Jean Monnet Centre of Excellence in International Trade and Global Affairs

Discussion Papers

Feeding your workhorse with quality data: analysis of trade costs in Central Asia

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Discussion Paper 2020-01

Co-funded by the Erasmus+ Programme of the European Union

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Keywords: agricultural export; trade costs; gravity model; Central Asia; Doing Business

Paper presented at the 20th Annual Central Eurasian Studies Society (CESS) conference, held at the George Washington University in Washington DC, 10-13 October 2019.

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Abstract

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Highlights

- The World Bank's Doing Business Trading across borders indicator (2005-2017) provides useful data for trade policy analysis
- Only post-2016 Doing Business Trading across borders indicators provide theory-consistent regression results for landlocked countries
- High trade costs and long distances to global markets reduce exports of agrifood products from Central Asia
- Underdeveloped logistics of trade has higher negative impact on agrifood commodities in Central Asia as compared to the global practices
- Perishable agrifood products are more time and cost-sensitive than non-perishable commodities

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FEEDING YOUR WORKHORSE WITH QUALITY DATA: ANALYSIS OF TRADE COSTS IN CENTRAL ASIA

1. Introduction

With tariffs now at historic lows, WTO members and researchers are tackling the next challenge to improve trade flows by lowering trade costs. The 2017 signing of the Trade Facilitation Agreement has identified that trade facilitation can provide mechanisms to reduce trade costs. Simulations using the gravity model, the 'workhorse' of international trade analysis (Head & Mayer, 2014), suggest an increase of exports by US$ 1.9 trillion for developing countries in case of full implementation of the 2017 TFA (World Trade Organization, 2015). However, the scale and scope of the impact of trade facilitation on trade flows are still debated due to the complex and ambiguous nature of the trade costs.

Broadly defined, trade costs are the direct and indirect costs incurred to move goods and services along the entire supply chain, from the producer's door in the exporting country to the consumer in the importing country. While direct costs are purely fees associated with movement, indirect costs - time and uncertainty - can reduce the quality of goods and subsequently alter the price paid for those goods. Consequently, trade barriers that impact on time are of particular concern to exporters of perishable agricultural products. For example, customs delays negatively impacted on exports in Uruguay, but especially on food exports, as their value declines due to perishability of this commodity group (Volpe Martincus, Carballo, & Graziano, 2015). Some authors calculated that *ad valorem* trade costs in agriculture were typically in the range of 50 percent higher than in manufacturing in 2010 at the global level (Arvis, Duval, Shepherd, Utoktham, & Raj, 2016). Additionally, agricultural trade is expected to gain twice the benefits compared to other industries, when institutional quality improves (Álvarez, Barbero, Rodríguez-Pose, & Zofío, 2018).

Trade costs can be divided into three classes: those costs incurred bringing goods to the border within a country; those costs incurred to cross the border; and costs experienced once the border is crossed. The broad definition of trade costs by Anderson and Van Wincoop (2004) included transportation (freight and time) costs, tariff and non-tariff policy barriers, information costs, contract enforcement costs, legal and regulatory costs, and local (wholesale and retail) distribution costs. Trade costs can be defined more narrowly as the difference between the costs of domestic and international trade other than those costs related to traditional trade policy instruments, for example import tariffs (Sourdin & Pomfret, 2012). Other definitions lie between these extremes, e.g. including behind-the-border costs such as trade finance or meeting national regulations in the importer country.

A lack of unity on the definition of trade costs makes it difficult to measure them and to estimate their impact on trade flows (Sourdin and Pomfret, 2012). The first challenge the researcher faces is the availability of reliable data on trade costs. Commonly used trade cost indicators are based on the World Bank's Cost of *Doing Business* and *Logistics Performance Index*, the World Economic Forum's *Enabling Trade Index* and the OECD's *Trade Facilitation Indicators*. The number and scope of the indicators is usually restricted to the data availability as well as the specific objectives of the researcher.[1] Nevertheless, the indicators are subject to assumptions and limitations, which may be crucial at the results interpretation stage. For example, simple composite indicators such as the World Bank's *Trading across Borders* are easy to use in a regression but may be subject to such concerns as data reliability due to generalization of the assumptions about the trading good. Moreover, in many cases reported data refer only to businesses in the economy´s

[1] For example, Wilson, Mann and Otsuki (2003 and 2005) focused on aggregated indicators reflecting the port infrastructure; customs environment; regulatory environment; and e-business infrastructure. Moïsé, Orliac & Minor (2011) developed and tested indicators aligned to the WTO draft agreement on trade facilitation. While Portugal-Perez and Wilson (2012) constructed trade cost indicators to separate 'soft' (policy and institutional environment) and hard (physical infrastructure) dimensions of trade costs. In most recent papers, authors tend to avoid aggregating the indicators and directly test publicly available indicators (Shepherd, Forthcoming).

largest city and relying on consultancy firms in the capital rather than traders' actual experience in crossing borders. Despite that, these datasets are appreciated by researchers as they have been harmonized across 190 countries, available since the early 2000s and are easy to use for analysis.

This paper explores the analytical risks from relying on data without carefully exploring how the data were collected and understanding how collection methods and definitions evolve over time. To do this, we use the case study analyzing the economic impact of trade costs on agrifood exports from the Central Asian countries, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan, between 2005 and 2017. The study employs a structural gravity model incorporating two of the World Bank's *Doing Business* indicators 'cost to export' and 'time to export' to investigate 1) how trade costs alter the volume of agrifood exports 2) whether Central Asian countries' agrifood exports are more affected by trade costs than the rest of the world; 3) whether changes to indicator definitions and measurement of trade cost variables produce different empirical results for determinants of agrifood export volumes.

The World Bank's *Trading across Borders* indicators provide a good example of these problems. The 2016 *Doing Business* report introduced significant changes to the *Trading across Borders* indicators. The changes included relaxation of the assumptions about traded goods. In *pre*-2016 datasets, 'traded goods' were six pre-selected products shipped in 20-foot containers; in the newer databases, traded goods are the products with the largest export value and their main export partners (World Bank, 2016). Moreover, the earlier *Trading across Borders* measures assumed that the goods are shipped by sea, implying that calculations of time and cost for landlocked economies included those associated with border processes in transit economies. For the landlocked Central Asian economies this could result in significant overstating of trade costs, as each of these countries requires at least one transit economy to reach the sea. In the new methodology introduced in 2016, natural trading partners may be neighbouring economies that can be accessed by land. Thus, trade is assumed to be conducted by the most widely used mode of transport (whether sea, land, air or some combination of these), and any time and cost attributed to an economy are those incurred while the shipment is within that economy's geographic borders (World Bank, 2016). This assumption makes the trade cost indicators more relevant for the Central Asian countries, as most of their international shipments, especially the agrifood trade, are conducted by trucks, railroad or cars among the Central Asian countries themselves.

We hypothesize that the new and old collection and calculation methods will create misleading results for trade economists and policy development for emerging economies. The data are split into two distinct periods, the first one refers to the years 2005 - 2014 and the second, to the years 2015 - 2017. The results contribute to the literature by demonstrating the sensitivity of the trade cost estimates to the changing measurement of the World Bank's *Trading across Borders* indicators. Apart from that, the results of this paper contribute to a better understanding of how particular policies may benefit agricultural trade flows, as well as informing public policy institutions on the allocation of resources to maximize the overall gain for the agricultural sector in Central Asia from engaging in international trade.

The rest of the paper is organized as follows. The next section provides background on the case study region, as well as an overview of the World Bank's *Trading across Borders* indicator. The subsequent sections explain the methods and data analysis approach, followed by the results and discussion section. The paper finishes with concluding remarks and ways forward.

