Yıl: 2024 **Cilt:**1 **Sayı:**2 **Sayfa:**115-136

Maltepe Üniversitesi Akdemik Bakış Dergisi
Maltepe University Academic Perspective

e-ISSN: 3062-4525

The Reflections of 2019-2020 Supply Shock on the CEE-DCs' Economy: Bounds Test Approach

Hakan Erpolat[1,2], Nurtaç Yıldırım[3]

ARTICLE INFO

Research Article

Article History

Received: 21.10.2025
Accepted: 24.12.2025

Keywords:
ADL, Export Sector, Real Exchange Rate, Supply Chain, Supply Shock.

Abstract

In this study are investigated the effects of the global outbreak triggered supply shock on five Central and Eastern European-Developing Countries' (CEE-DCs) export sector, with the expatiation of this effect through the severe currency fluctuations of 2018, and the supply chain rupture in the People's Republic of China (PRC) of 2020. The use has been made of Pesaran's ADL technique adjusted to our model in which the regression analysis, independent variable of which is the exports of countries in question, and the regressors of which are the foreign income level, the reel exchange rate, and the import from PRC being proxy for the global supply chain rupture, has corroborated that all variables are co-integrated, and in the long run are statistically significant effects on exports observed from foreign income levels, the real exchange rate, and imports from the PRC. In the short run is the import from PRC alone that has significant effects, a fact that global outbreak has adversely affected the export sector of the countries in question due to the supply chain rupture in PRC, being the main culprit of the supply shock of 2019-2020.

MAKALE BİLGİSİ

Araştırma Makalesi

Makale Tarihleri
Gönderim: 21.10.2025
Kabul: 24.12.2025

Anahtar Kelimeler:
ADL, Arz Şoku, İhracat Sektörü, Döviz Kuru, Tedarik Zinciri.

2019-2020 Arz Şokunun Gelişme Yolundaki Merkez ve Doğu Avrupa Ülkelerine Yansımaları: Sınır Testi Yaklaşımı

Özet

Küresel salgının yol açtığı arz şokunun beş Gelişme Yolundaki Merkez ve Doğu Avrupa ülkesinin ihracat sektörüne yansımalarının incelendiği bu makalede, 2018 yılındaki şiddetli kur dalgalanmaları ile 2020 yılındaki Çin Halk Cumhuriyeti'nde (ÇHC) yaşanan tedarik zinciri problemlerinin etkilerinin ayrıştırılması amaçlanmaktadır. Pesaran'ın geliştirdiği ADL tekniğinin kullanıldığı modelde, bağımlı değişken olarak ele alınan ülkelerin ihracat düzeylerinin, dış alem gelir seviyesi, reel efektif döviz kuru ve arz şokunu temsilen ÇHC'den yapılan ara malı ithalatı bağımsız değişkenleri ile uzun dönemde dengeye geldiği tespit edilmiştir. Uzun dönem denklemi, dış alem gelir seviyesi, reel döviz kuru ve ara malı ithalatının, ihracat üzerinde istatistiki olarak anlamlı etkileri bulunduğuna işaret etse de, hem uzun hem de kısa döneminde anlamlı çıkan tek serinin ithalat değişkeni olduğu görülmüştür. Bu bulgu, tedarik zinciri bozulmasının tetiklediği 2019-2020 arz şokunun, ihracat sektöründeki bunalımın lokomotifi olduğu sonucuna ulaşılmıştır.

[1] Graduate Research Assistant, Hakan Erpolat, Istanbul Maltepe University, Faculty of Business and Management Sciences, hakanerpolat@maltepe.edu.tr. ORCID: 0000-0002-6425-0258

[2] PhD Candidate at Istanbul University, Institute of Social Sciences, Economics, 1401120006@ogr.iu.edu.tr. This article originates from the author's doctorate dissertation titled "Küresel Salgının İktisadi Yansımaları: 2019-2020 Arz Şokunun Gelişme Yolundaki Merkez ve Doğu Avrupa Ülkelerine Etkisi".

