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The Nexus Between Trade Facilitation and Macroeconomic Variables: A Panel Data Approach*

Hakan KAYA[1]
Murat AKKAYA[2]
Erkut AKKARTAL[3]

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Abstract

The efforts to remove obstacles to international trade, facilitate trade, and reduce costs on international trade gained momentum with the liberalization of the world. Trade facilitation is an important part of the agenda of the World Trade Organization (WTO). Trade facilitation aims to harmonize basic rules among countries to increase transparency, predictability, and efficiency. The studies conducted by the WTO present results for the economic benefits. We aim to exhibit the nexus between trade facilitation and macroeconomic indicators for 63 countries in 2007 - 2019 with panel data analysis. The period ends in 2019 to exclude the negative effects of the Coronavirus (COVID-19) pandemic. Because COVID-19 has caused significant problems in the supply chain and foreign trade transactions. Panel regression and panel causality tests confirm the significant linkage between trade facilitation and macroeconomic variables. Trade facilitation has effects on the current account balance, net trade balance, exports and import growth, inflation, and real interest rate as expected. Also, trade facilitation mainly leads to an increase in international trade and exports of high-tech products.

Keywords: Trade Facilitation, International Trade, Authorized Economic Operator, Macroeconomic Variables, Panel Data Analysis.

JEL Classification: F13, F10, E27, C23

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[1] Assist. Prof. PhD, İstanbul Arel University, Turkey, e-mail: hakankaya@arel.edu.tr, http://orcid.org/0000-0003-1512-8739

2 Professor, İstanbul Beykent University, İstanbul, Turkey, e-mail: muratakkaya@beykent.edu.tr, http://orcid.org/0000-0002-7071-8662

3 Professor, Yeditepe University, İstanbul, Turkey, e-mail: erkut.akkartal@yeditepe.edu.tr, http://orcid.org/0000-0002-7090-4449

1. Introduction

The decline in tariffs and non-tariff barriers as a result of long efforts has recently directed countries' attention to other problem areas. Thus, trade costs became an important concept for countries after the 1980s. This is because trade costs affect the competitiveness of countries, the direction of international trade, and macroeconomic variables. International trade firms in underdeveloped and developing countries are exposed to long wait times, delays, and high costs due to long and complex bureaucracy and insufficient infrastructure, so they lose their competitive power. Thus, the facilitation of trade has come to the fore to get rid of these problems and to provide efficiency. The efforts to remove obstacles to international trade, facilitate trade, and reduce costs on international trade gained momentum with the liberalization of the world after 1990. Especially in complex global supply chains, preventing and controlling trade risks in a way that does not reduce the speed and intensity of trade flows has become the main area of work in trade simplification. Trade Facilitation is one of the main areas of work of the World Trade Organization (WTO) and the World Customs Organization (WCO). WCO adopted the SAFE Framework of Standards to secure and facilitate global trade in 2005. WCO launched the Authorized Economic Operator (AEO) program in 2007, based on the provisions of the SAFE standards framework. The Authorized Economic Operator (AEO) program is the most important and widespread international program based on trade facilitation. In addition, the World Bank has published the Doing Business Report since 2006, analyzing the trade simplification of 190 countries and creating an index. Then, a Trade Facilitation Agreement was signed between the member states of the World Trade Organization in 2017. Trade facilitation aims to harmonize basic rules between countries to increase transparency, predictability, and efficiency.

We cannot trace a study in the literature that reveals the relationship between macroeconomic variables and the AEO program within the scope of trade simplification using the Doing Business Report. This study aims to reveal the connection between trade simplification of member countries before and after participation in the AEO program and macroeconomic indicators, and to make a new contribution to the literature. This study uses the data up to 2019 to eliminate the effects of the Coronavirus (COVID-19) epidemic, which negatively affected the global supply chain flow and macroeconomic variables.

The rest of the paper proceeds in the following way. Section 2 describes the motivation of the paper. Section 3 provides the literature review. Section 4 explains the data and model. Section 5 reports the empirical findings. The last part of the paper is the conclusion and discussion.

2. Motivation

Trade Facilitation is important in preventing hunger and poverty by providing easier entry of needed goods, especially in underdeveloped and

developing countries (Rippel, 2011). Thus, facilitating trade emerges in almost all studies and at meetings where trade costs are under discussion. This concept aims to simplify the transactions required for international trade, reduce the documents and costs required for such transactions, accelerate the movement of tradable goods between sellers and buyers, and finally facilitate international trade (Marti et al. 2014). Country experiences reveal that trade facilitation contributes to foreign capital inflows, investments, production, and employment, especially in international trade, and increases the effectiveness of the controls of public institutions in the foreign trade process and the compliance of the private sector with regulations and public revenues.

Trade Facilitation (TF) means "*the simplification, harmonization, standardization, and modernization of procedures of international trade*". The TF aims to harmonize basic rules among countries to increase efficiency, predictability, and transparency. The trade facilitation gets its roots from rules, standards, and internationally accepted practices. Thus, it can achieve increased competitiveness for a country and reduce trade barriers and costs (de Sá Porto et al., 2015). In the most general terms, the trade facilitation (TF) concept refers to all kinds of innovation, harmonization, and simplification processes that will reduce customs procedures cost and transaction process (Çakmak, 2016). Trade facilitation means the harmonization and simplification of international trade procedures, which includes the collection, presentation, transmission, and processing of information in international trade (Ministry of Commerce of Turkey, 2019).