2. Background

2.1 Agrifood trade and costs to export in Central Asia

Central Asia has abundant land, is a resources-rich region with favorable climatic and soil conditions providing the potential to become a leading food supplier to the global market[2].

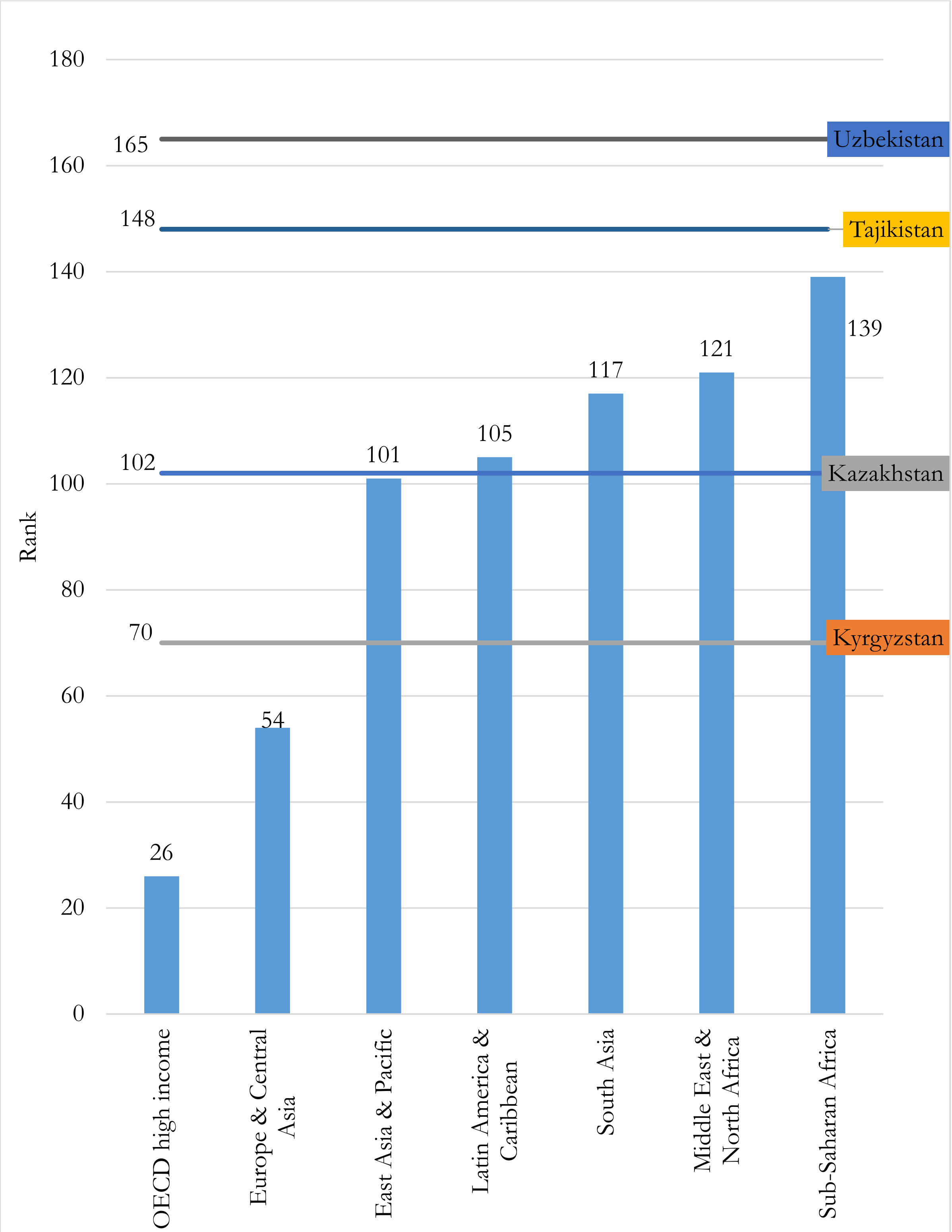
[2] This paper focuses on four Central Asian countries, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan. Turkmenistan was omitted from the sample as the World Bank's Doing Business indicators are not available for this country.

According to statements made by representatives of the ministries in interviews, some countries, for example China, are interested in agricultural products from Central Asia as they are attracted by the fact that agricultural production in this region is 'ecologically clean', ' safe' and 'natural' (Buyanov, 2016). This could add value to the agrifood exports from Central Asian countries, in case of improved conditions to trade. Moreover, changing dietary patterns in China, as well as an extended trade dispute with Washington, provides opportunities for Central Asian countries to increase their agrifood market share in China (Reuters, 2018).

Since the collapse of the Soviet Union, Central Asian countries have adopted relatively open and liberal trade regimes[3], as well as implemented export diversification policies that include diversification of agricultural exports (FAO UN, 2018b). However, despite the efforts and the significant investments from state budgets into export diversification programs the expected gains for agricultural exporters, have not materialized (FAO UN, 2018c). Lücke and Rothert (2006) suggested that low exports from Central Asia are largely due to border and behind-the-border trade costs, such as shortcomings in transport and customs procedures. According to the World Bank's *Trading across Borders* index the four Central Asian countries' trade costs have remained high in 2017 (Figure 1). Among the 190 countries covered, Kyrgyzstan ranked 70th, Kazakhstan 102nd, Tajikistan 148th and Uzbekistan 165th. To add transparency to these rankings, on average, in 2017 it cost only $200 US dollars and 15 hours per shipment to export goods from developed OECD countries, but it cost approximately $700 US dollars and 286 hours to export each shipment from Kazakhstan (IBRD & World Bank, 2018).

[3] With the possible exception of Uzbekistan where trade liberalization gradually started in 2017 only and it is not a WTO member

Figure 1 Trading across Borders rank in 2017.



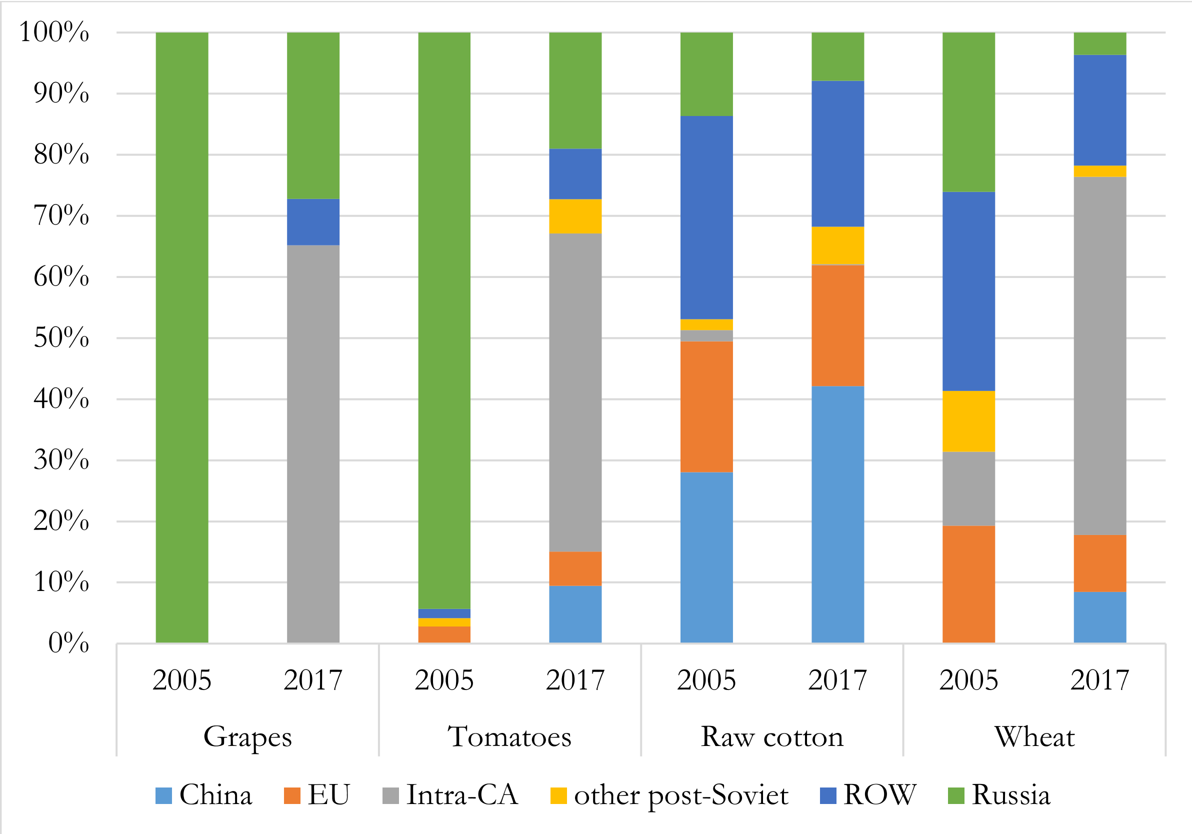
Source: Based on the data from the Doing Business reports, 2018