[3] Associate Professor, Nurtaç Yıldırım, Istanbul University, Faculty of Economics, nurtacy@istanbul.edu.tr. ORCID: 0000-0002-4374-2958

1. Introduction

The year of 2020 is known to be of no little bear upon the export being a locomotive of the Central and Eastern European-developing countries' (CEE-DCs) economic performance. What are the main reasons behind the fluctuations in the export sector of CEE-DCs which mostly depends on the trade with developed Central and Western European countries (CWECs)? Is the exchange rate depreciation of 2018, or the supply chain rupture, related to the mobilization of many international companies in the People's Republic of China (PRC) and the significant reduction in demand for goods and services engendered due basically to the lockdown policies triggered by the global epidemic, responsible for these vacillations? Hypothetical construction of this study is the following:

H_0: COVID-19 pandemic did negatively not bear upon the exports of CEE-DCs.

H_A: COVID-19 pandemic negatively borne upon the exports of CEE-DCs.

H_{A1}: It was primarily due to exchange rate depreciations that COVID-19 pandemic negatively borne upon the exports of CEE-DCs.

H_{A2}: It was primarily due to supply chain rupture in PRC that COVID-19 pandemic negatively borne upon the exports of CEE-DCs.

H_{A3}: It was primarily due to both exchange rate depreciations and supply chain rupture in PRC that COVID-19 pandemic negatively borne upon the exports of CEE-DCs.

The impact of the COVID-19 pandemic on the export sector through the disruption of the supply chain in PRC coincided with the effects of the ongoing upward movements in the exchange rates in the countries aforementioned is what motivates this paper. Above all, it is a consensual among economists that the COVID-19 outbreak subsumes demand shocks into supply-sided ones (Brinca et al., 2020). Accordingly, usual supply chain disruptions, more often than not, are expected to affect merely demand, whereas disruptions engendered by global pandemics are capable of pushing both supply and demand to the extremely high and inordinately low levels (Craighead et al., 2020). To consider, for instance, the economic measures by means of lockdown policies to control the effects of the pandemic have put limits on the consumers' access to goods and services representing the demand side of the shock. By the same token and as a result of these policies, there have been large scale layoffs having interrupted the production constituting the supply side of the shock. However, when reckoning with the international happenstances and consequential economic problems such as production, value and supply chain disruptions, it is compelling to think that supply chain shocks are of much broader dimensions, which is why this article is designed to concentrate on the supply side of the shocks, excluding demand side problems.

Nuno Fernandes (2020) draws attention to the fact that there is no correlation between the economic effects of the global outbreak and the death rates, unlike the effect of the pandemic on economic activities engendered by the lockdown policies implemented by the governments on the grounds that the economic effects of the epidemic would high likely be costly. Haleem and Javaid (2020) compartmentalize the impacts of the global outbreak into three as "health", "economic" and "societal" dimensions, and elaborate the economic effects as the reduction in production of basic needs, deterioration in supply chains, losses in national and international companies, solidification in liquidity flows and significant slowdown in growth. Michie (2020) brings attention to the lessons to be learned from the global outbreak, underscoring the impacts of the economic crises on economic performance incited by the major pandemics, and rather than the effect of the pandemics on the death rates, focusing on the economic recessions leading to death rates. Kalogiannidis et al. (2020) introduce the distinctive properties of the measures taken by developing countries against pandemic at the early phases of global outbreak, and recommends that these measures should be in accordance with the operational needs and policies of the particular country to dampen economic losses. Cúrdia (2020) puts forward that unemployment rate skyrocketed across countries due to the pandemic, had far exceeded the improvements in productivity and the reductions in demand, and that "aggressive" monetary policies might have been able to mitigate the uptrend in unemployment. Newbold et al. (2020) draws attention to the significative role of "social distancing" in reining the spill-over effect of global epidemic, yet argues that such practices might engender certain trade-off betwixt health burden and economic costs.