The Trade Facilitation Agreement (TFA) is a binding multilateral trade agreement and officially came into force in 2017 for the members of the WTO. The TFA has crucial effects on the economies. Thus, several trade facilitation measures may be in use as a proxy. The Authorized Economic Operator (AEO) program as a concept of TFA means "*party involved in the international movement of goods in whatever function that has been approved by or on behalf of a national customs administration as complying with World Customs Organization (WCO) or equivalent supply chain security standards (WCO, 2018:4)*". AEO is a business partnership program between the customs administrations and the private sector. It enables the WCO members to share their security responsibilities with the trade officers and offers an opportunity to reward the private sector with additional facilitations (WCO, 2019). This program enables facilitated customs clearance for companies in the global supply chain engaged in customs activities, including importers, exporters, brokers, port officers, warehouse operators, and distributors. The members maintain extra trade facilitation means for importing and exporting, or transit procedures in paragraph 7.3 of TFA, for authorized operators. They may offer such trade facilitation means to all operators. Thus, AEO is one of the important measures to simplify trade. The concept of AEO has emerged to determine the people that customs

administrations can trust in foreign trade transactions to reduce their control over them and to transfer resources to risky transactions (Terzi, 2017). AEO is "*a party involved in the international movement of goods in whatever function that has been approved by or on behalf of a national customs administration as complying with WCO or equivalent supply chain security standards. AEOs include inter alia manufacturers, importers, exporters, brokers, carriers, consolidators, intermediaries, ports, airports, terminal operators, integrated operators, warehouses, and distributors.*

The Single Window (SW) system, as another trade facilitation measure, is "*a facility that allows parties involved in trade and transport to lodge standardized information and documents with a single-entry point to fulfill all import, export, and transit-related regulatory requirements. If information is electronic, then individual data elements should only be submitted once (UN/CEFACT, 2005)*. The SAFE framework (Standards to Secure and Facilitate Global Trade) presents a unified platform that will increase international trade and increase the economic and social welfare of the countries. SAFE improves the ability of the customs administration to identify and minimize high risks in the shipments, and to boost the efficiency in the management of goods, thus accelerating the clearance-release of goods (WCO, 2018). The SAFE has two principles, which are defined as establishing a link that will ensure continuous communication between customs administrations and increasing cooperation between customs administrations and the private sector. The SAFE framework helps to construct and develop network regulations in customs to boost the uninterrupted exchange of goods through global supply chains. The SAFE facilitates and encourages international trade and sets standards to secure international trade. These standards encourage importers and exporters to trade internationally and facilitate the transportation of goods. The criteria sought within the scope of the SAFE Framework determine the minimum standards for the customs administrations regarding which criteria should be in those who will apply for AEO. The WCO gives priority to the implementation of an AEO program that leads to a solid customs-business partnership and enhanced economic prosperity. AEO accreditation provides utility companies on many different levels. Also, it strengthens the market position of companies through risk management, harmonious global trade, and commitment to facilitating operations (Pannu, 2014). Trade facilitation plays an important role in the decision for international progress (Marti et al., 2014).

Considering the effects of the development of trade on economic growth, trade facilitation has become an issue that requires serious work for countries in recent years. Countries where policies aimed at facilitating trade are implemented successfully appear as more competitive countries.

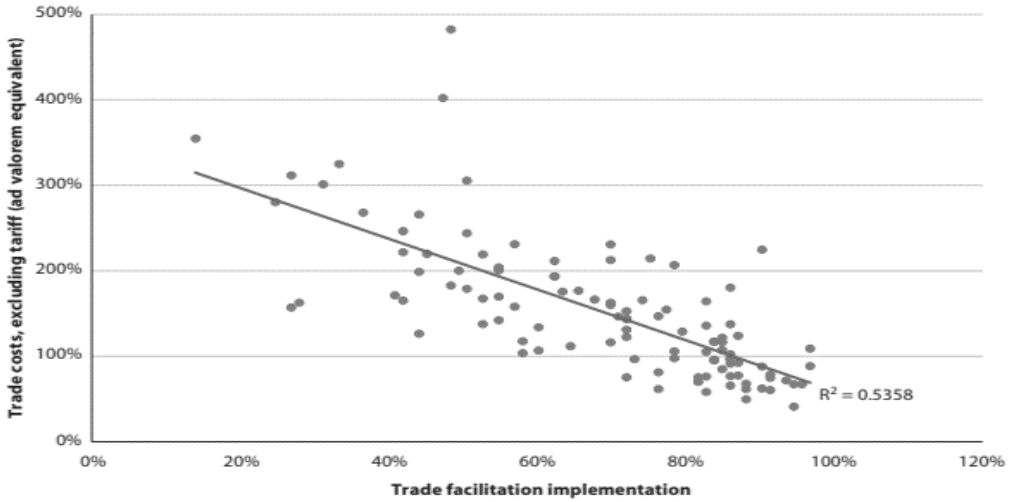
Trade facilitation, if fully implemented, could generate an increase of USD 1 trillion in total goods exports - trade rising by USD 569 billion - that is 9.9%

