run deviations from the equilibrium due to exogenous shocks are likely and can have different sources. This will again incentivize arbitrageurs to take action which moves prices back towards the long run equilibrium (Fackler and Goodwin, 2001). As long as the commodity is homogeneous (i.e. quality differences are neglectable), a long-run relationship between the prices is expected to exist. Variations in prices due to changes in supply and demand in one of the regions will affect prices in both regions. Hence, we expect these markets to be fully integrated which means that price signals are completely transmitted across markets. However, different factors such as trade policies can hamper the proper transmission of price signals between the markets. The magnitude, the speed and the direction of price transmission can be empirically examined by the use of cointegration techniques. The cointegrating relationship is interpreted as the long-run equilibrium between the prices (Rapsomanikis, 2011; Rezitis, 2019; Kopp et al., 2017).

Figure 11: Price differential for non-preferential sugar imports

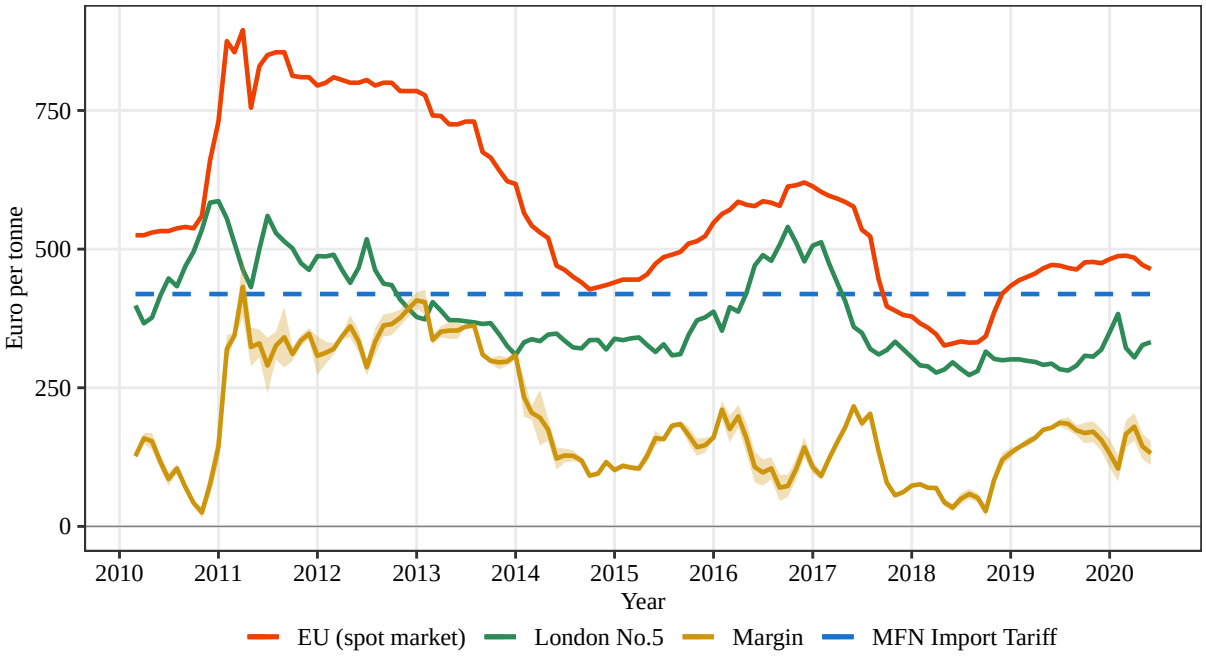


Figure 11 depicts the monthly spot price for white sugar in the EU and the monthly world market price which are already shown in figure 9. The margin depicts the monthly price differential between the EU and the world market price per tonne over time[22]. Importing sugar from non-preferential origins, under the full MFN import tariff of 419 Euro per tonne, is only profitable if the margin exceeds at least this tariff. Hence, the margin confirms the findings from figure 10, that there was nearly no incentive to import sugar from the non-preferential origins even in times of shortages – at least from this static perspective with monthly averages. This highlights that the very high MFN import tariff prevented spatial arbitrage and and presumably hampered price transmission between the world market and the EU as a consequence. Additionally, several factors might have led to an asymmetry in the transmission of price signals. Among these factors are the prevalence of contracts in the sugar market (the world market price is represented by a futures price) and concerns of market power in the sugar producing sector (e.g. Aragrande et al., 2017; Areté, 2012). The heterogeneity of sugar prices in the European countries as indicated by the range of the margin and especially the highly fluctuating margin in Figure 11 indicates, that a linear price transmission approach with a constant margin is not suitable.

3.5.2 Methodology

Since a linear price transmission is expected to be unsuitable for the following analysis of price transmission, we chose a non-linear autoregressive distributed lag (NARDL) model for the estimation. The NARDL model is a generalization of the autoregressive distributed lag approach (ARDL) proposed by Pesaran et al. (2001). In contrast to the commonly applied asymmetric error correction models, the NARDL can be used to simultaneously detect asymmetry in the long-run as well as in the short-run of price transmission. Assuming we have two time series such as y_t and x_t ($t = 1, 2, ..., T$), following Shin et al. (2014), non-linearity in the NARDL is introduced by decomposing the independent time series x_t into its positive (x_t^+) and negative (x_t^-) partial sums:

$$x_t = x_0 + x_t^+ + x_t^- \tag{3.5.1}$$

where x_t^+ and x_t^- are calculated as $\sum_{i=1}^{t} \Delta x_i^+$ and $\sum_{i=1}^{t} \Delta x_i^-$. This leads to the following representation of the asymmetric long-run (cointegrating) relationship between x and y:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t \tag{3.5.2}$$

The coefficients β^+ and β^- represent the asymmetric long-run coefficients corresponding to positive and negative changes in the independent variables, respectively (Shin et al., 2014). By associating a linear ARDL(p,q) model (Pesaran et al., 2001) with the asymmetric long-run relationship from equation 3.5.2, the following NARDL(p,q) model in error correction form can be obtained:

$$\Delta y_t = \alpha_0 + \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{i=1}^{p-1} \alpha_i \Delta y_{t-i} + \sum_{i=0}^{q-1} (\pi_i^+ \Delta x_{t-i}^+ \pi_i^- \Delta x_{t-i}^-) + \varepsilon_t \tag{3.5.3}$$

where Δ indicates first differences and p and q denote the lag order of the dependent variable and

[22] Since the spot price is an average of two regions (Mediterranean and Western Europe), it is additionally given as a range representing the maximum and minimum margin in the corresponding month.

the independent variables in the distributed lag part, respectively (Shin et al., 2014; Rezitis, 2019). The parameters π reflect short-run effects. The corresponding long-run coefficients from equation 3.5.2 can be obtained by $\beta^+ = -\frac{\theta^+}{\rho}$ and $\beta^- = -\frac{\theta^-}{\rho}$. The coefficient ρ can be interpreted as the speed to which the dependent variable y_t corrects deviations from the long-run equilibrium[23].

3.5.3 Results

First, we conduct different tests to determine the order of integration of the series. As pointed out by Philips (2018), the (N)ARDL model requires variables to be I(1)[24] or lower. Specifically, the dependent variable has to be I(1) whereas the independent variables can be either I(1) or I(0). We tested the variable for the order of integration using the Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1979) in which a unit root is present under the null hypothesis whereas Kwiatkowski et al. (1992) suggest a test routine (KPSS) which considers stationarity under the null hypothesis. Additionally, we apply a test proposed by Zivot and Andrews (2002) (ZA) which is robust in the presence of potential structural breaks. Table 5 depicts the test statistics of the variables in consideration. Given these test statistics, we conclude that all variables are I(1) or lower. The ZA test indicates that the order of integration is robust to structural breaks.