Agrifood products from this region are anticipated to be heavily penalized by high trade costs. As discussed, trade costs include issues associated with transportation, border-clearing, transactions, and other costs associated with fulfilment of non-tariff measures. While traditionally it has been assumed that Central Asian countries' high trade costs would be due to their landlocked nature and not having direct access to ports (Raballand, 2003), recent literature has challenged that perception and argued that the high costs to trade in Central Asia have been as much due to poor policies and institutions and low quality infrastructure as to geography (Pomfret, 2016).

Agricultural goods, in particular perishable ones, are vulnerable to time and uncertainty related trade costs. The geographical and topographical features include long distances between the main cities (e.g. Kazakhstan) and mountainous routes (e.g. Tajikistan). Administrative hurdles, unreliable train service (Christ & Ferrantino, 2011), lack of reliable storage and refrigeration (FAO UN, 2018a) add both time and money costs and degrade the quality of agrifood exports.

These high costs have changed he composition, profitability and future of agrifood industries in Central Asia. For example, Uzbekistan used to have a thriving apple export industry during the soviet era, and in earlier years after its collapse, but the combination of deteriorated logistics and time delays at customs borders means that its apple exports are now arriving to the Russian Federation at twice the average price of local apple producers (East Fruit News, 2018, quoting FAO). This loss of comparative advantage has contracted the Uzbekistan's apple industry. Central Asia's loss of comparative advantage to Russia has been significant for agrifood products. For perishable agrifood commodities such as tomatoes and grapes, Russia accounted for a 100 percent and 95 percent share of all Central Asia exports of these products respectively, but by 2017 Russia only took a 28 percent and 20 percent share of exports (Figure 2).

Figure 2 Exports destinations for selected commodities in Central Asia in 2005 and 2017, percent.



Source: based on data from the Center for International Development at Harvard University (2019)

The main suppliers of grapes and tomatoes to the Russian Federation became China, Turkey, some countries of Latin America and other post-Soviet countries, such as Azerbaijan, Moldova and others (based on the data from Center for International Development at Harvard University, 2019). The exports of these two products from Central Asia to the Russian Federation were largely substituted by the increase of intra-Central Asian trade. The two relatively non-perishable exporting agrifood commodities in the region, wheat and raw cotton, had more diverse exports destinations as compared to perishables during 2005-2017 (Figure 2).

Reduction in high trade costs should provide economic benefits. Felipe and Kumar (2012) estimated that aggregated trade in Central Asia may increase by 44 percent from reduction of trade costs, specifically through improvements in the logistics performance index. In 2017, WTO members signed the Trade Facilitation Agreement that sets up the framework for countries to reduce their trade costs by creating an enabling environment to trade (FAO UN, 2017). Central Asian countries, which are members of the WTO, are obliged to implement the Trade Facilitation Agreement and the work is already ongoing (FAO UN, 2018c). However, if the underlying data used can provide false analytics, it may help explain why past reforms have been unsuccessful.

2.2 The Doing Business Trading across Borders indicator

This paper estimates the impacts of two trade barriers indicators, time and cost to export, collected by the World Bank and annually published in the *Doing Business* reports. These two variables are components of the *Trading across Borders* indicator that has been available since 2005 in the *Doing Business* reports and has been widely used by researchers as they have been harmonized across 190 countries and are easy to use for analysis (e.g. Portugal-Perez and Wilson (2009), Lawless (2010) and Dennis and Shepherd (2011)). Most of the studies focus on the aggregated trade and as expected, obtain significant and negative impact of trade cost on trade flows.

Doing Business measures the time and cost (excluding tariffs and unofficial payments) associated with three sets of procedures - documentary compliance, border compliance and domestic transport - within the overall process of exporting or importing a shipment of goods. These include time and costs for documents, administrative fees for customs clearance and technical control, terminal handling charges and inland transport. The data measurement and assumptions for these two indicators have been changing since the dataset was first introduced (Annex 1).

In 2016 the *Doing Business* report introduced considerable changes to the *Trading across Borders* indicators to increase their "usefulness for policy and research" (p.32 World Bank, 2016). Prior to 2016 the standardized case study assumed that the goods were one of six preselected products, shipped in 20-foot containers and trade was assumed to be conducted by sea (World Bank, 2008). This was an important limitation for landlocked economies as it would imply that calculations of time and cost included those associated with border processes in transit economies, and thus raising the indicators for landlocked countries. For example, all Central Asian economies are landlocked, and Uzbekistan is double-landlocked, implying that the *Trading across Borders* indicator would reflect the time and costs associated with transition at least two borders before the good reaches the sea. However, the natural trading partners for Central Asian countries, especially for perishable goods are the neighbouring countries that can be reached in shorter times and at lower costs over the land border. The lack of variation with regard to trading partners and trading products might be an especially limiting factor for an analysis at the disaggregated level of export data. The *Trading across Borders* indicator for 2005 and 2015, assumes the containerized shipments of goods, which not necessarily, and for Central Asian countries in particular, would be the common way of shipping the agrifood commodities. For example, wheat and cotton could be transported by railways or trucks, and fruits and vegetables by trucks and cars. Thus, relaxation of this assumption in data starting from *Doing Business 2016* might provide more accurate results for the analysis of the impact trade costs had on agrifood exports in Central Asia.