increase- in developing countries and exports rising by USD 475 billion – that is 4.5% increase per annum in developed countries (Hufbauer and Schott, 2013). The Trade facilitation may increase international trade by the range of 750 billion to 1 trillion US dollars per annum (possibly more under full implementation). Also, it raises global GDP (Gross Domestic Product) growth. It is estimated at 0.5% per year (Nee & Teh, 2016). Both reforming countries and trade partners gain benefits from trade procedures and facilitation. Countries may realize opportunities for prospective mutual gains with a multilateral trade facilitation agreement. Thus, this agreement leads to efficiency in customs procedures. The TFA provides a much-needed boost to the global economy in the short term. Also, it raises the world growth trajectory for the long term. If fully implemented, TFA could enable global world exports to increase by 2.7% and world GDP growth by 0.5% per year between 2015 and 2030 (World Trade Organization, 2015). The 2021 survey exhibits that "*The WTO Trade Facilitation Agreement measures have been well implemented throughout the region by improving transparency (81.7%), streamlining the formalities (75.5%), and enhancing the institutional arrangement and cooperation mechanisms (68.4%). On the other hand, despite the continued improvement of digital infrastructure to facilitate trusted and secure sharing of trade-related data and documents in electronic form, implementation of cross-border paperless trade remains challenging, with a regional average implementation rate below 40% (Asian Development Bank, 2021)*.

Trade facilitation may reduce trade costs and provide economic growth, especially in emerging and developing economies. The 2021 UN survey indicates that implementing full trade facilitation may reduce the average cost of trade by more than 13%. That is 6.7 percent more than the WTO TFA requirements (United Nations, 2021). The trade facilitation implementation rate is 64.7%. International trade costs and trade facilitation measures have a strong negative relationship (Figure 1).

Economic globalization and information technology expand trade facilitation around the world (Liang et al., 2021). Trade facilitation is an effective way to reduce tariff evasion due to under-reporting of import prices, as well as in countries with weaker control of corruption (Beverelli and Ticku, 2022; Shepherd, 2022). Trade facilitation has significant positive impacts on the export technological sophistication of transition economies (Hu et. al., 2022). Also, trade facilitation positively affects China's agricultural exports scale to the Association of Southeast Asian Nations (ASEAN) market (Fan et. al., 2022).

Figure 1. Trade costs and trade facilitation



Source: Authors' Calculation

Although the literature has many definitions of trade simplification, a specific program that simplifies trade in a fundamental sense has not been defined. In addition, although humankind has many agreements that provide trade simplification, no program put forward within the framework of these agreements has represented trade simplification as a model. This study examines trade simplification within the framework of international agreements and designed programs and considers the AEO program as a model and an output of trade simplification using the Doing Business Report prepared by the World Bank.

The World Trade Organization and the World Customs Organization publish various research and reports on many commercial issues in member countries. These reports are the most important indicator of the trade flow in the member countries. In terms of trade facilitation indicators, one of the most important indices that allow us to compare countries is the Doing Business Report prepared by the World Bank. This report attempts to measure the difficulty or ease of establishing Small and Medium Enterprises (SMEs) with existing regulations for a new entrepreneur to invest. Also, it focuses on the requirements for exporting and importing goods by standard ocean freight, and it measures the time and cost involved (excluding tariffs). Time and cost here are the time and cost to bring together all the official procedures for export and import from the contract between the two parties, up to the delivery of the goods. Cross-border trade indicators therefore include the number of all documents required to export / import goods; all necessary to export / import goods time required to comply with procedures; and costs associated with all procedures required to export / import goods. Doing Business/Ease of Doing Business Index evaluates the suitability of the investment environment in a country. In other words, this index ranks the countries of the world according to the criteria of having a suitable economic

environment for doing business/starting a business, and this ranking is published every year in reports with different names.

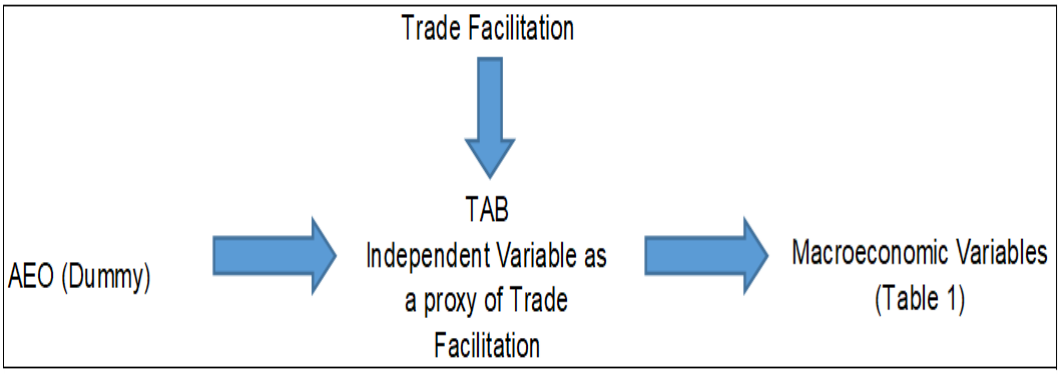
Trading Across Borders (TAB), the most important pillar of international trade, measures the customs performance of countries. Standardizing and modernizing customs procedures and reducing bureaucracy play a major role in removing barriers to global trade. The Trading Across Borders is a ranking that shows the transactions required for the export and import of goods in the Ease of Doing Business, as well as the cost of the shipment process, to shed light on the bureaucratic and logistical obstacles faced by traders. The TAB is determined by considering the documents required for exporting or importing goods, the time, and cost of the shipping process. The TAB also contains annual data for the time and cost in the logistical process and customs clearance of exporting and importing goods.