Table 5: Results of ADF, KPSS and ZA unit-toot tests

Variable (in logs)	**ADF**	**KPSS**	**ZA**
EU (ex-work)			
Level	-0.683	1.470^{***}	-2.844
1st Diff	-2.925^{***}	0.369^{*}	-8.422^{***}
EU (spot market)			
Level	-1.040	1.338^{***}	-2.720
1st Diff	-4.471^{***}	0.147	-8.225^{***}
London			
Level	-1.079	1.072^{***}	-3.693
1st Diff	-8.021^{***}	0.090	-9.227^{***}
ACP			
Level	-0.343	0.637^{**}	-8.279^{***}
1st Diff	-9.664^{***}	0.089	-19.872^{***}

***, **, * denote significance at 1%, 5% and 10% respectively.

The NARDL as given in equation 3.5.3 has been augmented by an additional independent variable and

[23] See Shin et al. (2014), Greenwood-Nimmo et al. (2013), Philips (2018) and Rezitis (2019) for more details on (N)ARDL estimation procedure and asymmetric price transmission.

[24] Integrated of order one.

control variables. Hence, for the NARDL$(1,1)$ the model can be rewritten as[25]

$$\begin{aligned}\Delta \mathrm{EU}_t = \alpha_0 + \rho \mathrm{EU}_{t-1} + \theta_0^+ \mathrm{London}_{t-1}^+ + \theta_0^- \mathrm{London}_{t-1}^- + \theta_1 \mathrm{ACP}_{t-1} + \theta_2 \mathrm{EU}_{t-1}^{spot} + \theta_3 D_{t-1}^{\mathrm{quota}} + \\ \varphi_0^+ \Delta \mathrm{London}_t^+ + \varphi_0^- \Delta \mathrm{London}_t^- + \varphi_1 \Delta \mathrm{ACP}_t + \varphi_2 \Delta \mathrm{EU}_t^{spot} + \\ \tau_0 \Delta D_t^{\mathrm{quota}} + \tau_1 D_t^{\mathrm{trend}} + \varepsilon_t\end{aligned} \tag{3.5.4}$$

The dependent variable EU_t and the independent variables LON_t, ACP_t and EU_t^{spot} represent the European price, the world market price, the ACP import price and the EU spot market price, respectively. Δ indicates first differences, hence φ captures short-run effects. The variable D_t^{quota} represents a dummy variable to capture effects of the terminated production quota in the EU in MY 2017/18, taking the value 0 until September 2017 and 1 after the quota ended in October 2017. The dummy enters the equation i) in first differences, capturing immediate short-run effects as an impulse dummy and ii) in levels, capturing effects on price levels in the long-run.

The results are presented in Table 6. The Breusch-Godfrey test for serial correlation indicates that residuals are free of autocorrelation for up to 12 lags (months) which represents an adequate period considering the frequency of the data. Based on the results from Table 6, a bounds test was conducted to test for the presence of an asymmetric (cointegrating) long-run relationship among the price series. Firstly, Shin et al. (2014) suggest the procedure proposed by Banerjee et al. (1998) using the t-statistic for the null hypothesis of $\rho = 0$ (t_{BDM}). Secondly, the authors follow Pesaran et al. (2001) and propose an F-test for the joint null hypothesis of $\rho = \theta_0^+ = \theta_0^- = \theta_1 = \theta_2 = 0$ (F_{PSS}). Both the t_{BDM} and F_{PSS} statistics reject the null hypothesis. Hence, cointegration can be presumed.

The results displayed in Table 6 indicate that the officially reported EU price, which is based on prices reported by EU sugar factories, is significantly affected by the ACP, the EU spot market price and the world market price. Table 7 reports the long-run price transmission elasticities for ACP, world market and the EU spot market as well as the effect of the ending quota in the long-run equilibrium. The latter indicates, that with the end of the quota the gap between the EU ex-work price and the other price series has decreased statistically significant. Regarding the world market price, the Wald test confirms that the ex-work price is asymmetrically affected by the world market price in the long-run. The coefficients shown in table 7 indicate, that an increase in the futures price for sugar on the world market (ceteris paribus) transmits to an increase in the EU sugar price reported by the factories in the long-run. More specifically, the result suggests that an increase of the sugar price on the world market by one percent leads to an increase of the EU price by 0.39 percent in the long-run. Interestingly, a decline in the world market price for sugar, does not result in a decline of the EU price reported by the factories but in an increase with nearly the same magnitude. In the short-run, the EU price is not significantly affected by changes in the world market price. The asymmetry in the long-run and the absence of statistically significant short-run interactions with the world market price is interpreted as i) a strong indication of the effective protection of the EU market from movements in the world market price by the European agricultural and market policy and ii) a sign of market power that is exerted by the European sugar industry – attempting to maintain prices within Europe at a higher level. This has already been pointed out in previous studies (e.g. Areté, 2012; Aragrande et al., 2017; Tangermann, 2012). However, it has

[25] For technical reasons, variable ΔLondon was also split into positive and negative changes, although differences in the estimated coefficients φ_0^+ and φ_0^- are not statistically significant.

Table 6: NARDL with asymmetry imposed for London

Var.	Coeff.	S.E.
EU_{t-1}	-0.178^{***}	0.029
$London^{+}_{t-1}$	0.069^{***}	0.025
$London^{-}_{t-1}$	-0.056	0.037
ACP_{t-1}	0.064^{***}	0.022
$EU^{(spot)}_{t-1}$	0.150^{***}	0.019
$Quota_{t-1}$	-0.022^{*}	0.011
ΔEU_{t-7}	-0.201^{***}	0.074
ΔEU_{t-11}	-0.223^{***}	0.074
$\Delta London^{+}$	0.010	0.062
$\Delta London^{-}$	0.026	0.072
$\Delta EU^{(spot)}$	0.051	0.050
$\Delta EU^{(spot)}_{t-5}$	-0.161^{***}	0.045
ΔACP	0.050^{***}	0.014
$\Delta Quota$	-0.112^{***}	0.019
Trend	-0.003^{**}	0.001
Constant	-0.255	0.156
χ^2_{SC}	$14.318[0.281]$	
R^2	0.727	
$\overline{R}^2$	0.679	
F_{PSS}	21.654^{***}	
t_{BDM}	-6.178^{***}	

***, **, * denote significance at 1%, 5% and 10% respectively. Based on Pesaran et al. (2001), the critical values (bounds) for the F_{PSS} (t_{BDM}) for $k = 3$ and for ***, ** and * are 6.36 (-4.73), 5.07 (-4.16) and 4.45 (-3.84), respectively. χ^2_{SC} denotes Breusch-Godfrey tests for serial correlation up to 12 lags. Figures in square parentheses are the associated p-values.

Table 7: Asymmetric long-run price transmission elasticities

Var.	Coeff.	S.E.
$London^{+}$	0.387^{***}	(0.144)
$London^{-}$	-0.316^{*}	(0.182)
ACP	0.362^{***}	(0.101)
EU (spot market)	0.842^{***}	(0.137)
Quota	-0.124^{**}	(0.053)

***, **, * denote statistical significance at 1%, 5%, and 10%, respectively. The long-run coefficients are obtained by $\hat{\beta} = -\frac{\hat{\theta}}{\hat{\rho}}$

not been specifically tested for market power in this report.

Turning to the long-run price transmission elasticity of the ACP price, a one percent increase (decrease) of the raw sugar price for ACP imports leads to an increase (decrease) of the EU ex-works price for white sugar by 0.36 percent. Regarding short-run movements, the EU price is affected by changes in the ACP price but only weakly. Since sugar imports from ACP countries are not subject to tariffs, the symmetric transmission of price signals is not surprising. At the same time, the magnitude of the effects is rather small. Imports from ACP countries are mainly raw sugar which must first be refined and thus also ACP imports find their way to the European (white) sugar market via European sugar factories. Hence, if market power is exercised here, it is not surprising that price signals from the ACP countries are only passed on to a limited extent to the EU price. Additionally, the amount of sugar that ACP countries export to the EU is also dependent on the price level on international markets and the price differential between EU and world market. Hence, if the world market price is comparatively low (high), imported quantities from ACP countries are increasing (decreasing). This could dampen the transmission of price signals.

With regard to the spot market price in the EU, the estimates suggest that the long-run price transmission elasticity is rather high: A one percent change in the EU spot market price leads to a change in EU ex-work price by 0.84 percent in the long-run. In the short-run, however, the results suggest that it takes some time for at least parts of the spot price changes to be reflected in the officially reported EU price.