In *Doing Business 2016*, it was assumed that each economy exports the product of its comparative advantage to its natural export partner - the economy that is the largest purchaser of this product (World Bank, 2016). Trade is assumed to be conducted by the most widely used mode of transport (whether sea, land, air or some combination of these), and any time and cost attributed to an economy are those incurred while the shipment is within that economy's geographic borders. All of these newer specifications make it closer to the real trading conditions in Central Asia. Moreover, because the new methodology also allows for regional trade, it emphasizes the importance of customs unions:

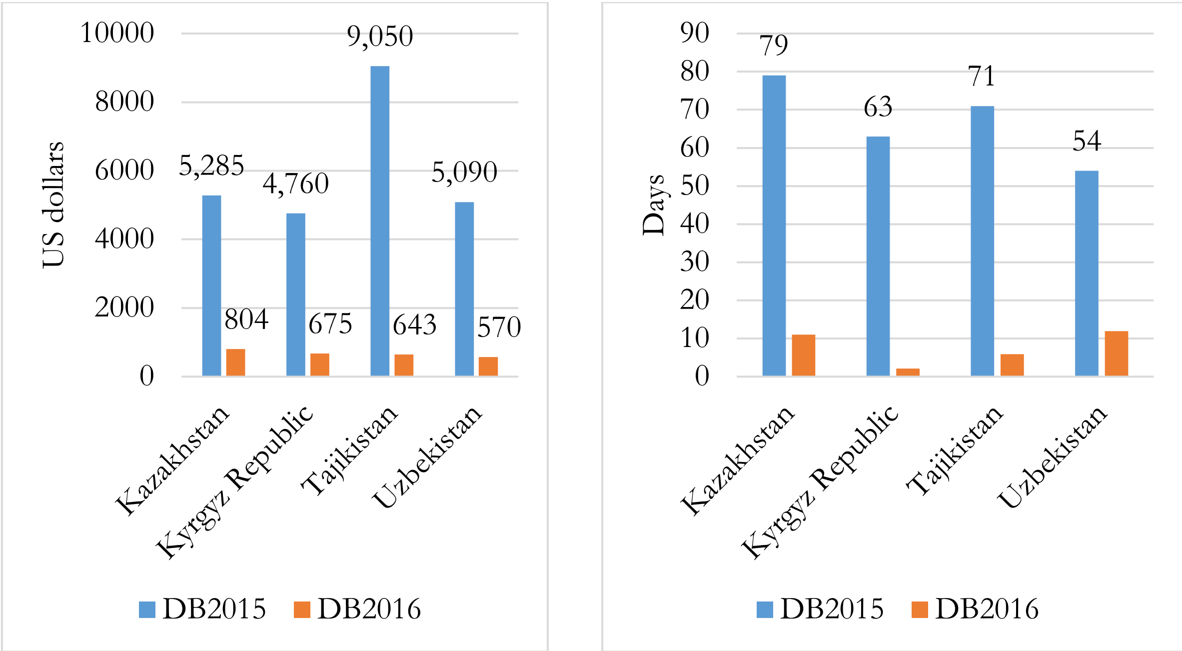
An improvement under the new methodology was recorded for Croatia, which is part of the European Union. In the new case study Croatia both exports to a fellow EU member (Austria) and imports from one (Germany), and documentary and border compliance therefore take very little time and cost as measured by Doing Business" (p.33 World Bank, 2016)

Following this example, the Central Asian countries should have also received a better score as they are predominantly trading with neighbouring countries, especially agricultural products mostly traded inside Central Asia, and all of them are members of free trade agreements, either Eurasian Economic Union (Kazakhstan and Kyrgyzstan) or the Commonwealth of Independent States Free Trade Area (all four countries).

In *Doing Business* for 2005 – 2014 the time to trade is recorded in calendar days, starting from the moment when the trading process is initiated and running until it is completed (data notes from World Bank, 2008). It is assumed that document preparation, inland transport and handling, customs clearance and inspections, and port and terminal handling require a minimum time of one day each and **cannot take place simultaneously**. Whereas in *Doing Business* for 2016 and later years, time is measured in hours (1 day is 24 hours) and the "set of procedures for documentary compliance is **potentially simultaneous** with those for domestic transport and is **highly likely to be simultaneous** with port or border handling, with customs clearance and with inspections" (data notes from IBRD & World Bank, 2018). Thus, we may anticipate an overall reduction of the time to export in this indicator.

As would be expected, the new measurement of the *Trading across Borders* indicators resulted in significant improvement of the indicators for some countries. Specifically, looking at the Central Asian countries, it can be noted that the time to export in Kyrgyzstan improved by 30 times, from 63 days in DB2015 (reporting the data for 2014) to export to two days in DB2016 (reporting the data for 2015), while in Kazakhstan, it changed from 79 days in 2014 to 11 days in 2015 (Figure 3).

Figure 3 Cost (left) and time (right) to export in DB2015 vs DB2016 for Central Asian countries.



Source: Based on the data from the Doing Business database

Finally, the data note in each year's *Doing Business* report states that "contributors are private sector experts in international trade logistics". However, for Central Asia a cursory review of the list of contributors' employers (i.e. company name) who potentially could be directly involved in trade and logistics varied between zero and 19 percent (summary statistics in Annex 2). Notably, the share of companies that can be approximated as focused on trade and logistics is zero across all the Central Asian countries after 2016. This suggests that the contributors are only data reporters whereas people involved in international trade logistics are left unrepresented.

To address the concerns raised in the background section, this paper tests the following hypotheses:

1. Remoteness (measured as a physical distance) of Central Asian countries remains a significant impediment to engagement in global trade;

2. The cost to export has a greater impact on agrifood exports in Central Asian countries compared to the rest of the world;

3. The impact of time to export is higher on perishable as opposed to non-perishable agricultural products;

4. The impacts of cost to export and time to export estimated by gravity models are sensitive to their changing definitions and measurements between 2005-2014 and 2015-2017.

3. Methods

The study employs a gravity model, the most commonly used model to analyze the determinant of international trade. The traditional gravity model is based on an analogy with Newton's law of gravitation (Tinbergen, 1962). A mass of goods or labor or other factors of production supplied at country i, Y_i, is attracted to a mass of demand for goods or labour at destination j, E_j, but the potential flow is reduced by the total trade costs between countries i and j, T_{ij}^{θ},

$$X_{ij} = Y_i E_j / T_{ij}^{\theta} \tag{1}$$

Anderson and Van Wincoop (2003) derived the structural gravity model of trade with multilateral resistance terms under the assumptions of identical constant elasticity of substitution preferences across countries for national varieties differentiated by place of origin (the Armington assumption). Multilateral resistance terms take into account that trade between two partners is subject to the barriers that each country faces with all its trading partners.

$$X_{ij} = \left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma} Y_i E_j \tag{2}$$

Where X_{ij} is exports in value terms from country i to country j; E_j is expenditure in country j; Y_i is production in country i; t_{ij} captures bilateral trade costs; σ is the elasticity of substitution across varieties; P_j is inward multilateral resistance, which captures the dependence of bilateral shipments into j on trade costs across all inward routes; Π_i is outward multilateral resistance, which captures the dependence of bilateral shipments out of i on trade costs across all outward routes. Not accounting for multilateral resistance terms in a gravity model can lead to biased parameter estimates. At the estimation stage multilateral resistance terms can be addressed with country-level fixed effects, but one then loses scope for analysis of country-level factors.

Most commonly, the model is estimated by Poison Pseudo Maximum Likelihood (PPML) with fixed effects, which collapses into the following empirical setup:

$$X_{ij} = exp\left(T_{ij}\beta + \pi_i + \chi_j\right)e_{ij} \tag{3}$$

Where: T_{ij} is a vector of observables capturing different elements of trade costs; π_i is a set of exporter fixed effects; χ_j is a set of importer fixed effects; and e_{ij} is a standard error term. If a model is estimated with PPML with fixed effects, the estimated fixed effects correspond exactly to the terms required by the structural model (Silva & Tenreyro, 2006). The estimation strategy follows Yotov, Piermartini, Monteiro, and Larch (2016) and the benchmark estimation model takes the multiplicative form:

$$X_{ijt} = (\beta_0 + \beta_1 \ln(GDP_{it}) + \beta_2 \ln(GDP_{jt}) + \tag{4}$$

$$\beta_3 \ln(Trade\ cost_{it}) * RoW + \beta_4 \ln(Distance_{ij}) * RoW +$$

$$\beta_5 \ln(FTA_{ijt}) +$$

$$+ \beta_6 \ln(Comcol_{ij}) + \beta_7 \ln(Landlocked_i) + \beta_8 \ln(Border_{ij}) +$$

$$\beta_9 \ln(Language_{ij}) + \beta_{10} \ln(Trade\ cost_{it}) * CA + \beta_{11} \ln(Distance_{it}) * CA + \eta_{jt} + \mu_{jt} + \gamma_{ij})\varepsilon_{ijt}$$

Where, the dependent variable (X_{ijt}) is the export values in US dollars. The trade costs indicator, $\ln(Trade\ cost_{it})$, is the vector of the trade costs indicators related to the definition of trade costs: $\ln(Trade\ cost_{it})$={ $\ln(Time\_Ex_{it}); \ln(Cost\_Ex_{it})$}. Trade cost indicators are measured as time to export in days ($Time\_Ex_{it}$) and cost to export in US dollars ($Cost\_Ex_{it}$).