The data on TAB comes from a questionnaire applied to local freight forwarders, customs brokers, port authorities, and traders, and is listed in the Doing Business Report. Ibrahim and Ajide (2022) also use five components of TAB in investigating the effects of trading facilitation on environmental quality for African countries.

Literature does not include a variable measuring direct trade facilitation. We use *"Trading Across Borders Ranking (TAB)"* as a trade facilitation proxy. This study uses all components of TAB. We try to understand whether TAB is an appropriate measure of trade facilitation. Accordingly, this study includes a dummy variable using AEO, which is one of the important parts of trade facilitation. The years that countries transitioned to the AEO program are determined by the Doing Business Report. If there is no AEO program for a year, it is marked as 0, if there is, it is marked as 1. If AOE significantly affects TAB, we can use TAB as a proxy and then test the impact of Trade Facilitation on macroeconomic indicators via AEO. Figure 2 explains the model using Trade Facilitation.

In the economic literature, growth theories reveal the close relationship between international trade and economic growth. According to the export-led economic growth model, domestic productivity increases, and other effects of exports through indirect channels have a positive impact on economic growth. The effects of liberalization and simplification of international trade policies on macroeconomic variables such as economic growth, employment, current balance, and foreign direct investments, etc., are traced in the studies in the literature. This study also investigates the footprint of trade facilitation on the macroeconomic variables.

Figure 2. Model Formation



3. Literature Review

The literature provides local and regional studies (Brooks and Stone, 2010; Boopen Seetanah and Fauzel, 2016; Toševska-Trpčevska and Tevdovski, 2016; Fauzel, 2017; Sakyi et al., 2018; Maciejewski and Wach, 2019; Arevalo & Merlo, 2020; Ijirshar, 2022) on this subject. However, the literature does not include a global one, especially a panel data analysis for many countries. The panel data method will also lead to a more comprehensive and descriptive common conclusion with long-term data.

International trade encourages economic growth, as reflected in the GDP. International trade is the sum of export and import transactions and greatly affects the economic growth of a country. Some studies suggest that exports have a positive influence on economic growth. Trade openness affects economic growth positively and also boosts economic growth (El Khoury and Savvides, 2006; Zahonogo, 2017).

Trade facilitation was important in the economic growth of 23 developing countries in the 2007 – 2014 period (Fauzel, 2017). The linkage between improved trade-facilitation policy and global business sourcing through international trade transactions is positive (Mann, 2012).

An average decrease in trade costs based on facilitating trade among Asian members of the Asia-Pacific Economic Cooperation could yield significant gains (Brooks & Stone, 2010). Boopen Seetanah and Fauzel (2016) analyze the nexus between trade facilitation and trade flows of the African economies in 2007 – 2014 using a panel vector autoregressive method in the view of the Logistics Performance Index (LPI) developed by the World Bank. Trade facilitation positively and significantly affects trade flows, and a 1 % increase in trade facilitation contributes to a 0.77 % increase in trade flow. The model specifications for South-Eastern European countries show that only 5 indicators

positively influence trade. Model results provide strong evidence for export growth (Toševska-Trpčevska and Tevdovski, 2016). A panel data study by Arevalo & Merlo (2020) estimates the relationship between interoceanic highway construction and trade facilitation for Brazil and Peru. The paper indicates that highway construction positively influences trade facilitation for them.

Iwanow and Kirkpatrick (2009) apply a panel data analysis for developed and developing countries in Africa over the period 2003 – 2004 to investigate the effects of trade facilitation and other trade-related institutional factors on export performance in the manufacturing sector. Trade facilitation reforms may improve export performance. Trade facilitation affects South America and mainly Chile's export volume using static panel data on Chilean exports in 2006 – 2014 (Fuenzalida-O'Shee et al., 2018). A panel data study by Oberhofer et al. (2018) measures the effects of reductions in time spent on border procedures based on international trade and welfare for high and middle/low-income countries throughout 2006 and 2012. The positive welfare influences middle and low-income countries on average. Factors such as the quality of welfare, institutional quality, and the education system have crucial effects on them.

Busse et al. (2012) focus on the relationship between foreign aid spent on Aid for Trade and Trade Facilitation on the costs of trading for 99 developing countries in 2004 – 2009 using panel data. Aid indicators negatively affect the costs of trading. Sakyi et. al. (2018) analyzes the contribution of trade facilitation to the social welfare of African countries. By GMM methodology and observe significant relations among them. Avetisyan and Hertel (2021) analyze the impacts of trade facilitation on international trade and exhibit positive and significant relations among them. Economics of Transportation, 28, 100236. Ijirshar (2022) investigated the effects of trade facilitation on economic growth in middle-income countries for the 2010 - 2020 period by GMM methodology and observed a weak positive influence of trade facilitation on economic growth.