Giri and Rana (2020) point out to the infrastructural lack regarding the diagnosis of COVID-19 of developing countries, and argue that it is primarily through the national and international cooperation that public authorities could indemnify this problem. Stubs et al. (2021) speak to the measures taken by multinational financial institutions to quell the financial insolvency of emerging markets fighting against the pandemic and to minimize the financial gap between them and developed ones, assessing how much of the goals have been achieved. Alon et al. (2020) come up with the suggestion that the policies implemented by developing countries in the fight against the epidemic should be different from those in developed countries, claiming that lockdown policies have been quite little effective in developing countries, with fewer lives being saved compared to the losses in national income. Instead, age-oriented policies and other measures such as temporary break in education are more effective in combating pandemic. Loayza and Pennings (2020) address the effects of pandemic having exceeded those of the 2008-2012 financial crisis, bringing attention to the economic costs of measures against outbreak. It is suggested that these costs might have been higher in developing countries due to such specific factors as low health capacity, large black market, underdeveloped financial markets, narrow fiscal areas and mismanagement. By modelling the possible impacts of the global outbreak on national income and international trade, Maliszewska et al. (2020) indicate that the slowdown of the global economy will be approximately 2%: 1.8% for developed countries and 2.5% for emerging economies. In this context, the author draws attention to the necessity of international solidarity in combatting the pandemic. Kejzar et al. (2022) underscore the role of global supply chain disruptions caused by pandemic triggered shocks on the foreign trade of European Union (EU). By applying the gravity model, it is concluded that in relation to the COVID-19 outbreak a general decline in international trade and the negative-significative effects associated with the global epidemic for both origin and destination countries would be highly probable. Verma (2020) examines the economic relations between PRC and CEE-DCs during the global pandemic, and states that the PRC has an intention to break the influence of EU on the economies of CEE-DCs by means of "mask policy" and foreign trade. Through the window of global epidemic, Kordalska and Olczyk (2021) analyse the importance of functional specialization structures of 8 Central and Eastern European countries (CEECs) in centre of the global value chain across countries and industries.

2. Economics of the Pandemic

The new type of coronavirus detected for the first time in the Wuhan city of PRC's Hubei province in the last quarter of 2019, had a strangling influence upon the income level of CWECs, the fluctuations in real exchange rate, and the imports from PRC as an important component of the global supply chain. It is highly probable that exports sector would be affected by the chain of events unfolded by a supply shock. Above all, exports, for an origin country, stand for the supply of goods and services into the international markets, and represent, for a destination country, the demand of goods and services from the international markets.

The COVID-19 outbreak spread fast all over the world in the first quarter of 2020 tended to induce a decline in nominal interest rate, trigger stock prices to rise and gain volatility. As a reflection of the real growth, contractions in the economic activities would be highly likely (Barro et al., 2020) Accordingly, the measures taken to bridle the death rates of the global outbreak have resulted in short-term economic losses (Deb et al., 2022). The last time when such large-scale economic losses were experienced was the 2008-2009 crisis (Jackson, 2021). In comparison to the volatility in global financial markets, fluctuations incited by the COVID-19 are greater than did by the crisis of 2008-2009 (Fernandes, 2020). Furthermore, the average contraction in the world economy engendered by the great depression of 2009 was only 0.1%, while the global pandemic is estimated to usher in contraction in the world economy by about 3% (Jackson, 2021). The global economy shrunk by 3.3%, having exceeded the estimations.

In spite of which many pandemics are of the common characteristics, COVID-19 pandemic having stormed the world significantly diverges from the previous global outbreaks at some points in terms of rapidly spilling over in comparison with such outbreaks in the past as SARS, Ebola, AIDS, etc. The rapid contagiousness of the COVID-19 as well as the point at which international economic integration and globalization reached have ushered in the fact that the pandemic is largely felt on a global scale, having rendered international retreat in economic activities certainly inevitable (Boissay and

Rungcharoenkitkul, 2020). On top of this, and in relation to the supply chain rupture in the PRC, a mounting trade relation betwixt CEE-DCs and PRC is why CEE-DCs have profoundly been influenced by the economic impacts of the COVID-19.

3. Significance of the Imports from PRC

Because CEE-DCs are highly dependent on such CWECs as Germany, Italy and France in terms of a sustainable exports sector, as it were, CEE-DCs largely carry out the exports to the countries aforementioned, therefore, severe fluctuations in the income level of CWECs, as is postulated in the economic theory, would greatly affect the exports sector of CEE-DCs, countries of which are also highly dependent upon the imports in order to maintain the economic growth. These are the main reasons of why the dire demand for reserve currency and sufferings from "currency bottlenecks" with high dependence upon the imports of intermediate goods and services are, metaphorically, the Achilles heel of these countries. More imports from the PRC, a phenomenon that cannot be given short shrift, is another challenging task and pressing issue which is closely connected to the exports of CEE-DCs.