The overall speed of adjustment indicates that the EU price corrects (only) 17.8% of the deviations from the long-run equilibrium within a month. This means that it takes nearly four months to correct 50% of a shock to the long-run equilibrium and more that two years to correct 99% of the deviation. This is rather slow but is in line with our initial suspicion of little market integration, because several factors were identified that might have impeded the proper transmission of price signals between the markets.

The results of the price transmission analysis indicate that movements of the world market price for sugar are not well reflected in the officially reported price for white sugar in the EU. We have identified several reasons for this. Besides the influence of the ACP price, which reflects the prices of duty-free raw sugar imports from ACP countries, the instruments of the European sugar market organization also play a decisive role. In addition to the high tariff, which prevents imports from third countries even in periods of shortages, the quota had an effect on the EU ex-work price. The asymmetry in the long-run relation between EU and world market price leads to the fact that signals from the world market affect the EU market only in one direction. A possible explanation for this could be that – due to the high concentration in the EU sugar production and favored by the SMO – European sugar producers exert market power in order to maintain high levels of sugar prices in the EU.

4 The view into the future - scenario analyses

The final sections combine the assessment of future developments in the European sugar sector along various dimensions. To systematise these very different developments, they are bundled into sets of scenarios. For each of these scenarios, we provide first the economic rationale, with repeating the market diagram that describes the current situation (Figure 3), followed by one with corresponding modifications. Subsequently we employ the parameterised models from the previous sections to derive quantitatively well informed predictions. Along these lines we model the consequences of changes to the world prices,

of substantial policy changes in the EU through a drastic reduction of the intervention price, and the effects of possible expansion of production capacities in countries benefiting from preferences, or the expansion of the preferences themselves.

This quantitative development of scenarios is followed by qualitative insights on what we term "uncertain potential game changes" — developments which bear the potential to cause dramatic upheavals in the EU sugar market but are very difficult to grasp today in terms of exact numbers.

4.1 World price changes substantially – in either direction

The first set of scenarios illustrates the effects of changes in the world market price for sugar. We differentiate between a situation in which the EU is a net exporter or a net importer. The future world price levels depend firstly on policy adjustments in the Rest of the World (RoW). Examples include the unclear situation in India, which currently relies on interventionist policies such as subsidies in marketing and replanting. The question is whether these measures stay in place or the government subsides to international pressure and abandons these policies. While Brazil passed a law in 2017 that ethanol content in fuels should rise to 40% (Haß, 2020), the future development of the bioethanol policies remain unclear. Nutrition policies such as soda taxes have been implemented in a few countries (e.g., in Italy from July 2020, Haß, 2020) and are discussed in many more countries. Taking the Paris Agreement on climate gas emissions seriously will at one point hold the agricultural sector accountable for its emissions like other industries, with corresponding repercussions on supply. And finally, additional free trade agreements involving major sugar exporters (most notably, Brazil) are under negotiation.

Figure 12 presents the reference scenario whereas figures 13 and 14 illustrate what would happen if the world price was to increase, distinguished by the level of the increase[26]. It becomes clear that even a moderate increase in world prices is going to raise EU prices, too. If world prices were to increase to a high degree, it would turn the EU from a net importer to a net exporter.

Based on the results from the price transmission analysis carried out above, we simulate the dynamic reaction of the EU price from one equilibrium to a new equilibrium due to shocks of the independent variables. Figure 15 depicts the cumulative change of the EU price as a response to the shock in the world market price by one standard deviation (SD) (20.9"%) and by 1.96 SDs (41.01%)[27]. For both scenarios the green line indicates the response to a positive change in the world market price whereas the red line indicates a negative change, respectively. As the figures show, the reaction of the EU price is highly asymmetric which is indicated by the grey line. A positive shock to the world market by one SD is transmitted to the EU price almost by half when it reached its new equilibrium after approximately two years, the larger shock of 1.96 SDs is transmitted at a comparable scale. At the time when the new equilibrium is reached, the initial positive shock of 41% ends up in an increase of the EU price by around 17%. The simulations also show that a negative shock results in a positive change of the EU price.

[26] The scenario in which the world price decreases is not modelled, as we would expect little consequences on the current situation as it is highly unrealistic to have a RoW autarky price that is below the EU price after tariffs are added.

[27] Assuming a normal distribution of the prices, only 5% of the shocks exceed a change of 1.96 standard deviations in absolute terms. This translates into a period-to-period change of about 41%.