The literature contains limited studies focusing on trade facilitation and the Authorized Economic Operator (AEO) program analysis with panel data. The availability of an authorized economic operator program and a single-window program improves the trading performance of each country. (de Sá Porto et al., 2015). This paper explores trade facilitation indicators on trade transactions using a panel data methodology between 2011 and 2012 for 72 countries. Al-Shbail (2020) identifies the key risk profiles and indicators contributing to the protection of the customs revenue of Jordan with a panel data approach using a total of 600 observations for 2019. Customs authorities should adopt successful programs such as authorized economic operators and post-clearance audits as an important variable in measuring and improving compliance.

Safaeimanesh and Jenkins (2021) investigate the effects of trade facilitation on the economic gain in the countries of the Economic Community of

West African States (ECOWAS). The economic welfare gains may be between US$1.6 billion and US$2.7 billion by 2019 prices if they reduce excessive trade compliance costs with using trade facilitation, the economic welfare gains may be between 0.24% and 0.42%. Ibrahim and Ajide (2022) analyze the relationship between trade facilitation and foreign direct investment for 26 African countries using a panel data analysis from 2004 to 2014. Trade facilitation puts off foreign direct investment inflows. Moreover, it significantly affects the Gross Domestic Product and inflation. Abdulqadir (2022) analyzes the nexuses between trade openness, renewable energy consumption, economic growth, and environmental degradation for OPEC members (Organization of Petroleum Exporting Countries) in the period of 1990 – 2019 and determines a long-run relationship between economic growth and environmental degradation.

Alfarajat and Masron (2023) determined that 10 trade facilitation indicators positively affect imports in developing countries using UNDP's formula on the Human Development Index to construct the trade facilitation index. Tapkara et. al. (2024) investigates the empirical relationship between trade facilitation and sustainable development using 36 African countries' data for the period 2007–2019 and determine the significant positive effects of trade facilitation on a sustainable environment using Trade Facilitation data from the World Economic Forum and Doing Business reports. Bakouan et. al. (2024) examines the potential economic implications of trade facilitation for East Africa. They observe that trade facilitation would increase economic activities and household consumption. Melo et. al. (2024) report that implementing the Trade Facilitation Agreement would have an impact on imports in the range of 3.5%–7% and 8% extra growth for exports.

4. Data and Methodology

This study aims to analyze the relationship between trade facilitation and macroeconomic indicators for 63 countries (24 developed and 39 developing countries) in the period 2007 - 2019 with panel data analysis. In the WCO compendium 2020 report, 63 countries with accessible data are included in the study out of 97 countries implementing the AEO program. The period ends in 2019 to exclude the impact of the Coronavirus (COVID-19) pandemic. Due to COVID-19, the global supply chain has been disrupted in the world and there have been significant deviations in international trade volume and balances.

The method that combines time series and cross-sectional analysis and tests suitable models is called panel data analysis. Panel data analysis combines cross-sectional data and time series. Accordingly, it provides more illuminating data, more variability, less linear connection between variables, more degrees of freedom, and more efficiency (Gujarati, 2003). The panel data model is.

$$Y_{it} = \alpha + \sum_{t=1}^{k} \beta_k X_{kit} + \mu_{it,} i = 1, \dots, N, t = 1, \dots, T, k = 1, \dots q \quad (1)$$

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Here, Y means (dependent variable), X_k (independent variables), α constant parameter, β_k slope parameters, and μ error term. i shows the sub-index represents the cross-section units (such as individual, firm, city, country), and t represents the sub-index represents time (such as day, month, year). the mean of the error term (μ_{it}) is zero and has constant variance. In this model, the continuous and slope parameters take values according to both units and time (Tatoğlu, 2013: 4).

Table 1. Variables & abbreviations

Variables	**Abbreviations**
Dummy	AEO
Current Account Balance (% of GDP)	CAB
Current Account Balance	CAD
Consumer Price Index	CPI
Growth in Exports of Goods & Services	EXG
Foreign Direct Investment Inflows (% of GDP)	FDI
High-Technology Exports (% of Exports)	HTE
High-Technology Exports (% of total trade)	HTG
Growth in Imports of Goods & Services	IMG
Inflation	INF
Gross Domestic Product (GDP)	GDP
GDP per Capita Growth	GDC
Gross National Income (GNI) Growth	GNG
GNI per Capita Growth	GNC
Net Trade Balance	NTB
Real Interest Rate	RIR
Unemployment ratio	UEN
Unemployment is modeled by the ILO	UEI
Trading Across Borders Ranking	TAB

We get AEO data from the World Customs Organization's AEO Compendium reports. This study uses nominal data and the annual rate of change of the variables $(X_t - X_{t-1}) / X_{t-1}$.

We use *"Trading Across Borders Ranking (TAB)"* as a trade facilitation proxy. Since academic literature does not have a direct variable to analyze the effects of AEO on international trade and the macro economy. The study uses all components of TAB. We try to understand whether TAB is an appropriate measure of trade facilitation. Accordingly, this study includes a dummy variable about using AEO, which is one of the important parts of trade facilitation. If AOE significantly affects TAB, we can use TAB as a proxy and then test the impact of Trade Facilitation on macroeconomic indicators via AEO.