Interactions of the trade costs indicators and distance with the variables CA and RoW were used to differentiate the impact on Central Asian countries and on the rest of the world, and thus, address the second hypothesis to be tested. The independent variables include the classic set of trade explaining variables. The GDPs of the exporter and importer in current US dollars, (GDP_{it} and GDP_{jt}) and geographic distance between the capital cities of the trading partners ($Distance_{ij}$). There is also a set of commonly included dummy variables such as landlockedness ($Landlocked_i$), common language($Language_{ij}$), common colonizer ($Comcol_{ij}$) common border ($Border_{ij}$) and bilateral trade agreements(FTA_{ijt}).

4. Data and estimation strategy

The dependent variable is the export value in current US dollars at HS four-digit products classification: grapes (HS0806) and tomatoes (HS0702) standing for the group of perishable commodities; wheat (HS1001) and cotton (HS5201) – for the non-perishable products. All the 'classic' variables, GDPs, distance, common border and language, Free Trade Agreement (FTA) and landlockedness, come from CEPII database[4]. Trade cost variables are the time and cost to export components of the *Doing Business Trading across Borders* indicator. The datasets are separated

[4] The Centre d'Études Prospectives et d'Informations Internationales, http://www.cepii.fr/CEPII/en/cepii/emploi.asp?IDemploi=11

into two time periods, 2005 - 2014 (reflecting the earlier *Trading across Borders* methodology) and 2015 - 2017 to analyze the effect of the updated methodology.

Table 1 Data and sources used for the analysis

Variable	Definition	Notation	Source
Exports (dependent variable)	Exports from country i to country j in time t Perishable: grapes (HS0806); tomatoes (HS072); Non-perishable: wheat (HS1001); cotton (HS5201)	X_{ijt}	Atlas of Economic Complexity
Common language	Dummy variable equal to one for countries that have a common official language.	$Language_{ij}$	CEPII
Common colonizer	Dummy variable equal to one for countries that have a common colonizer post 1945	$Comcol_{ij}$	CEPII
Landlocked	Dummy variable equal to one if country is landlocked.	$Landlocked_i$	CEPII
Distance	Population weighted distance between country i and country j.	$Distance_{ij}$	CEPII
FTA	Dummy variable equal to one for country pairs that are members of the same regional trade agreement.	FTA_{ijt}	CEPII
GDP exporter	GDP of exporter in current US$ dollars	GDP_{it}	CEPII (2005-14)

			World Bank (2015-17)
GDP importer	GDP of importer in current US$ dollars	GDP_{jt}	CEPII (2005-14) World Bank (2015-17)
Time to export	Number of days to export 20-foot container (2005 – 2014), and unit of shipment (2015 - 2017)	$Time\_Ex_{it}$	World Bank *Doing Business* database
Cost to export	US$ dollars to export a 20-foot container, and a unit of shipment (2015 - 2017)	$Cost\_Ex_{it}$	World Bank *Doing Business* database
Central Asia	Dummy variable equal to one if exporting country is Kazakhstan, Kyrgyzstan, Tajikistan or Uzbekistan	*CA*	
Rest of the World	Dummy variable equal to one if exporting country is not *CA*	*ROW*	

The estimation approach was as follows. A benchmark model (equation 4) is estimated with PPML exporter-year, importer-year fixed effects to control for multilateral resistance terms[5]. The lack of internal trade data would not support the use of the traditional approach recommended in the most recent literature. The exporter-year and importer-year fixed effects that are commonly recommended by the literature absorb the estimates for all the time varying variables, including

[5] All the regressions were run using the specific STATA command developed by Correia, Guimarães, and Zylkin (2019) for high dimensional fixed effects with PPML. The OLS was estimated at the early stage of the analysis, but, since the literature consensus is in using the PPML, only results obtained with PPML are presented in this paper.

trade cost indicators. Despite that, the theory consistent coefficients for time invariant variables obtained in such a set up act as a benchmark for all other estimation techniques (Annex 6).

The next step was to estimate the model with exporter, importer and year fixed effects only, which resulted in close estimates for time-invariant variables compared to the benchmark results. Thus it is safe to assume that such an approach would provide results similar to the theory-consistent outcome. Therefore, the results reported in this paper are obtained from the PPML estimator with exporter, importer and time fixed effects.

A panel dataset with four periods (2005, 2008, 2011, and 2014) was used instead of consecutive years for the 2005-2014 dataset analysis. This approach allows for adjustment in bilateral trade flows in response to trade policy or other changes in trade costs (e.g. Yotov et al., 2016). The model estimated separately for each product. The number of observations in each dataset varied between 86,317 and 93,586 for the selected four products (descriptive statistics in Annex 3).

A similar approach was used to estimate the impact of trade costs based on the data from 2015-2017. However, due to the small number of years in the panel, consecutive years, instead of periods were used. The number of observations for this period varied from 52,761 to 68,229. The regression was run twice for each product, with cost to export and time to export indicators appearing separately in the models, to avoid the multicollinearity problem (summary statistics in Annex 4, and correlation table in Annex 5).

5. Results and discussion

Table 2 reports estimates for the perishable (tomatoes and grapes) and non-perishable (wheat and raw cotton) products for 2005-2014, each product group at HS 4-digit level, using PPML with exporter, importer, and year fixed effects. With the global dataset, the standard gravity variables are statistically significant and have the signs expected in gravity models; export values are positively related to partners' GDP and negatively related to distance. The trade policy variable, FTA between trading partners, plays a positive and statistically significant role for exports of perishable products, but coefficients are not significant for the non-perishable commodities, wheat and raw cotton.

The estimation results support the hypothesis that long distances to meet global markets play a significant role for Central Asian countries' agrifood exports. The effect of longer distance in Central Asia as compared to the outcome at the global level is three times higher for exports of grapes, two times higher for wheat and raw cotton and almost the same level for tomatoes. This explains the reliance of Central Asian countries on intra-regional trade. As expected, some perishable products, such as grapes, are more sensitive to longer distances in Central Asia, than non-perishable products. The results suggest that a one percent longer distance between the Central Asian country and its trading partners reduces the exports of grapes by 2.9 percent, or raw cotton by 1.7 percent.

However, the answers for the second and third hypotheses are not straightforward. The coefficients for the trade costs indicators, cost to export and time to export, yield mixed outcomes, some of which are contrary to expectations, and others are not significant.

The second hypothesis tests, whether higher cost to export has a stronger impact on trade in Central Asian countries than on the rest of the world. However, the trade cost coefficient result is only significant and negative for exports of tomatoes at the global level, implying a one percent increase in trade cost would lead to a one percent decrease of exports of tomatoes. In Central Asia, the coefficient of the trade cost indicator is significant and negative for exports of wheat. Counterintuitively, the results for raw cotton for Central Asia are positive and significant, implying a one percent increase of trade cost would lead to a one percent increase in export value of raw cotton. With such a mixed and theory-inconsistent outcome, it is impossible to conclude that Central Asian agrifood exporters suffer more than global exporters due to higher costs to export.