Figure 12: Reference scenario

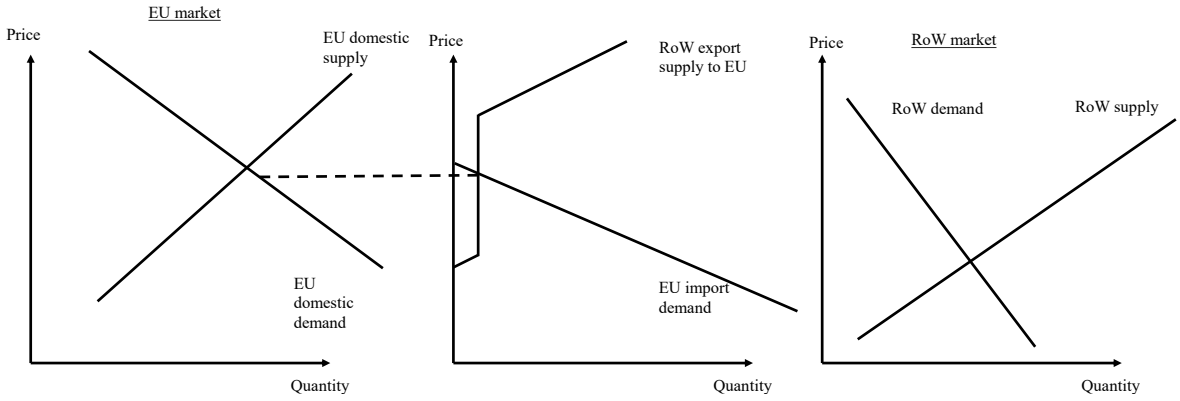


Figure 13: Price increase in RoW , below EU reference price

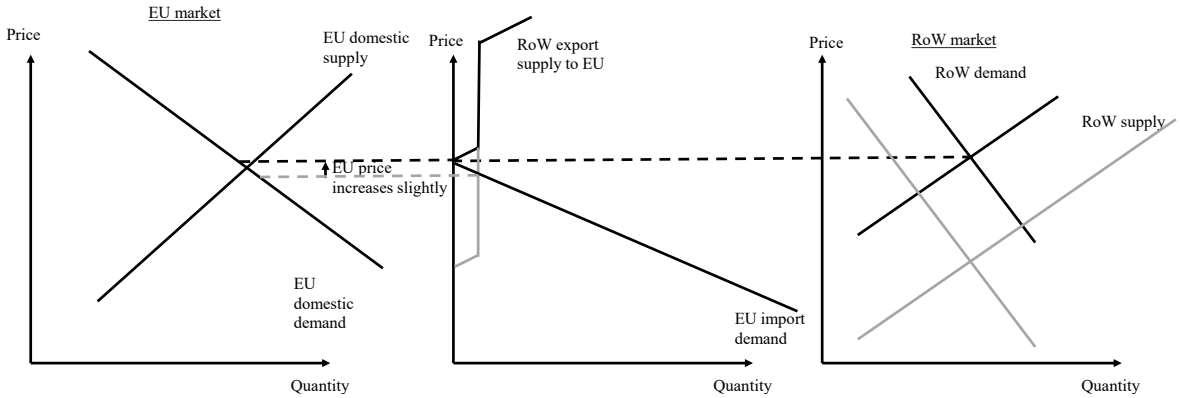


Figure 14: Price increase in RoW , above EU reference price

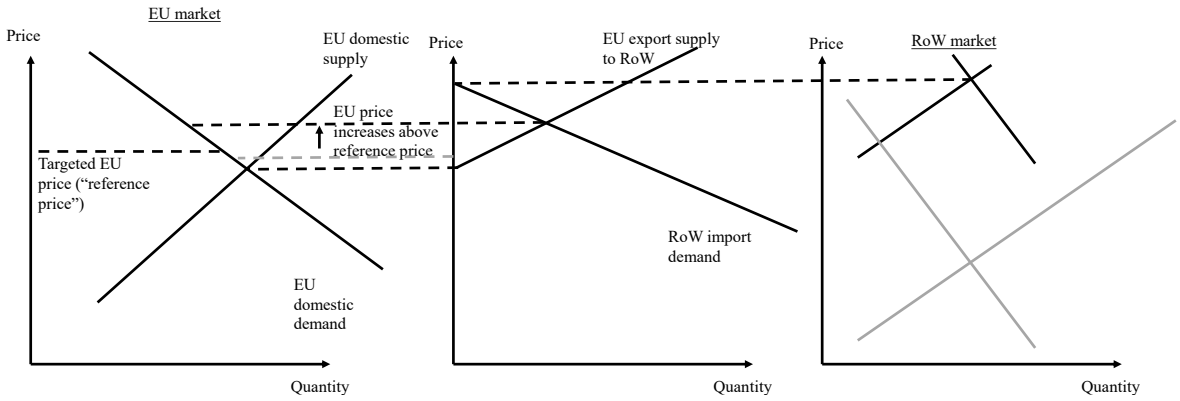
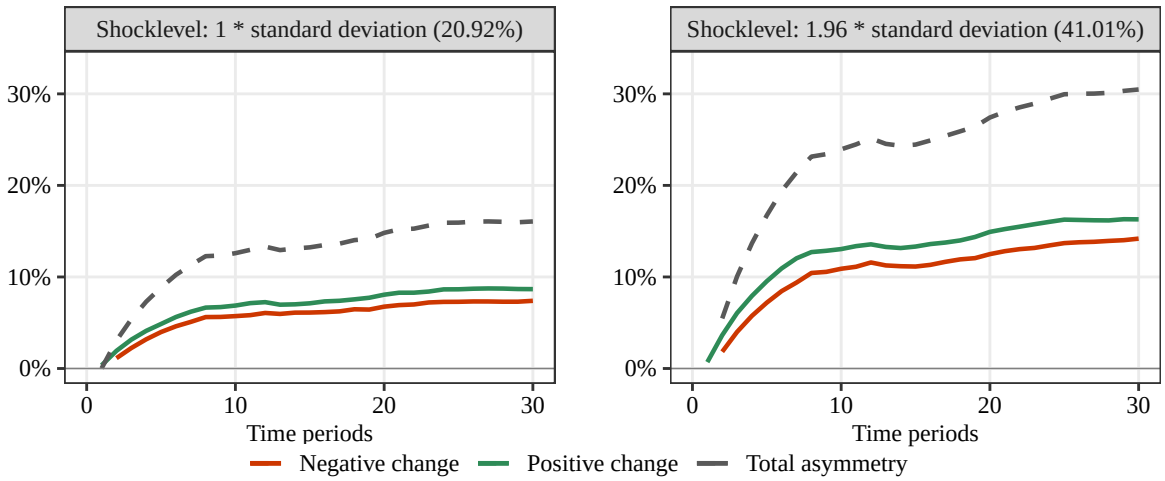


Figure 15: Cumulative effect of change in world market price on EU price



4.2 Market and policy process I in EU: further liberalization (drastic reduction of MFN tariff)

Although the still ongoing negotiations on the CAP reform process are largely focused on the future shape of the domestic agricultural policy mix, the overall effects of the CAP should not exclude potential changes to the EU tariff structure. The complete elimination of any external protection measures in the EU sugar market is chosen as a scenario here in order to identify the expected changes of such a move, despite the reluctance of the EU commission, let alone other agricultural policy makers, to touch the tariff structure of the EU outside the framework of multilateral trade negotiations. Since the persistent stall in WTO negotiations is unlikely to change in the near future, EU policy makers should at least consider the possibility of changing tariffs unilaterally.

The outcomes of such an unilateral elimination of the EU's import tariffs depend on the net trade position. If EU prices were below world prices, i.e., whenever the EU is a net exporter, a drastic reduction of the import tariff on sugar would not cause any measurable consequences. However, if EU prices are above world prices, an abolishment of the MFN tariff would cause EU prices to decrease as Figure 17 illustrates by a reduction of the tariff-induced vertical shift of the RoW export supply function to a tiny fraction of the previous value.

This is illustrated empirically with the gravity model by modelling what would happen if every country had preferences, as displayed in Table 8. According to these simulations, the complete abolition of import duties would lead to an increase of sugar supply to the EU of 0.5%. Note that this is based on a ceteris paribus assumption regarding the level of price transmission. The gravity model is estimated based on the historical constellations of policies and prices. Therefore, it is by construction not fully capable of capturing the dynamic effects of a full liberalisation of the EU sugar trade policies. Such dynamic effects include increased foreign competition that in turn eliminates asymmetries in price transmission, and increases the speed of adjustment of EU prices to international price changes. Furthermore, markups between EU domestic prices and international prices that are likely present in at least some EU regions will also come under pressure. The magnitude of such dynamics will likely magnify the indicated initial modest response in imports.

Figure 16: Reference scenario

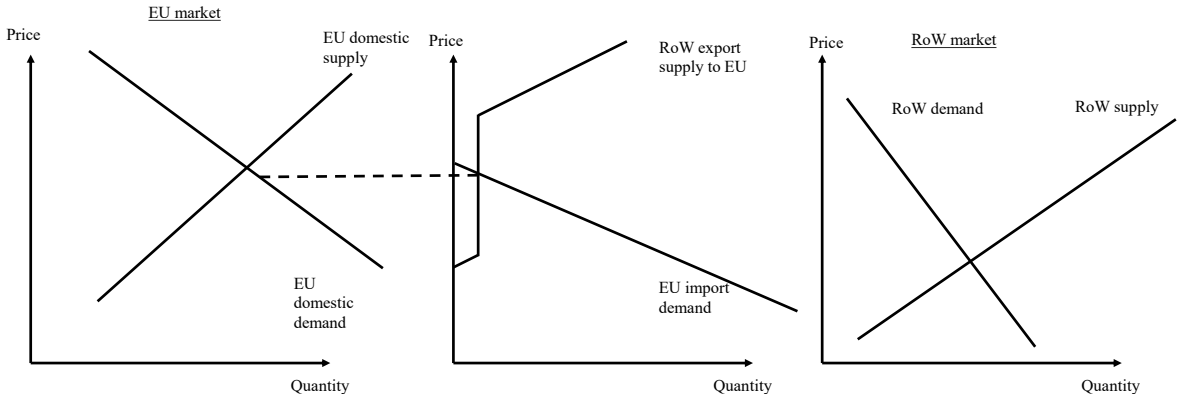


Figure 17: Further liberalization (drastic reduction of MFN tariff)

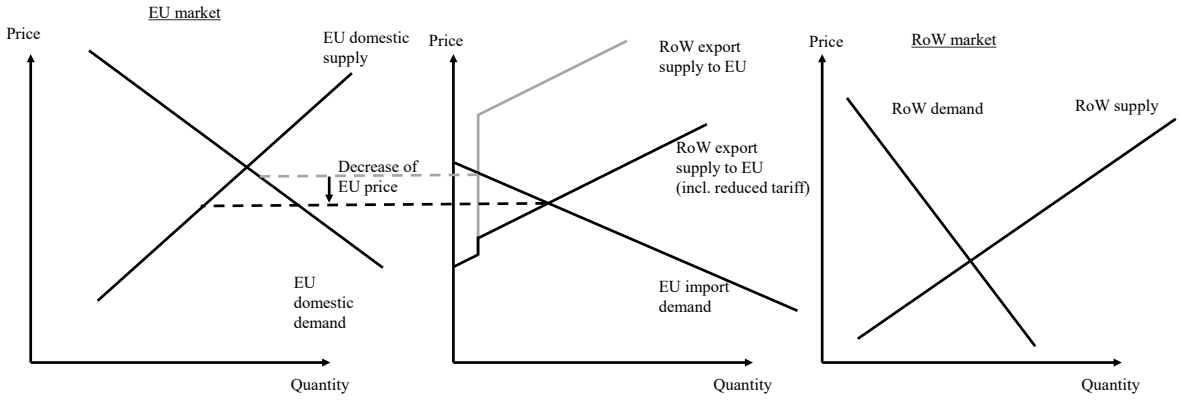


Table 8: Simulated change in total EU imports in 2018

Predicted imports (A)	Scenario	Simulated imports (B)	Difference ($B-A$)	% change
3474	10% production increase in ACP	3493	19	+0.532
3474	25% production increase in ACP	3519	45	+1.276
3474	50% production increase in ACP	3560	85	+2.397
3474	All countries have preferences	3491	16	+0.470

All trade values are reported in EUR million.