5. Results

The correlations between TAB and other variables of the model are low. The highest positive correlation is 0.4355 between TAB and inflation (INF). The negative one is 0.3471 between TAB and High-Technology Exports % of total trade (HTG) (Table 2).

Table 2. Correlation table

	CAB	CAD	CPI	EXG	FDI	GDC	GDP	GNC	GNG
TAB	-0.3227	-0.0365	0.2136	0.0371	-0,1286	0.0556	-0.2633	0.0451	0.0642

	HTE	HTG	INF	IMG	RIR	NTB	UEI	UEN	RI
TAB	-0.1518	-0.3471	0.4355	0.0147	-0.0803	-0.003	0.0995	0.0671	0.2687

Source: Authors' Calculations

Panel data models can be estimated based on panel least squares, fixed effects or random effects approaches. For an economic model, Hausman (1978) offers a test to choose fixed effects or random effects estimators. If the difference between the parameters is not systematic at the end of the test, it is decided that the random effects model is appropriate, and if systematic, the fixed effect model is appropriate. The Hausman test proves that the model has a random effect in panel data analysis (Prob. = 0.0748 > 0.05).

Cross-sectional independence assumes that all countries are affected by a shock to any of the panel units and that the other countries that make up the panel are not affected by a macroeconomic shock occurring in any of the countries. Today, with the increase in the level of international trade and the degree of financial integration, it is more realistic that the economic shock in any country will affect other countries differently. Thus, it is necessary to test whether there is a cross-sectional dependence between the series before starting the analysis. If the results obtained in the analysis are obtained without considering the cross-sectional dependence will be biased and inconsistent (Breusch and Pagan, 1980; Pesaran, 2004). Unit root tests are divided into two as, first-generation and second-generation panel unit root tests, depending on whether the horizontal sections that make up the panel are independent from each other. First-generation tests assume that the cross-sections that make up the panel are independent (no correlation between the units that make up the panel). Many economies interact with each other in the international arena. Therefore, there is often a correlation between cross-sections. To eliminate this deficiency, second-generation unit root tests have been developed, considering the dependency between cross-sections. The main feature of the second-generation tests is that they assume a correlation between the series belonging to the units. Breusch-Pagan LM test, Pesaran LM

Test, and Pesaran CD Test results confirm that no cross-sectional dependency occurs in the model (Table 3).

Table 3. Cross-sectional dependency test

Test	Statistic	Prob.
Breusch-Pagan LM	13.6352	0.3446
Pesaran scaled LM	4.3418	0.4131
Bias-corrected scaled LM	4.2883	0.8009

Levin, Lin & Chu, Im, Pesaran & Shin, ADF-Fisher and PP-Fisher test statistics indicate that EXG and GDP variables are not stationary, and they become stationary at the first difference (Table 4). The stationary variables in the first difference are transformed and added to the model.

Table 4. Unit root test results

Variable	Levin, Lin & Chu	Im, Pesaran & Shin	ADF-Fisher	PP-Fisher	Prob. *	1. Diff.	Prob. *
TAB	-23.6362	16.3715	458.984	566.503	0.0000		0.0000
CAB	-12.9143	-7.1537	247.152	317.742	0.0000		0.0000
CAD	-11.0190	-5.1697	207.564	219.962	0.0000		0.0000
CPI	-4.6761	1.2223	163.886	319.732	0.0000		0.0000
EXG	-23.8858	-17.3599	495.653	664.517	0.1386	-27.2534	0.0000
FDI	-18.1413	-13.8763	411.621	480.993	0.0000		0.0000
GDC	-18.1001	-15.0653	436.521	488.553	0.0000		0.0000
GDP	-0.7146	3.5853	98.825	121.588	0.2374	-23.0674	0.0000
GNC	-19.6765	-15.4937	447.851	502.586	0.0000		0.0000
GNG	-18.7661	-14.9352	435.333	503.811	0.0000		0.0000
HTE	-11.6795	-2.0187	167.640	165.248	0.0000		0.0000
HTG	-10.3163	-5.3564	225.251	208.390	0.0000		0.0000
INF	-15.6306	-9.5550	302.495	277.249	0.0000		0.0000
IMG	-25.1885	-17.4562	500.021	627.035	0.0000		0.0000
NTB	8.9717	-3.2041	171.321	177.479	0.0000		0.0000
RIR	-10.3573	-7.5685	275.197	293.331	0.0000		0.0000
UEI	-5.7726	-2.2577	178.108	130.350	0.0000		0.0000
UEN	-5.5128	-2.9229	189.046	145.669	0.0000		0.0000

Source: Authors' Calculations

Table 5 exhibits Panel Least Squares results with a random effects model. The Model is statistically significant at the 5% level (F-stat = 0.0000 < 0.05).