Trade relations betwixt CEE-DCs and the PRC date back to 1950s; before 1989, total trade operated by the state-owned trade enterprises with the direct involvement of the Chinese Communist Party in PRC was quite rare. On the heels of 1990s, the atmosphere of economic depression and political transition in CEE-DCs produced immense negative outcomes for numerous trade relations long established with the PRC. The early 2000s borne witness to a rapid improvement in trade, being a fruit of the economic recovery (Ruixia and Yuxin, 2009). The year of 2008 was a milestone for the trade relations of CEE-DCs with PRC in terms of which global financial crisis of 2008 was nothing but a motivator for both partners to mutually enhance the economic relations. To this end, in 2009, Xi Jinping, back then vice president no the leader of the PRC, paid an official visit to Bulgaria, Hungary, and Romania (Song, 2018). Initiatives to improve economic relations between CEE-DCs and PRC maintained after the global crisis. In 2011, for the first time, economic and trade negotiations were organized between PRC and CEE-DCs in Budapest, Hungary's capital city (Zuokui, 2013). Intentions to ameliorate trade association between CEE-DCs and PRC took one step ahead in 2012* and 2013. By the year of 2018, compared to 2011, PRC's foreign trade with CEECs increased by an average of 6.5% annually, reached 68 billion dollars, and the significance of CEE-DCs in foreign trade, especially in the imports of intermediate goods, was being ossified. Approximately 60% of CEE-DCs' foreign trade with the rest of the world consists of trade in intermediate goods, and more than 50% of trade in intermediate goods is carried out with PRC (Jie, 2019). Although CEE-DCs, having low production costs and partially cheap labour force advantageous in international trade, are dependent (Voinescu and Moisoiu, 2019) upon CWECs performance by exports as well as capital flows, PRC's significative share in their imports, especially imports of intermediate goods having high share in exports of goods of CEE-DCs, cannot be received very short shrift, so much so that CEE-DCs have a large foreign trade deficit with PRC, while exports to PRC could not show rapid increase in comparison to imports (Weiwei, 2019). Large export destinations of CEE-DCs are CWECs rather than PRC, and the long-term foreign trade deficit of both CEE-DCs and CWECs in trade with PRC seems to take attention as an important problem (Wang and Xu, 2019).

4. International Supply Chain Rupture

Supply chain stands for the network of firms operating in manufacturing and assembly line to produce the final product (Choi and Hong, 2002). The significance of the international supply chain along with the global value and production network in foreign trade with PRC come to light more and more. In that context, globalization, especially globalization of supply chains, through the reduction of trade barriers and the amelioration in telecommunication technology, has helped manufacture companies expand their production networks, cross national borders (Caniato et al., 2013) and increase costumer portfolio. However, these developments have also made the companies aforementioned highly vulnerable to the deteriorations in supply chains, ushering in significant transformations in the function and structure of global industrial production and international trade. Throughout the 21. century, global industrial production and international trade have been structured on the global value and international production lines, being operated through the same chains (Pencea, 2019). With this in mind, globalization have