4.3 Holders of preferences expand production capacities or more preferences are granted

The third set of scenarios describes an increased inflow of raw sugar via preferential trade. These increases in preferential imports can have two causes: either the countries that enjoy unlimited preferential treatment (i.e., the EPA beneficiaries) further increase their production capacities when they expect prices to increase. This has been happening in the 2010-2013 period when EU prices were at their peak of the

last two decades (Figure 10)[28]. The second reason is the expansion of tariff free quotas which is likely to happen soon, given the FTA between the EU and Mercosur, as well as against the background of ongoing FTA negotiations with Australia, India, and Thailand (although the latter two agreements have been put on hold and thus are not likely to materialize in the near future). The EU commission has highlighted in its impact assessments on the EU-Australia FTA from 2016 that agricultural exports, including sugar, are a sensitive aspect in this FTA. Hence, addtional TRQs for sugar are likely to be part of the final negotiation package. Figure 19 shows that increasing production capacities and/or additional preferences cause increased preferential imports and a reduction in the European price. This holds as long as no imports above the total preferential quantity occurs. In settings where EU domestic supply would be substantially lower, so that already in Figure 18 substantial imports beyond the preferential quantity exist, thus with very high EU prices, this stabilizing effect of additional preferences on dampening upward price swings is greatly reduced.

Figure 18: Reference scenario

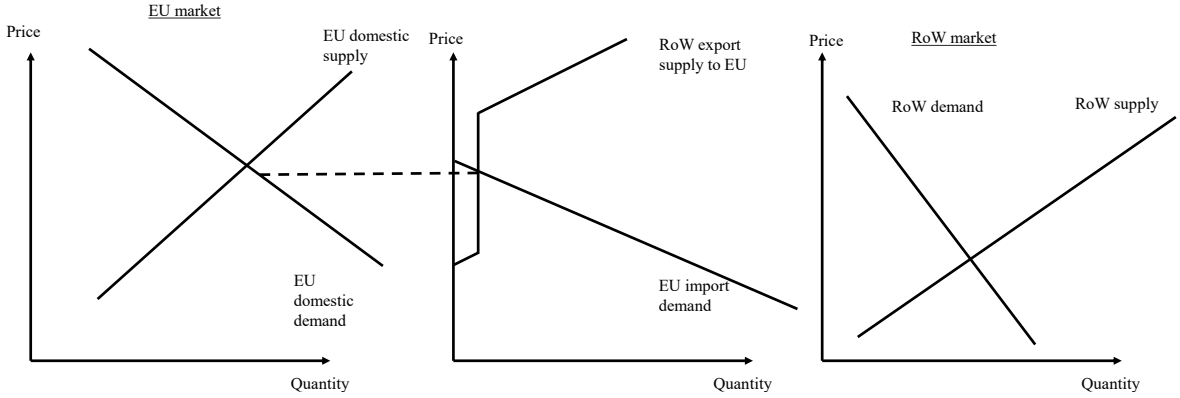
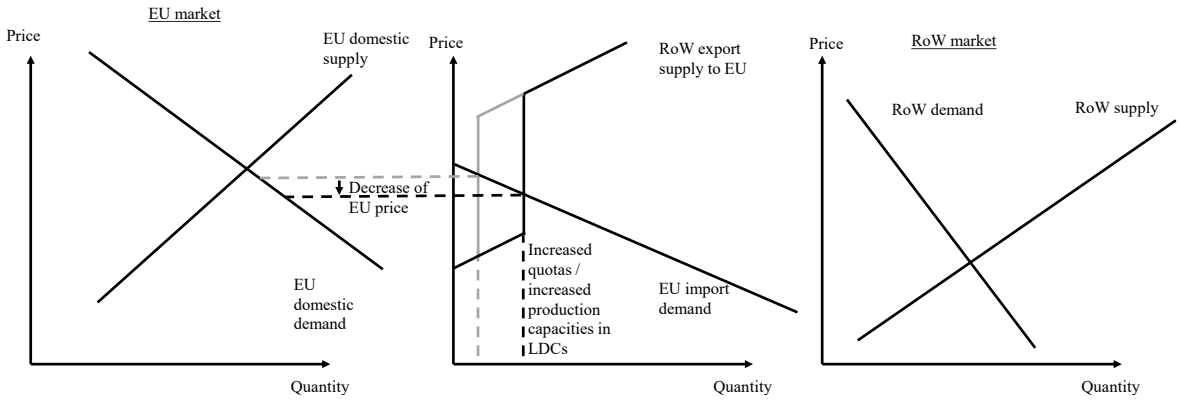


Figure 19: Holders of unlimited preferences expand production capacities

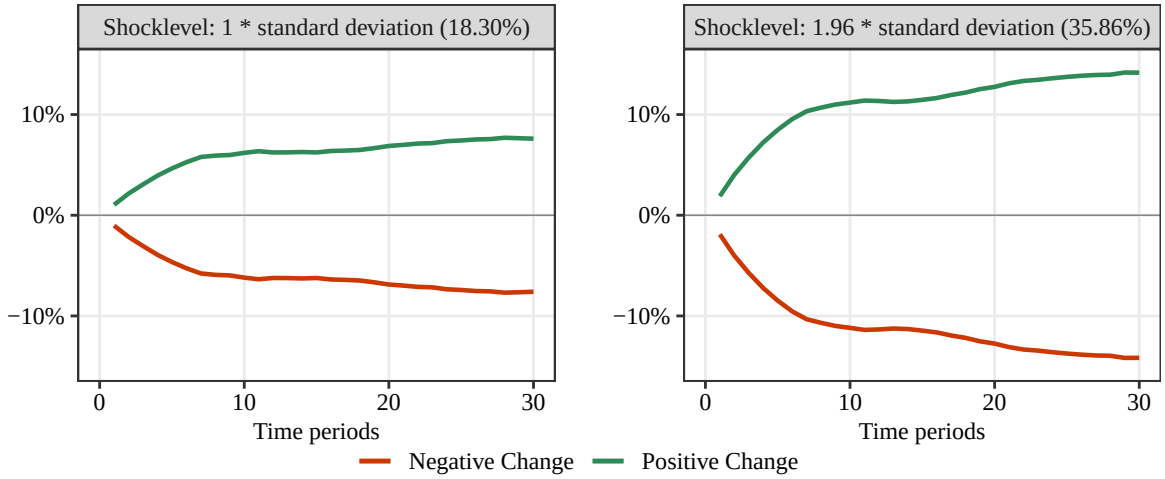


Given that we have established the trade enhancing effect of preferences on sugar imports, the estimated models allow us to determine what happens to EU imports if production capacities increase in countries that benefit from these preferences. The results of counterfactual changes in the EU import volumes if sugar production increased by different proportions in the ACP region in 2018 — whilst

[28]Note that in times of relatively low EU prices, such as in the period since 2014, ACP and LDC exports decrease, as can be also seen in Figure 10.

holding production in all other countries including the EU fixed — are shown in Table 8. The ACP group has unlimited duty-free and quota-free access to the EU sugar market, although safeguards could limit extreme changes in imported volumes.