Table 5. Panel regression results (dependent variable: TAB)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AEO	-6.6912	3.0772	-2.1745	**0.0300**

UEI	7.5948	1.8946	4.0087	0.0001
UEN	-7.6461	1.8673	-4.0947	0.0000
RIR	2.4231	0.2424	9.9967	0.0000
NTB	-4.2100	4.8900	-0.0087	0.9931
IMG	-2.5300	7.5600	-3.3428	0.0009
INF	2.8875	0.2973	9.7136	0.0000
HTE	-0.7149	0.1672	-4.2755	0.0000
HTG	9.7301	3.6300	2.6760	0.0076
GNG	1.5632	2.5038	0.6243	0.5326
GNC	-2.3958	2.6373	-0.9085	0.3639
GDPD	-0.1802	0.4612	-0.3908	0.6960
GDG	2.6636	2.9238	0.9110	0.3626
GDC	-1.1534	3.0696	-0.3758	0.7072
FDI	-0.6403	0.1913	-3.3473	0.0009
EXGD	-1.3200	2.8500	-0.4627	0.6437
CPI	0.1124	0.0423	2.6557	0.0081
CAD	9.2600	5.3800	0.1721	0.8634
CAB	-0.4782	0.3145	-1.5204	0.1288
C	35.9068	7.6138	4.7160	0.0000

The panel model demonstrates a significant relationship between TAB and AEO. Thus, we can use TAB as a proxy to analyze the impact of trade facilitation on macroeconomic indicators. The model has no autocorrelation (Table 6) and no heteroskedasticity (Table 7) problem among variables.

Table 6. Autocorrelation Test

Wald Test	
t- Statistic	**Prob**
-0,6825	0,5063

Source: Authors' Calculations

Table 7. Heteroskedasticity Test

Breusch – Pagan - Godfrey LM Test	15.25	0.1234

Source: Authors' Calculations

As a result of determining that the TAB variable can be used as a trade facilitation indicator, 17-panel regression analyses in which each macroeconomic variable shown in Table 1 is the dependent variable, and TAB and the other variables are the independent variables, were conducted. Table 8 summarizes Panel Least Squares results with a random effects model for each macroeconomic variable. Except for foreign direct investment (FDI), other variables are statistically significant at the 5% level (F-statistic value = 0.0000 < 0.05). Thus, trade facilitation influences economic growth, but the coefficient is negative. We expect to have a positive coefficient. We believe that instrumental variables and

dummy variables in the model turn the coefficient negative. Trade facilitation affects the current account balance, net trade balance, exports and import growth, inflation, and real interest rate as expected. A statistically significant relationship between trade facilitation and export growth. If the TAB variable increases by 1%, the export growth rate increases by 268.15%. This relationship is also valid for import growth. If the TAB variable increases by 1%, the import growth rate increases by 359.74%. Trade facilitation has a greater impact on imports than on exports. Therefore, the net foreign trade balance turns negative (-64,68). Moreover, the biggest impact of trade facilitation emerges in high-tech exports (806.79). Trade facilitation increases the volume of exports of high-tech products. It affects the unemployment rate. But the coefficient is very low (0.0169%). Like, trade facilitation creates a slight decrease in the current account balance. Net trade balance and current account balance together create a 2.89 % increase in inflation and 2.42 % real interest rates.

Table 8. Panel Regression results for macroeconomic variables

Dependent Variable	Coefficient	Std. Error	t-Statistic	Probability	R-squared
GDP	-0.0287	0.0099	-28.677	**0.0043**	0.9739
CAB	-0.0221	0.0047	-49.022	**0.0000**	0.7723
NTB	-64.6790	34.1850	-18.920	**0.0489**	0.9446
EGV	268.1536	106.6478	25.144	**0.0121**	0.9786
FDI	0.0113	0.0112	10.014	0.3169	0.4524
HTE	806.7901	376.4080	21.434	**0.0324**	0.9260
IMG	359.7358	126.1253	28.522	**0.0045**	0.9710
INF	2.887497	0.297262	9.71363	**0.0000**	0.6348
RIR	2.423084	0.242388	9.99669	**0.0000**	0.7298
UEI	0.0169	0.0031	55.196	**0.0000**	0.8480

Source: Authors' Calculations

We apply the Panel Granger Causality test developed by Granger (1969) to define the causality relationship between variables in the next step. The Panel Granger causality test determines the direction of causality in the presence of a time-dependent lagged relationship between variables. Table 9 shows the causality test results between economic growth and variables.

Table 9. Panel Granger causality test

Variable	F-Statistic	Probability	Variable	F-Statistic	Probability
CAB- TAB	214.81	0.1175	HTE- TAB	0.19	0.8228
TAB- CAB	380.25	**0.0228**	TAB- HTE	0.99	0.3714
CAD- TAB	0.98	0.3774	HTG- TAB	0.07	0.9315
TAB- CAD	0.67	0.5138	TAB- HTG	0.73	0.4811