been producing profound outcomes for global value and production network as well as international supply chain, while it has at the same time subjected international trade to the significant structural changes. The global value chain has transformed the structure of international trade-exports of goods and services have become more and more dependent upon imports, in most of the countries the share of imported products in total exports has reached up to 1 in 3, doubled the rate in 1990. In many countries with a modest economy, this rate is over 50% (Sally, 2021). When examined through the perspective of governing and controlling, it is clear that problems have oftentimes cropped up in the timely and effective distribution of the commodity, which is flowing through the supply chain (Gereffi and Joonkoo, 2012). According to some, the supply chain is already embodied by these problems, pointing out that there is no other supply chain definition beyond it. Nevertheless, in terms of its scope, contagiousness, and disruptive-shifting effects on both supply and demand, COVID-19 outbreak, which assumes distinctive characteristics from other ordinary supply chain disruptions, has ignited the most extensive and unprecedentedly violent supply chain tectonics in modern history (Ketchen Jr., 2020). The rupture of international supply chain, as is in PRC, is closely associated with the interests of firms and countries all over the world. By virtue of mounting economic puissance of PRC, many firms around the world – consider, for example, such firms as Boeing, Ford, Coca Cola and Kodak of United States of America (USA); Samsung and LG Electronics of South Korea; Hongfujin, Shanghai Dafeng and Legend of PRC – have had to carry out their supply chain stratagem either through or in the PRC (Hong et al., 2006). Besides that, supply chain in the PRC is of intimate concern to the CEECs, having certain indications that PRC and CEECs are the part of global production network, with both belonging to the same supply chain network (Fung et al., 2009). Despite the fact that Germany and Italy are two largest members of the greatest supply chain network amongst CEECs, insofar as imported products subject to export are concerned, PRC has a slightly important role for many CEECs in terms of 2% to 3.5% of value-added products (Vasiljeva et al., 2020).

5. Currency Depreciation

With the exports sector on the centre, the factors bearing upon how international trade operates are not merely qualified it for the imports of goods and the functionality of supply chains, but also economic theory assumes that fluctuations in the exchange rate may produce outcome for the exports. In this context, the exchange rate is an indicator that links domestic markets to global ones, and at the same time, stands for the degree of competitiveness of one country against others (Ismaila, 2016). Mostly due to the movements in macroeconomic factors combined with the dynamic nature of economic activities, the exchange rate is in a constant manner vulnerable to the violent fluctuations (Morina et al., 2020). Accordingly, vicissitudes in the exchange rate are quite potent of dominating macroeconomic magnitudes, e.g., international trade to the extent of imports, especially imports of intermediate goods. The general economic postulate takes it for granted that exports are the increasing function of the real exchange rate, unlike imports moving in an inverse manner with real exchange rate. At this point, it is consensual that the depreciation of the national currency against foreign currencies would increase net exports through stimulating domestic production. However, with the developing countries concerned, there exists a longtail controversy at that point emerged from the necessity for structural interventions-such as reducing imports and increasing non-oil-commodity based exports (Eme and Oyeranti, 2012). On the other hand, and reckoning with the mounting share of imported goods in exports, this ambiguity becomes fathomable. If exports are at large hinged upon the imported components, the depreciation (appreciation) of the national currency reduces (increases) the export price in foreign currency, and conversely increases (decreases) the price of imported components in national currency. In case of a depreciation (appreciation) in domestic currency, the bearing of imported components' increasing (decreasing) prices at domestic currency on the prices of exports of goods at foreign currency is contradicted with the expected effect of depreciation (appreciation) by stifling total effect, ushering in the fact that sensitivity of exports to the real exchange rate would gradually decrease (Jongwanich, 2010). The first periods of 2018 witnessed the rapid depreciation of national currencies against the dollar, despite the different magnitudes across countries.[*] Such negative outlook has proceeded in 2019.

[*] The general appreciation of the dollar against national currencies, which especially wreaked havoc on Turkish Lira, resulted in a speculative currency crisis in Turkey in the third quarter of 2018.

In 2020, some national currencies, e.g., Bulgarian Leva, Romanian Lei, Hungarian Forint and Polish Zloty, started to compensate for their previous losses of two years against dollar, while some currencies, e.g., Turkish Lira, were poised to depreciate in a cascade, which is exactly when the negative effects of the COVID-19 coincided with those of exchange rate fluctuations in developing countries being an ongoing process since 2020. The prospective impacts of the COVID-19 on economic performance could be disintegrated by thoroughly perusing the "lockdown" policies, sharp policy changes and incentive packages implemented in many countries around the world, with the financial markets having simultaneously reacted to the pandemic incited panic-at this point, it wouldn't be economic at all to think that exchange rate markets would go unaffected at such an atmosphere (Iyke, 2020).