The explanation of such results may be due to the assumptions behind the cost to export indicator. This indicator is based on a full 20-foot container of dry-cargo, loaded with the economy's leading export products and shipped by sea. Such a specification excludes the heterogeneity of trade cost options. This, especially, applies to perishable agricultural commodities, where refrigeration might be required. A positive relationship between the export value of raw cotton and the cost to export indicator may be due to the specifics of raw cotton trading procedures.

Finally, the results are also not sufficient to prove the third hypothesis, whether the impact of time to export is higher on perishable as opposed to non-perishable goods. Time to export is negative and significant only for perishable products, tomatoes and grapes, at the global level. The results are not significant for the non-perishable group. In Central Asia, time to export is only significant with a high positive coefficient for wheat, implying longer times are associated with greater exports values of wheat. This result may be due to: 1) assumptions about the traded-good; 2) the mode of transport specified in the *Trading across Borders* measurement which assumed that the good is containerized and shipped by the sea - none of which applies to Central Asia, where wheat is usually sent by trucks or railroads, not in containers. I the case of landlocked countries, goods shipped by sea must pass at least one extra border before reaching the sea port, which implies an overestimation of the trade costs of Central Asian wheat, where up to 50 percent is traded once it crosses the border. This might be a reason for a positive association between time indicators and exports of wheat, providing nonsensical results. Apart from this, a lack of variation in the value of exports from Central Asia by export market for each of the selected products could also be a reason for such theory-inconsistent results.

Table 2 Gravity model results for perishable and non-perishable products at HS 4-digits level estimated with PPML exporter, importer and year fixed effects, 2005-2014

	(1)	(2)	(3)	(4)
	Tomatoes	Grapes	Wheat	Raw Cotton

	(HS 0702)	(HS 0806)	(HS 1001)	(HS 5201)
GDP exporter	0.093	0.316	0.407	0.201
	(0.231)	(0.160)**	(0.220)*	(0.273)
GDP importer	1.196	1.088	0.200	0.523
	(0.228)***	(0.147)***	(0.152)	(0.289)*
Distance RoW	-2.016	-1.053	-1.923	-0.965
	(0.242)***	(0.129)***	(0.122)***	(0.164)***
Cost RoW	**-0.974**	0.067	0.124	0.009
	(0.217)***	(0.150)	(0.269)	(0.234)
Time RoW	**-0.386**	**-0.306**	0.051	-0.818
	(0.203)*	**(0.119)****	(0.209)	(0.561)
Distance CA	-2.492	-3.251	-3.626	-2.026
	(0.730)***	(0.390)***	(0.444)***	(0.581)***
Cost CA	1.149	0.609	**-1.350**	**0.810**
	(0.962)	(0.534)	**(0.786)***	**(0.293)*****
Time CA	1.336	-0.065	**9.411**	2.205
	(1.555)	(1.448)	**(3.314)*****	(2.629)
Common border	0.033	0.536	0.065	0.696
	(0.273)	(0.202)***	(0.164)	(0.279)**
Common language	1.337	0.155	0.242	0.353
	(0.511)***	(0.170)	(0.178)	(0.309)
Common colonizer	0.860	-0.064	0.767	0.355

	(0.391)**	(0.394)	(0.299)**	(0.331)
FTA	1.795	1.251	0.222	0.158
	(0.298)***	(0.148)***	(0.142)	(0.190)
Constant	1.710	-14.004	15.623	7.643
	(10.484)	(6.071)**	(7.503)**	(8.368)
N	88,915	93,586	89,385	86,317

Standard errors in parentheses

* $p < 0.10$, ** $p < .05$, *** $p < .01$

Standard errors clustered by country pair

To address the fourth hypothesis that changing definitions and measurement of the same trade cost indicator from one period to another affects the gravity model results, the models were re-estimated by using data from 2015 to 2017. Table 3 reports the trade cost and distance related results. The distance-related variable is in line with expectations with somewhat higher coefficients as compared to the previous period results.

The trade cost variables reveal striking results. For Central Asia cost to export turns out to be highly negative for both tomatoes and grapes at a one percent level of significance, implying that a one percent increase of cost to export would result in a 16 and 12 percent decrease in exports of these products, respectively. The impact of high trade costs on the export of grapes is four times higher for Central Asia as compared to the rest of the world. Moreover, the coefficient for Central Asian raw cotton changed the high positive sign in the previous dataset analysis to a negative and significant coefficient in the latest trade costs specification. These results are all far more plausible than those in Table 2.

Table 3 Gravity model results for perishable and non-perishable products at HS 4-digits level estimated with PPML exporter, importer and year fixed effects, 2015-2017

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Tomato1	Tomato2	Grapes1	Grapes2	Wheat1	Wheat2	Raw_Cotton1	Raw_Cotton2
RoW_distance	-3.031	-3.031	-1.302	-1.302	-1.495	-1.495	-1.169	-1.169
	(0.220)***	(0.220)***	(0.158)***	(0.158)***	(0.153)***	(0.153)***	(0.175)***	(0.175)***
RoW_cost	**1.184**	**1.184**	1.651	1.654	**-1.610**	**-1.614**	-1.413	-1.426
	(0.659)*	**(0.660)***	(1.579)	(1.579)	**(0.763)****	**(0.763)****	(0.961)	(0.961)
RoW_time	-0.622	-0.622	**-0.393**	**-0.393**	1.902	1.899	**1.773**	**1.806**
	(0.541)	(0.541)	**(0.183)****	**(0.183)****	(1.172)	(1.172)	**(0.748)****	**(0.757)****
CA_distance	-2.042	-2.042	-2.716	-2.716	-6.634	-6.634	-1.479	-1.479
	(0.811)**	(0.811)**	(0.562)***	(0.562)***	(0.953)***	(0.953)***	(0.630)**	(0.630)**
CA_cost	**-16.366**		**-12.497**		0.268		**-4.158**	
	(0.711)***		**(3.854)*****		(0.685)		**(1.164)*****	
CA_time		-73.012		**-6.388**		1.313		**-2.905**
		(67.977)		**(3.043)****		(5.754)		**(1.262)****
N	64,251	64,251	68,229	68,229	58,056	58,056	52,761	52,761

Standard errors in parentheses * $p < 0.10$, ** $p < .05$, *** $p < .01$

Standard errors clustered by country pair

Finally, the time to export is negative and significant for the exports of grapes and raw cotton in Central Asia, implying that a one percent increase of time to trade would reduce grape exports by six percent, which is two times higher than for exports of raw cotton. This can be translated as any two hour delay on the way to the border, would cost a Central Asian grape exporter almost $10 million US dollars (calculation based on the 2017 data). At the global level, results are only significant and positive for raw cotton. Overall, the drastic change of the signs and the trade cost coefficients demonstrate high sensitivity of the gravity model results regarding the impact on export values due to changing definitions and measurement of trade cost variables.

The results confirm the hypothesis that gravity estimates are sensitive to the changing trade cost measurement and since 2016 result in more theory-consistent outcomes. A changed definition of the export goods from the pre-selected products to the products with comparative advantage allows selection of the products at a disaggregated level. Next, the extension of the assumption about the transportation mode from the containerized sea shipments to 'the most widely used for the chosen export product (truck, train, or riverboat)' and assuming a 'natural' partner provide more relevant indicators for landlocked countries. This is an important improvement for the analysis of Central Asian countries, where the goods, agrifood in particular, are traded by trucks and railroads and most of the trade, especially of the perishable products, occurs intra-regionally.