Figure 20: Cumulative effect of change in ACP price on EU price (symmetric by construction)



As shown in Table 8, the increased production leads to slightly increased imports from these countries. This is likely to reduce the ACP import price, which in turn will be transmitted to the EU price. Figure 20 illustrates how a shock to the ACP price will be transmitted to the European price level, which is based on the results from the price transmission analysis carried out above. It depicts the cumulative change of the EU price as a response to the change in the ACP price by one standard deviation (SD) (18.30%) and by 1.96 SDs (35.86%)[29]. Again, the green line indicates the response to a positive change in the ACP price whereas the red line indicates a negative change, respectively. As the figures show, the reaction of the EU price is symmetric which is indicated by the fact that the two lines follow an identical path. A shock in the ACP price leads to a price change in the EU but at a smaller magnitude. Hence, the associated negative price change associated with the production increases in the ACP countries is expected to be transmitted only to a limited extent to the EU.

As in the previous scenario, the dynamic effects might differ from the static analysis. Since the competition will not increase as strongly as with the full liberalisation scenario, the dynamic effects on price transmission might likely be much more limited. Furthermore, the expansion of production capacities in the preferentially treated countries could take place through foreign direct investments by EU players in the sugar processing chain. In that case, the competition intensity could even become lower in the longer run, with the potential for even higher markups.

5 Uncertain game changers

The sugar markets are subject to a number of further shocks in the future. What these have in common is that they are difficult to predict, given especially political uncertainty, but are at the same time associated

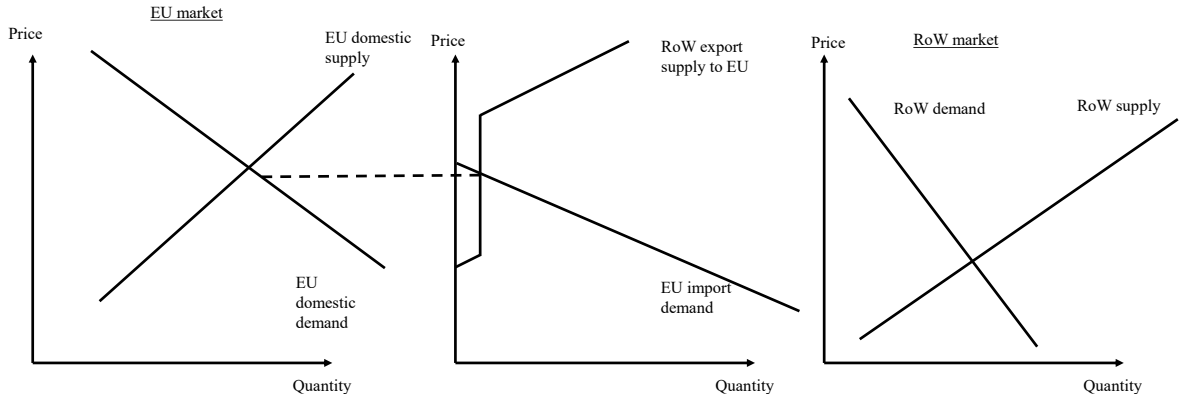
[29] Assuming a normal distribution of the prices, only 5% of the shocks exceed a change of 1.96 standard deviations in absolute terms. This translates into a period-to-period change of about 36%.

with potentially tremendous consequences. Therefore the following assessments are of purely qualitative nature based on approximate definitions of scenarios.

5.1 Brexit – agreement and its implementation

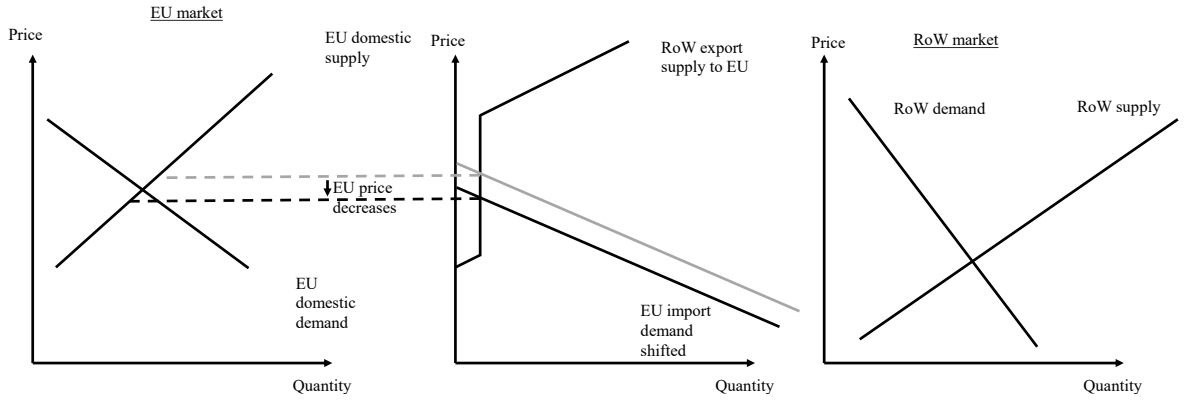
The long negotiations between the EU and the UK regarding the future relations between the EU and the UK have been brought to a conclusion just before the deadline set by UK's administration's would have passed at the end of 2020. A Hard Brexit, which would have left the UK from the EU's perspective as an arbitrary third country, was avoided, and the agreement is in many aspects close to continued economic integration with some areas where little common ground was agreed upon. As the first months have shown, the actual implementation of the agreement is still subject to substantial differences in the interpretation. The outcome in the medium term will likely lie between the extreme ends. The case of full economic integration, where essentially no change in sugar trade would occur compared to the current situation, is shown in the reference scenario (Figure 21).

Figure 21: Reference scenario



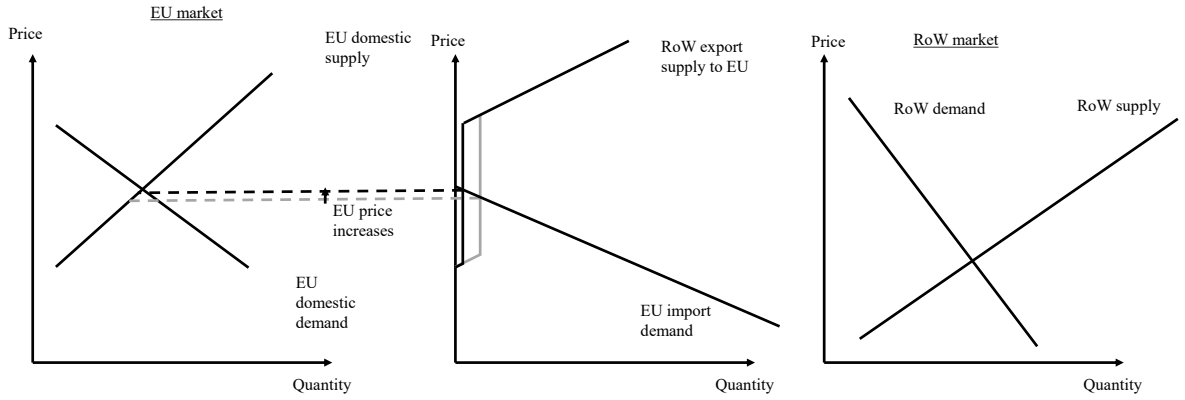
A Hard Brexit would have reduced both demand and supply of sugar in the EU-27 relative to the EU-28, illustrated by a horizontal, leftward shift of both supply and demand curves in the EU. However, the demand curve moves further, since with the UK the largest importer of sugar leaves the union (Haß, 2020). As Table 4 indicates, the effects of preferences on raw sugar imports are generally larger for the UK (and Portugal) compared to the rest of the EU-25. Figure 22 shows that this would cause a decrease in the EU price.

Figure 22: Hard brexit



In December 2020, the UK has decided to introduce an autonomous tariff rate quote for raw sugar of 260,00 t. Albeit UK sugar beet farmers objecting to this quota, it seems more likely that this quota will replace some of the current white sugar imports from the EU, and withdraw some ACP raw sugar from the EU-27 destinations to the UK. If the latter redirect a substantial share of their exports to the UK, the inflow of preferentially treated sugar into the EU will decrease, causing a slight increase in the sugar price (Figure 23)[30]. The policy process shaping the future UK sugar trade policy will largely depend on the negotiations of the web of free trade agreements that the current UK government seems to envision. In these negotiations, agriculture, including sugar, will be an area where UK as a substantial net importer will be granting preferences in exchange for improved market access for British exporters. The exact outcome for UK total sugar supply will depend on the relative strength of the sugar cane refiners vs. beet processors. While the former group has already been an enthusiastic supporter of Brexit and continues to lobby for a liberal UK import regime, the latter favoured a much stronger integration with the European Union, and will object any additional import preferences for sugar. The outcome will only become visible once Britain's first FTA agreements with major sugar producers are on the table.