6. Empirical Evidence for the Reversal in the Exports of CEE-DCs

Iqbal et al. (2020) through the panel ADL technique, found a significative-negative relationship between the COVID-19 outbreak, energy consumption and CO_2 emissions. Cirakli et al. (2021) using the panel ADL technique, discovered a significative-negative relationship between the number of COVID-19 testing and cases. Barua and Nath (2021) analyzed the short- and long-run effects of "lockdown" policies on air pollution during the pandemic through the panel ADL technique. Rabhi (2020) applied panel ADL with a view to investigate the effects of COVID-19 cases and news about pandemic related death rates on Asian financial markets, and stumbled upon a significative-negative relationship. Caporale et al. (2022) have shown that when CEECs are concerned, financial development has long-term significative-positive bearing upon the exports and trade openness.

At the beginning of 2020, international supply chains, especially one in the PRC, have been exposure to severe disruptions. Despite the fact that COVID-19 outbreak is not the only reason for the deterioration, the global epidemic has been distinctive in pushing the disruption to its peaks. The effects of the trade wars between the US and PRC coupled with the decremental push on production and consumption of the "lockdown" policies countries started suffering due to the pandemics, have companies around the world reconsider over the general production pattern they operated in PRC. A large number of companies in PRC have shifted their orders, production capacity and operations outside of PRC (Hille, 2020). This is exactly what has triggered a full-blown global supply shock in addition to the consumer boycotts by foreign companies in PRC having precipitated the process (The Economist, 2021). An economic disruption to this extent in PRC, the powerhouse of the world, would have produced outcomes for the supply chain within the country, the foreign trade, the domestic markets of the countries in particular that are airtight dependent upon the imports. To put it simply, COVID-19 pandemic stands for the father of the fears nestled within the global financial system with long term effects on all economic structure, which is where the conviction in which COVID-19 pandemic might usher in a global financial crisis (Phan and Narayan, 2021) originates from, leading to assumption that one of the assets whose price is high likely to be affected by the COVID-19 outbreak is the exchange rates (Narayan, 2021).

6.1. Modelling

Although the acronym of CEECs refers to a general concept, there is no standardized method for defining countries in the region. According to the classification of the United Nations (UN) and the World Bank (WB), those countries consist of such nations as Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Serbia, Slovakia, Slovenia (Wang and Xu, 2019). The CEECs, where influence of the Union of Soviet Socialist Republics (USSR) was once quite puissant, today bear characteristics of being a highly heterogeneous group economically as well as politically (Wieners, 1996). However, having closely looked at the other developing countries in the region, common characteristics would become more crystal: chronical current account deficit, import-driven export and growth, dependence on the exports to CWECs and on the imports from the Russian Federation (RF) and the PRC.

Through this paper, by employing five CEE-DCs[*] imports[**] from PRC being the proxy variable for COVID-19 induced supply chain rupture, and the exchange rate fluctuations exasperated since the beginning of 2018 representing the devaluation of domestic currencies of 5 selected countries, the impacts of global outbreak on the exports of these countries are being investigated. Economic theory assumes that the exports are an increasing function of real exchange rate and income level of the importing countries. The export destination of the countries under review is included in the model as another regressor which represents the income level of the 3 largest nations.[***] The regression in which dependent variable is total exports (EXP), and independent variables are foreign income level (FGDP), reel exchange rate (RER) and imports from PRC (IMPFC) is estimated by means of panel analysis technique.

The data composition covers the interval of 2013Q1-2022Q4, 10 years and 40 observations, isolating the tectonic effects of Russian Special Military Operation of 2022 on Ukraine. It is safe to say that panel data analysis has specific superiorities over cross-sectional and time series analysis. First and foremost, time series and cross-sectional data analysis would not reckon with the idiosyncrasies of cross-units and unit-specific matters, which often leads to illative errors (Marques et al., 2010).

The main advantage of panel data analysis operates under the theory of allowing the researcher to model the idiosyncrasies distinctive to the units (Greene, 2003). Now that it is just a composition of both cross-sectional and time series data, panel data contains more information in nature, alleviating the problem of multicollinearity, increasing the degree of freedom, producing more efficient results (Baltagi, 2005). Macro and micro dynamic effects generally couldn't be modelled in the cross-sectional data, and time series analysis, by the same token, wouldn't have accurate estimations in terms of dynamic regressors (Hsiao, 2014). In this context, if it is desired to learn about the dynamics of the adjustment process, it would be convenient to work by either the panel or longitudinal data (Klevmarken, 1989).