These findings raise questions about past policy formulation based on the 2005-2014 *Trading across Borders* data. It is logical to assume that resource misallocation may have occurred and the outcome of trade costs reduction policies will have been less than anticipated. For example, some countries spend millions US dollars from state or donor funds to create online applications and web-platforms for promoting goods for export even though potential users - farmers - simply do not have access to the Internet. Issues of improving the export policies of the Central Asian countries are becoming ever more relevant as national strategies and programs for export development have been developed or are under development, with a special role given to agrifood exports (FAO UN, 2018b). Often these strategies are not effective, which is expressed, in particular, in the insufficient development of export support institutions, primarily non-governmental organizations such as chambers of commerce or associations of exporters and underestimation of their potential in promoting products to foreign markets. A closer analysis of the pre-border, border and behind-the-border costs to trade will contribute to better resource allocations in order to promote exports in Central Asia.

6. Conclusion

The goal of the paper was to analyze the impact of trade costs on exports of agrifood products with a focus on Central Asian countries. The rationale is that reduced trade costs, or trade facilitation, can improve these countries' capacity to export agrifood products and thus benefit both the region itself as well as global society. Specifically, the impact of trade costs was estimated at the disaggregated HS 4-digit level for perishable (grapes and tomatoes) and relatively non-perishable (wheat and cotton) products. The study employed the World Bank's *Trading across Borders* indicators such as time and cost to export. These indicators have been widely used to analyze the impact of trade costs on international commodity flows, mainly because they are harmonized across 190 countries and have been published since 2004, making them convenient to use and analyze.

The structural gravity model for international trade was used for the analysis. Contrary to expectations, the estimation analysis revealed mixed and sometimes theory-inconsistent results across products as well as across trade costs indicators. Some results supported the hypotheses tested, confirming that distance and cost to export have greater impact in Central Asia compared to the world, as well as suggesting that perishable products are more sensitive to time delays than non-perishables. However, the cost to export coefficients for some products had positive significant signs, implying that the higher trade costs exporters face the more they trade, which does not make any sense. Using the newer methodology *Doing Business* trade costs data revealed more theory-consistent results as compared to results using the earlier datasets.

Thus, the findings suggest that the commonly used gravity model and *Doing Business* trade costs indicators may work well for some countries and some groups of the products but are not well suited for disaggregated agricultural products and not for Central Asia, where the logistics of agrifood commodities may differ from the assumed practices. Therefore, to fill the research gap there is a need to find alternative data sources and estimation techniques to estimate the impact of trade costs on perishable and non-perishable products in Central Asia.

Acknowledgements

This research was supported by the Beacon of Enlightenment PhD Scholarship provided by the University of Adelaide. The author is grateful to her supervisors, Dr Alec Zuo, Dr David Adamson and Professor Richard Pomfret, who provided insight and expertise that greatly assisted the research. A special thanks for valuable comments to Ben Shepherd (Principal, Developing Trade Consultants). The final version of the paper was improved from discussions at the 20th Annual CESS conference, held at the George Washington University in October 2019.

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Annex 1

Comparison of Trading across the border measurement, DB2015 and DB2016

DB2015	DB2016
A dry-cargo, 20-foot, full container load	A shipment
Containerized	Export shipments do not necessarily need to be containerized; 15 tons of noncontainerized products
One of the economy's leading export or import products	A product of economy's comparative advantage (defined by the largest export value) to its natural export partner
1. Documentary compliance 2. Customs clearance and inspections 3. Inland transport and handling 4. Port and terminal handling • Does not include sea transport • Each stage require a minimum time of 1 day each and cannot take place simultaneously	1. Documentary compliance 2. Border compliance 3. Domestic transport • For a coastal economy with an overseas trading partner, domestic transport captures the time and cost from the loading of the shipment at the warehouse until the shipment reaches the economy's port • The set of procedures is potentially simultaneous
Sea	The one most widely used for the chosen export or import product and the trading partner, as is the seaport, airport or land border crossing (truck, train, riverboat)

Annex 2

Summary statistics about the Doing Business contributors from Central Asia

Country		DB2006	DB2009	DB2012	DB2015	DB2016	DB2017	DB2018
Kazakhstan	Total number of respondents	42	39	56	68	100	134	117
	Trade and logistics respondents	1	5	1	3	1	1	0
	Share of trade and logistics firms	2%	13%	2%	4%	1%	1%	0%
	Not identified				1	3	1	2
Kyrgyzstan	Total number of respondents	21	42	33	50	57	52	48
	Trade and logistics respondents	2	2	2	3	2	3	0
	Share of trade and logistics firms	10%	5%	6%	6%	4%	6%	0%
	Not identified		2			4		4
Tajikistan	Total number of respondents	na	19	29	28	34	35	39
	Trade and logistics respondents	na	1	4	4	0	0	2
	Share of trade and logistics firms	na	5%	14%	14%	0%	0%	5%
	Not identified			1		7	1	2
Uzbekistan	Total number of respondents	11	31	31	37	33	28	32
	Trade and logistics respondents	1	4	6	5	0	0	0
	Share of trade and logistics firms	9%	13%	19%	16%	0%	0%	0%
	Not identified		1	1				3

Annex 3

Descriptive statistics 2005-2014 full dataset

Variable	Obs	Mean	Std. Dev.	Min	Max
HS0702					
year	267,320	2009.5	2.872287	2005	2014
Export value (USD)	267,320	2.79E+05	1.09E+07	0.00E+00	1.85E+09
Distance (weighted distance (pop-wt, km))	267,320	8.03E+03	4.49E+03	9.43E+01	1.97E+04
Common border	267,320	1.79E-02	1.33E-01	0.00E+00	1.00E+00
Common language	267,320	1.64E-01	3.70E-01	0.00E+00	1.00E+00
Common colonizer	267,320	1.01E-01	3.01E-01	0.00E+00	1.00E+00
GDP of exporter	265,853	3.85E+11	1.42E+12	1.05E+08	1.74E+13
GDP of importer	265,853	3.85E+11	1.42E+12	1.05E+08	1.74E+13
Cost to export	267,320	1.93E+03	1.72E+03	4.16E+02	1.76E+04
Time to export	267,320	2.40E+01	1.61E+01	6.00E+00	1.02E+02
Landlocked	267,320	2.01E-01	4.01E-01	0.00E+00	1.00E+00
FTA	267,320	1.15E-01	3.18E-01	0.00E+00	1.00E+00
HS0806					
year	270,600	2009.5	2.872287	2005	2014
Export value (USD)	270,600	2.95E+05	6.55E+06	0.00E+00	8.32E+08
Distance (weighted distance (pop-wt, km))	270,600	8.03E+03	4.49E+03	9.43E+01	1.97E+04
Common border	270,600	1.78E-02	1.32E-01	0.00E+00	1.00E+00
Common language	270,600	1.62E-01	3.68E-01	0.00E+00	1.00E+00
Common colonizer	270,600	9.93E-02	2.99E-01	0.00E+00	1.00E+00
GDP of exporter	269,124	3.83E+11	1.41E+12	1.05E+08	1.74E+13
GDP of importer	269,124	3.83E+11	1.41E+12	1.05E+08	1.74E+13
Cost to export	270,600	1.93E+03	1.71E+03	4.16E+02	1.76E+04
Time to export	270,600	2.40E+01	1.61E+01	6.00E+00	1.02E+02
Landlocked	270,600	2.06E-01	4.04E-01	0.00E+00	1.00E+00
FTA	270,600	1.14E-01	3.17E-01	0.00E+00	1.00E+00
HS1001					
year	264,060	2009.5	2.872287	2005	2014
Export value (USD)	264,060	1.38E+06	2.23E+07	0.00E+00	1.97E+09
Distance (weighted distance (pop-wt, km))	264,060	7.94E+03	4.45E+03	9.43E+01	1.97E+04
Common border	264,060	1.83E-02	1.34E-01	0.00E+00	1.00E+00
Common language	264,060	1.58E-01	3.65E-01	0.00E+00	1.00E+00
Common colonizer	264,060	9.82E-02	2.98E-01	0.00E+00	1.00E+00
GDP of exporter	262,602	3.87E+11	1.42E+12	1.38E+08	1.74E+13
GDP of importer	262,602	3.87E+11	1.42E+12	1.38E+08	1.74E+13
Cost to export	264,060	1.94E+03	1.72E+03	4.16E+02	1.76E+04
Time to export	264,060	2.41E+01	1.62E+01	6.00E+00	1.02E+02
Landlocked	264,060	2.09E-01	4.06E-01	0.00E+00	1.00E+00