Figure 23: Hard Brexit, UK becomes more attractive than EU for many ACP and LCD exports



[30]Some preferential exports to EU will remain, namely the ones that export within quotas, i.e., the ones that are not bound by capacity restrictions.

5.2 Effects of SARS-CoV-2 pandemic

For more than a year, the world is confronted with the Covid-19 pandemic, which will leave many countries in a dramatically different state. Estimates predict that the GDP in Germany, which is one of the countries the least affected, will take more than one year to recover to the pre-crisis level (Holtemöller et al., 2020). Even though vaccines are becoming increasingly available since the beginning of 2021, limited vaccine availability and uncertainties about new virus variants are likely to persist for the near future. Hence, all predictions made here must be taken with a grain of salt. What is already clear is that on the short run (after the immediate reaction of panic-shoppers had died off), demand for food products and sugar in particular decreased in all countries that have implemented measures of social distancing, such as closing down of hotels and restaurants (Nicola et al., 2020). Second, international transport prices decreased tremendously, caused by a sudden decrease in international trade and therefore less demand for the existing transport capacities. This combined with a rather inelastic supply of raw sugar is expected to have caused a sharp decline in sugar prices. One opposing factor is the reduced availability of seasonal workers. While this is not an issue in the EU where beet production does not rely substantially on seasonal workers, the sugar cane production in the tropics depends on cheap migratory workers, for example in India (Paramita Sahoo and Rath, 2020). When looking at the medium- and long run effects, it became clear already during the early weeks of the crisis that countries tended to return to nationalist policies. This might be followed by a stronger focus on self-sufficiency and a general move to de-globalisation in post crisis policies. Busch et al. (2020) found already in the early weeks of the crisis that the majority of German citizens would support a higher level of national self-sufficiency on food. In light of the ongoing discussions about the reform of the Common Agricultural Policy (see next section), such developments could lead to a more interventionist nature of the future policy, including a revival of direct market interventions.

5.3 Market and policy processes at the EU level

The Common Agricultural Policy (CAP) has been the cornerstone of price formation processes in the European sugar market since the Common Market Organisation for sugar had been established in 1968. In section 2, the decisive role of the policy interventions in the various phases of the CAP has been described in detail. Currently, however, the direct effects of the CAP are relatively limited since a wide range of CAP measures with direct effects on EU sugar prices has now been reduced to only one element: Direct payments to sugarbeet producers that are coupled to production. While the original direct payments as they had been introduced in the Fischler reform of 2003 were planned as fully decoupled from farmers' production decisions, the various subsequent reforms have allowed that a majority of EU member states has re-coupled a non-negligible share of the direct payments to farmers' sugarbeet area.

At the heart of the Commission's proposal for the upcoming CAP reform is an even wider scope for the member states to adapt the overall CAP framework to their needs. Although there is currently a stalemate in the process that has been exacerbated by the Covid-19 crisis, this element of additional subsidiarity is likely to be part of the final CAP reform agreement. Member states will have to set up their own National Strategic Plans, spelling out their mix of objectives, and selecting appropriate measures from the overall portfolio of CAP instruments that is to be agreed upon at the EU level.

While the final outcomes of this reform are far from being clear at this stage, this step towards greater

subsidiarity in general is an important step to increase both the acceptance of the CAP, and its effectiveness in contributing to objectives that are better tailored to the needs of each member state. In the particular context of direct payments, however, the picture is more mixed. The ongoing trilogue process between Commission, Council, and Parliament has already revealed that a substantial number of member states is pushing for a more interventionist nature of the CAP, and such intentions are in particular focused on those subsectors of agriculture where there has been a focus on interventionist policies in the past, i.e., dairy and sugar. Some demands towards an increased scope for an even stronger re-coupling of direct payments than under the current rules might lead to distorted incentives for sugarbeet production among the member states. Would such demands find their way into the final reform package, then more sugarbeet production would be kept in regions where comparative advantages for producing sugarbeet and processing sugar are rather limited. This would, on average, lead to higher production costs for sugarbeet in Europe, and an increased volume of production compared to fully decoupled direct payments. With the higher domestic supply of sugar, a scenario with strong import dependence, however, becomes more unlikely so that the sugar market in the EU would be less likely to become fully import-dependent.

The broader EU policy framework of the European Green Deal has the potential to change the nature of the CAP in more fundamental ways. Notably, the two strategy plans that were published in May 2020, have potentially large repercussions on the production of sugarbeet in the EU. The Farm to Fork strategy puts forward a 50% reduction commitment on the use and risk of pesticides in general, and a reduction in the same magnitude for the use of hazardous chemicals. These reductions should be met by 2030. While this sounds as a relatively remote point in time, the lengthy development and regulation process for new pesticides effectively shrinks this decade substantially. The development of new pesticides that are to be ready for use by farmers in 2030 has to start about now, and it is unclear whether the pesticide industry sees sugarbeet as their main priority, given the relative small market size and the current heterogeneity in pesticide regulations between EU member states. Other stipulations from the Farm to Fork strategy, e.g., reductions in fertilizer use and promotion of organic farming, are probably less relevant for the EU sugar supply. The demand side issues, however, might turn out to be more decisive. The mandatory nutritional labelling that the Commission plans to require front-of-pack in an EU-wide harmonised way might be one of the desirable yet hard to implement measures. If these plan succeed, though, a decrease of demand for sugar-containing food products cannot be ruled out.

The biodiversity strategy will in a similar vein lead to higher production costs and, more importantly, reduced availability of land for intensive agricultural production in the EU. Targets such as legally protecting at least 30% of the EU's land area, dedicating at least 25% of agricultural land organic production, or planting at least 3 billion new trees by 2030 will divert substantial land resources either completely away from agriculture or towards less intensive forms of agriculture. Sugarbeet, with its relatively high intensity, will likely get particularly under pressure so that the move into a net import situation, where the current prohibitively high tariffs become decisive for price formation, is more likely to occur.

6 Conclusion

This report shows that in the past the political target to shield EU sugar producers from competition from the rest of the world has been effective, with the tariffs in place preventing almost any inflow of sugar into the European Union from non-preferred sugar exporters. Therefore, the vast majority of

sugar imports to the EU occurred under preferential trade agreements, leading to a close integration and corresponding transmission of price signals between the European sugar market with the sugar markets in ACP countries. With the world market, however, there is only limited integration – price shocks that occur on the international market are only partially transmitted, and some evidence for asymmetry was found.

In times of low European prices caused by slight decreases in the demand due to health related policies and temporarily stagnating supply despite production decreases following the abolition of the quota (due to high stocks), the European Union becomes a net exporter, as observed during the marketing year 2017/18. In these times, import tariffs are ineffective, and preferentially treated countries have only a limited advantage over sugar producers in the rest of the world that do not enjoy trade preferences. Nevertheless, at least in scenarios with low international prices, supplying preferential sugar to the EU continues to be an attractive option to the ACP exporters, given the relative size and stability of EU domestic demand. Hence, the major effect of the tariff regime in such phases seems to be a stabilizing effect regarding the origins of sugar imports.

However, projections indicate that this is a rather temporary phenomenon and that the EU supply will continue to fall, turning the EU into a net importer, again. Once the EU turns back into the net import situation due to a reduction in output quantity, an abolition of tariffs would keep the EU price tied to global price developments. With an unchanged tariff regime, however, any substantial shortfall of supply in the EU will lead to increases in the EU sugar prices. As long as additional preferential imports can be mobilized to compensate the deficit in the EU, these price increases will largely remain connected to international price developments. However, if accompanied by substantial price increases on the international market, diversion of ACP export capacities to other countries might happen so that a continued delivery to the EU would require additional price premiums to be paid, a scenario not unlike the situation that has dominated in 2012 and 2013.