CPI- TAB	760.44	**0.0005**	IMG- TAB	0.28	0.7568
TAB- CPI	725.53	**0.0008**	TAB- IMG	134.28	0.2618
EXG -TAB	0.12	0.8906	INF- TAB	804.02	**0.0004**
TAB- EXG	586.68	**0.0030**	TAB- INF	518.41	**0.0058**
FDI- TAB	183.06	0.1611	NTB- TAB	0.79	0.4556
TAB- FDI	265.38	**0.0411**	TAB- NTB	0.19	0.8277
GDC- TAB	201.56	0.1340	RIR- TAB	0.42	0.6575
TAB- GDC	0.03	0.9732	TAB- RIR	946.87	**0.0000**
GDP- TAB	506.36	**0.0066**	UEI- TAB	458.52	**0.0105**
TAB- GDP	0.35	0.7055	TAB- UEI	132.99	0.2652
GNC- TAB	274.36	0.0651	UEN- TAB	510.48	**0.0063**
TAB- GNC	0.35	0.7015	TAB- UEN	209.58	0.1238
GNG- TAB	579.67	**0.0032**	AEO- TAB	371.16	**0.0249**
TAB- GNG	0.12	0.8845	TAB -AEO	0.39	0.6755

Source: Authors' Calculations

Two-way causality occurs between Inflation (INF), Consumer Price Index (CPI), and Trading Across Borders Ranking (TAB). One-way causality emerges from the Trading Across Borders Ranking (TAB) to Gross Domestic Product (GDP), Unemployment rate (UEI), and Authorized Economic Operator (AEO). Also, one-way causality emerges from Current Account Balance (CAB), Export Growth (EXG), Foreign Direct Investment (FDI), Real Interest Rate (RIR), and unemployment rate by ILO methodology UEI) to Trading Across Borders Ranking (TAB). Panel Causality Test results are consistent with the Panel regression results.

6. Conclusion

With the liberalization of trade in the world, efforts to remove obstacles to foreign trade, facilitate trade, and reduce costs on foreign trade have gained momentum. Trade facilitation is an important part of the agenda of the WTO as part of the Doha Development Round negotiations. The Trade Facilitation Agreement, in general; GATT Article V (Freedom in Transit), Article VIII (Trade-Related Fees and Formalities), and Article X (Transparency and Uniformity of Trade Legislation and Practices) contains the provisions drafted to explain and improve the cooperation between the customs administrations and the provisions of special and favorable treatment. Authorized Economic Operator (AEO) applications are now in use to simplify and accelerate customs practices and reduce costs. The authorizations and permissions AEO contain bring great convenience to the authorized officer in terms of time and cost and greatly increase competitiveness. With the "*Single Window System*" to digitize customs and facilitate trade, it has been ensured that all the information and documents required for goods subject to foreign trade are presented at a single application point. The World Bank measures and reports the results of all trade facilitation and AEO with the World Bank Doing Business Report.

Economic analyses and papers reveal that the efforts to facilitate trade have an undeniable positive effect on trade and economic growth. The most important benefit of facilitating foreign trade is the reduction of trade costs. With the facilitation of trade, the reduction in costs will have positive effects both for businesses and for the national economy. In addition, with the decrease in foreign trade costs, the competitiveness of companies will increase, and companies will be able to deliver their goods to consumers in a faster and cheaper way. As a result, consumers will have the opportunity to access a wider range of goods more cheaply and more easily.

Panel regression and panel causality tests confirm this significant linkage. The panel model demonstrates the relationship between trade facilitation and macroeconomic variables. Trade facilitation has effects on the current account balance, net trade balance, exports, and import growth, inflation, and real interest rate as expected. Also, trade facilitation mainly leads to an increase in international trade and exports of high-tech products. In addition, this study proves that the Trading Across Borders Ranking is a trade facilitation proxy. Results are consistent with Mann (2012). Panel Causality Test results are consistent with the Panel regression results. A causal relationship emerges between the many variables. Two-way causality occurs between inflation (INF), consumer price index (CPI), and Trading Across Borders Ranking (TAB). We know that inflation and the consumer price index affect all macroeconomic variables directly or indirectly. Also, one-way causality emerges from the Trading Across Borders Ranking (TAB) to Gross Domestic Product (GDP) and unemployment rate (UEI), which are important macroeconomic indicators.

The main reason why trade facilitation affects international trade and especially exports of high-tech goods positively is that it brings many features such as new production techniques, technologies, knowledge, research, and development activities. With trade facilitation, the flow of goods per unit time from customs will increase, and thus, the entry of enterprises to export markets will be facilitated with the decrease in commercial costs. Despite the recent increasing protectionist tendencies in world trade, it is also necessary to remove, at least reduce, and better determine the rules and facilitate legal trade to prevent damage to global production processes and the safe growth of global trade. Thus, the international trade volumes of especially developing countries will increase and states will earn more income, as well as a positive contribution to the social welfare of countries with increasing employment, falling poverty, and rising quality of life.

The evidence demonstrates that countries using effective trade facilitation strategies experience high growth in exports, foreign direct investment, and support domestic capacities. Also, trade facilitation stimulates integration, cooperation, and economic stability among nations. In conclusion, trade

facilitation is a cornerstone of economic policy to fulfill the potential of international trade. This can only be achieved in countries that are dedicated to the ongoing enhancement of infrastructure, legal frameworks, and technological advancements to support trade facilitation efforts.

The most important limitation of this study is the lack of a variable to measure trade simplification directly. To overcome this limitation, we use a dummy variable. The World Bank developed the Trade Across Border Index in 2019, but there is no retrospective data. This index can be developed and used retrospectively in future studies.

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