FTA	264,060	1.16E-01	3.20E-01	0.00E+00	1.00E+00
HS5201					
year	267,320	2009.5	2.872287	2005	2014
Export value (USD)	267,320	515451.3	1.89E+07	0	3.29E+09
Distance (weighted distance (pop-wt, km))	267,320	7979.749	4468.824	94.27333	19650.13
Common border	267,320	0.0180308	0.133063	0	1
Common language	267,320	0.1600329	0.366637	0	1
Common colonizer	267,320	0.1005536	0.300737	0	1
GDP of exporter	265,853	3.85E+11	1.42E+12	1.05E+08	1.74E+13
GDP of importer	265,853	3.85E+11	1.42E+12	1.05E+08	1.74E+13
Cost to export	267,320	1939.857	1717.633	416	17581
Time to export	267,320	24.04878	16.12992	6	102
Landlocked	267,320	0.2073171	0.405385	0	1
FTA	267,320	0.1149334	0.318942	0	1

Annex 4

Descriptive statistics 2015-2017 full dataset

Variable	Obs	Mean	Std. Dev.	Min	Max
HS0702					
year	87,210	2016	0.816501	2015	2017
Export value (USD)	87,210	2.96E+05	1.28E+07	0.00E+00	1.93E+09
Distance (weighted distance (pop-wt, km))	87,210	8.00E+03	4.50E+03	9.43E+01	1.97E+04
Common border	87,210	0.017338	0.130526	0	1
Common language	87,210	0.159477	0.366123	0	1
Common colonizer	87,210	0.105263	0.306894	0	1
GDP of exporter	87,210	1.03E+12	5.48E+12	4.06E+07	8.09E+13
GDP of importer	87,210	1.03E+12	5.48E+12	4.06E+07	8.09E+13
Cost to export	87,210	529.693	433.5416	0	2918
Time to export	87,210	109.7235	110.6999	1	816
Landlocked	87,210	0.192983	0.394642	0	1
FTA	87,210	0.148217	0.355317	0	1
HS0806					
year	89,268	2016	0.816501	2015	2017
Export value (USD)	89,268	333294.6	7.60E+06	0	9.20E+08
Distance (weighted distance (pop-wt, km))	89,268	7932.757	4483.776	94.27333	19650.13
Common border	89,268	1.71E-02	1.30E-01	0.00E+00	1.00E+00
Common language	89,268	1.61E-01	3.68E-01	0.00E+00	1.00E+00
Common colonizer	89,268	0.109356	0.312087	0	1
GDP of exporter	89,268	1.02E+12	5.45E+12	4.06E+07	8.09E+13
GDP of importer	89,268	1.02E+12	5.45E+12	4.06E+07	8.09E+13
Cost to export	89,268	529.4224	432.4141	0	2918
Time to export	89,268	109.2324	110.5036	1	816
Landlocked	89,268	0.190751	0.392896	0	1
FTA	89,268	0.149639	0.35672	0	1
HS1001					
year	82,170	2016	0.816502	2015	2017
Export value (USD)	82,170	1348954	2.01E+07	0	1.80E+09
Distance (weighted distance (pop-wt, km))	82,170	7805.099	4413.087	94.27333	19650.13
Common border	82,170	0.01789	0.132552	0	1

Common language	82,170	0.15429	0.361229	0	1
Common colonizer	82,170	0.106024	0.30787	0	1
GDP of exporter	82,170	1.06E+12	5.56E+12	4.06E+07	8.09E+13
GDP of importer	82,170	1.06E+12	5.56E+12	4.06E+07	8.09E+13
Cost to export	82,170	530.0796	438.2436	0	2918
Time to export	82,170	108.7454	111.8532	1	816
Landlocked	82,170	0.192771	0.394477	0	1
FTA	82,170	0.155994	0.362852	0	1
HS5201					
year	79,218	2.02E+03	8.17E-01	2.02E+03	2.02E+03
Export value (USD)	79,218	4.14E+05	1.07E+07	0.00E+00	8.80E+08
Distance (weighted distance (pop-wt, km))	79,218	7688.876	4397.783	114.6373	19650.13
Common border	79,218	0.019011	0.136564	0	1
Common language	79,218	0.142392	0.349454	0	1
Common colonizer	79,218	0.09975	0.299668	0	1
GDP of exporter	79,218	1.08E+12	5.61E+12	4.06E+07	8.09E+13
GDP of importer	79,218	1.08E+12	5.61E+12	4.06E+07	8.09E+13
Cost to export	79,218	520.9072	437.8128	0	2918
Time to export	79,218	107.6752	112	1	816
Landlocked	79,218	0.202454	0.401831	0	1
FTA	79,218	0.157187	0.363979	0	1

Annex 5

Correlation between independent variables

	Distance	Common border	Common language	Common colonizer	GDP of exporter	GDP of importer	Cost to export	Time to export	Landlocked	FTA
Distance	1									
Common border	-0.2066	1								
Common language	-0.0668	0.1242	1							
Common colonizer	-0.0242	0.0666	0.3663	1						
GDP of exporter	0.0604	-0.0027	0.0174	-0.0217	1					
GDP of importer	0.0604	-0.0027	0.0174	-0.0217	0.0187	1				
Cost to export	0.0845	0.0085	0.0959	0.0682	0.0374	-0.0003	1			
Time to export	0.0278	0.0155	0.0433	0.0584	-0.0637	-0.0024	**0.664**	1		
Landlocked	-0.0767	0.0244	-0.0168	-0.0218	-0.032	0.0002	-0.1818	0.0464	1	
FTA	-0.3312	0.2065	0.068	0.0123	-0.0241	-0.0241	-0.1412	-0.1634	-0.0675	1

Annex 6

Baseline results for perishable and non-perishable products at HS 4-digits level estimated with PPML exporter-year, importer-year fixed effects, 2005-2014

	(1) Tomato	(2) Grapes	(3) Wheat	(4) Raw Cotton
GDP exporter				
GDP importer				
Distance RoW	-2.020	-1.065	-1.969	-1.070
	(0.244)***	(0.128)***	(0.125)***	(0.173)***
Cost RoW				
Time RoW				
Distance CA	-3.245	-3.825	-3.475	-1.978
	(0.756)***	(0.467)***	(0.447)***	(0.580)***
Cost CA				
Time CA				
Common border	0.027	0.540	0.105	0.693
	(0.273)	(0.201)***	(0.168)	(0.261)***
Common language	1.330	0.152	0.253	0.387
	(0.519)**	(0.171)	(0.178)	(0.299)
Common colonizer	0.897	-0.021	0.886	0.406
	(0.400)**	(0.396)	(0.299)***	(0.309)
FTA	1.820	1.223	0.193	-0.101
	(0.309)***	(0.155)***	(0.163)	(0.206)
Constant	30.698	25.173	34.605	28.309
	(2.039)***	(1.143)***	(1.079)***	(1.519)***
N	69,203	74,776	63,983	64,678

Standard errors in parentheses * $p < 0.10$, ** $p < .05$, *** $p < .01$; Standard errors clustered by country pair