In case that the EU remains a net exporter, a drastic reduction or even removal of import tariffs will have limited consequences. In the latter case, dynamics in the global market for sugar would be largely transmitted to the EU market. In the import situation, price increases in the rest of the world will be transmitted to the EU market only partially and at low speed as long as the tariffs remain in place. Scenario analyses and a discussion of uncertain game changers suggest that the import case seems to be more likely to occur.

This report also looked at the effects of an output increase in the countries that enjoy unlimited preferential access within the EBA agreement which are currently only bound by production capacities. These effects are similar to the ones of an increase of the tariff-rate quotas assigned to third countries, for example as part of regional trade agreements. An increase of these capacities/quotas will increase preferential imports and correspondingly decrease the price level within the EU.

In light of the long-run developments at the EU level, the signs point toward a re-orientation of both the broad EU policy and the CAP from the productivity objective towards environmental objectives. These scenarios reduce incentives for sugar production in the EU, making the net import scenarios even more likely so that in the absence of a reform of the tariff regime, effects of the high tariffs on the EU price levels will occur at least temporarily. A reduction of the currently prohibitively high tariffs is thus direly needed.

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Table A1: EU sugar tariff regimes applicable to the sample of exporting countries

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Afghanistan*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Albania	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan
Algeria	none	none	none	none	none	none	none	none	none	none
Argentina	none	none	none	none	none	none	none	none	none	none
Australia	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl
Azerbaijan	none	none	none	none	none	none	none	none	none	none
Bangladesh*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Barbados	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Belarus	none	none	none	none	none	none	none	none	none	none
Belize	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Benin*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Bolivia	none	none	none	none	none	none	none	none	none	none
Bosnia & Herzegovina	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan
Brazil	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl
Cabo Verde*	acp	acp	acp	none	none	none	none	none	none	none
Cambodia	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Cameroon	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Canada	none	none	none	none	none	none	none	none	none	none
Chile	none	none	none	none	none	none	none	none	none	none
China	none	none	none	none	none	none	none	none	none	none
Colombia	none	none	none	none	none	fta	fta	fta	fta	fta
Costa Rica	none	none	none	none	none	fta	fta	fta	fta	fta
Cuba	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl
Côte d'Ivoire	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Dominican Republic	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Ecuador	none	none	none	none	none	none	none	none	fta	fta
Egypt	none	none	none	none	none	none	none	none	none	none
El Salvador	none	none	none	none	none	fta	fta	fta	fta	fta
Eswatini	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Ethiopia*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Fiji	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
French Polynesia	none	none	none	none	none	none	none	none	none	none
Georgia	none	none	none	none	none	none	fta	fta	fta	fta
Ghana	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp

Table A1: EU sugar tariff regimes applicable to the sample of exporting countries

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Guatemala	none	none	none	none	none	fta	fta	fta	fta	fta
Guyana	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Haiti	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Honduras	none	none	none	none	none	fta	fta	fta	fta	fta
India	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl	cxl
Indonesia	none	none	none	none	none	none	none	none	none	none
Iran	none	none	none	none	none	none	none	none	none	none
Israel	none	none	none	none	none	none	none	none	none	none
Jamaica	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Japan	none	none	none	none	none	none	none	none	none	none
Kazakhstan	none	none	none	none	none	none	none	none	none	none
Kenya	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Laos*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Lebanon	none	none	none	none	none	none	none	none	none	none
Liberia*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Madagascar*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Malawi*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Malaysia	none	none	none	none	none	none	none	none	none	none
Mali*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Mauritius	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Mexico	none	none	none	none	none	none	none	none	none	none
Moldova	none	none	none	none	none	none	fta	fta	fta	fta
Morocco	none	none	none	none	none	none	none	none	none	none
Mozambique*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Myanmar*	none	none	none	acp	acp	acp	acp	acp	acp	acp
Nepal*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Nicaragua	none	none	none	none	none	fta	fta	fta	fta	fta
Niger*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Nigeria	none	none	none	none	none	none	none	none	none	none
North Macedonia	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan
Oman	none	none	none	none	none	none	none	none	none	none
Pakistan	none	none	none	none	none	none	none	none	none	none
Palestine	none	none	none	none	none	none	none	none	none	none
Panama	none	none	none	none	none	fta	fta	fta	fta	fta

Table A1: EU sugar tariff regimes applicable to the sample of exporting countries

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Papua New Guinea	none	acp	acp	acp	acp	acp	acp	acp	acp	acp
Paraguay	none	none	none	none	none	none	none	none	none	none
Peru	none	none	none	none	fta	fta	fta	fta	fta	fta
Philippines	none	none	none	none	none	none	none	none	none	none
Russian Federation	none	none	none	none	none	none	none	none	none	none
Rwanda*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Saint Lucia	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Senegal*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Serbia	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan	balkan
Sierra Leone*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Singapore	none	none	none	none	none	none	none	none	none	none
South Africa	fta	fta	fta	fta	fta	fta	fta	acp	acp	acp
Sri Lanka	none	none	none	none	none	none	none	none	none	none
Sudan*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Suriname	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Switzerland	none	none	none	none	none	none	none	none	none	none
Syria	none	none	none	none	none	none	none	none	none	none
Taiwan	none	none	none	none	none	none	none	none	none	none
Tanzania*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Thailand	none	none	none	none	none	none	none	none	none	none
Tunisia	none	none	none	none	none	none	none	none	none	none
Turkey	none	none	none	none	none	none	none	none	none	none
Uganda*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Ukraine	none	none	none	none	none	none	none	fta	fta	fta
USA	none	none	none	none	none	none	none	none	none	none
Uruguay	none	none	none	none	none	none	none	none	none	none
Uzbekistan	none	none	none	none	none	none	none	none	none	none
Venezuela	none	none	none	none	none	none	none	none	none	none
Viet Nam	none	none	none	none	none	none	none	none	none	none
Yemen*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Zambia*	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp
Zimbabwe	acp	acp	acp	acp	acp	acp	acp	acp	acp	acp

* refers to ACP countries that are least-developed countries and enjoy Everything-but-Arms preferences.

Table A2: EU trade preferences and sugar imports: country-pair fixed effects

	Sugar	Raw sugar	White sugar
	(1)	(2)	(3)
Log Production$_{ikt}$	0.536***	0.728***	0.499***
	(0.130)	(0.257)	(0.145)
Log(1 + Tariff$_{ikt}$)	−0.026	0.017	−0.151***
	(0.031)	(0.034)	(0.040)
Preference$_{it}$	1.258***	1.526***	0.703**
	(0.193)	(0.259)	(0.275)
Observations	33,146	14,126	19,020

***, **, * denote statistical significance at 1%, 5% and 10% respectively. Robust country-pair-product clustered standard errors in parentheses. Importer-product-time, exporter-product, product-time and importer-exporter fixed effects included in all regressions. Intercepts and fixed effects included but not reported. Raw sugar = HS170111, HS170112, HS170113, and HS170114. White sugar = HS170191 and HS170199

Table A3: Definitions of sugar

Group	HS6 product	Description
Raw sugar	170111	Raw cane sugar (excluding added flavouring or colouring)
	170112	Raw beet sugar (excluding added flavouring or colouring)
	170113	Raw cane sugar, in solid form, not containing added flavouring or colouring matter, obtained without centrifugation
	170114	Raw cane sugar, in solid form, not containing added flavouring or colouring matter (excl. cane sugar of 170113)
White sugar	170191	Refined cane or beet sugar, containing added flavouring or colouring, in solid form
	170199	Cane or beet sugar and chemically pure sucrose, in solid form (excl. cane and beet sugar containing added flavouring or colouring and raw sugar)

Source: (European Commission, 2020a)
Our analysis considers the products 170111, 170113 and 170114 as one raw cane sugar. This brings our counts of products to four.

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Die Wurzeln der **Fakultät für Agrarwissenschaften** reichen in das 19. Jahrhundert zurück. Mit Ausgang des Wintersemesters 1951/52 wurde sie als siebente Fakultät an der Georgia-Augusta-Universität durch Ausgliederung bereits existierender landwirtschaftlicher Disziplinen aus der Mathematisch-Naturwissenschaftlichen Fakultät etabliert.

1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.

Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Lehrstühlen zu den folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

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