The panel data regression of this study is the following:

$$\exp_{it} = \mu_i + \vartheta_1 \mathrm{fgdp}_{it} + \vartheta_2 \mathrm{reer}_{it} + \vartheta_3 \mathrm{impfc}_{it} + \delta_i \mathrm{syn}_{2020Q3} + \varepsilon_{it} \quad \textbf{(1)}$$

Not merely having facilitated the interpretation of the parameters but alleviated the gap in scale between observations, natural logarithm has been applied to the variables. Because difference betwixt its observations is not large, reel exchange rate would not be transformed by natural logarithm.

$$\mathrm{lexp}_{it} = \mu_i + \vartheta_1 \mathrm{lfgdp}_{it} + \vartheta_2 \mathrm{reer}_{it} + \vartheta_3 \mathrm{limpfc}_{it} + \delta_i \mathrm{syn}_{2020Q3} + \varepsilon_{it} \quad \textbf{(2)}$$

Explanatory information on the model is below.

[*] Bulgaria, Hungary, Poland, Romania and Turkiye.

[**] To be specific analysis, not all imports from China were used, instead, such selected products include in those of which consist of more than 60% of the imports of countries under review from PRC and had larger share in exports, were processed and exported, and were directly linked to the supply chain rupture in PRC: (1) Knitted Or Crocheted Fabrics, (2) Articles Of Apparel And Clothing Accessories, Knitted Or Crocheted, (3) Articles Of Apparel And Clothing Accessories, Not Knitted Or Crocheted, (4) Articles Of Iron Or Steel, (5) Nuclear Reactors, Boilers, Machinery And Mechanical Appliances; Parts Thereof, (6) Electrical Machinery And Equipment And Parts Thereof; Sound Recorders And Reproducers, Television Image And Sound Recorders And Reproducers, And Parts And Accessories Of Such Articles, (7) Railway Or Tramway Locomotives, Rolling Stock And Parts Thereof; Railway Or Tramway Track Fixtures And Fittings And Parts Thereof; Mechanical (Including Electromechanical) Traffic Signaling Equipment Of All Kinds, (8)Vehicles Other Than Railway Or Tramway Rolling Stock, And Parts And Accessories Thereof, (9) Optical, Photographic, Cinematographic, Measuring, Checking, Precision, Medical Or Surgical Instruments And Apparatus; Parts And Accessories Thereof, (10) Furniture; Bedding, Mattresses, Mattress Supports, Cushions And Similar Stuffed Furnishings; Lamps And Lighting Fittings, Not Elsewhere Specified Or Included; Illuminated Signs, Illuminated Nameplates And The Like; Prefabricated Buildings, (11) Toys, Games And Sports Requisites; Parts And Accessories Thereof.

[***] Germany, Greece and Italy for Bulgaria, Germany, Italy and Slovakia for Hungary, Czechia, Germany and United Kingdom for Poland, France, Germany and Italy for Romania, and finally, Germany, Italy and United Kingdom for Turkiye.

Table 1: Explanatory information on the variables

	Explanation	**Identity**
exp	Exports (€, 2015=100)	Dependent variable
lexp	Exports with natural logarithm	Dependent variable
fgdp	Foreign income (€, 2015=100)	Regressor
lfgdp	Foreign income with natural logarithm	Regressor
reer	Reel exchange rate (2015=100)	Regressor
impfc	Imports from PRC (€, 2015=100)	Regressor
limpfc	Imports from PRC with natural logarithm	Regressor
syn_{2020Q3}	Synthetic variable for the structural shift of last quarter in 2020	Control variable
	Interval: 2013Q1-2022Q4 | Observation: 40	
Note: All variables are deflated, price movements are removed. Seasonal adjustment is applied.		

Descriptive statistics on the model is:

Table 2: Descriptive statistics [1]

	exp	**fgdp**	**reer**	**impfc**
Mean	32664.77	1500019	90.9291	1600.841
Maximum	78071.46	1953092	106.5783	4603.481
Minimum	6480.972	1085957	51.0279	87.9646
Standard deviation	20359.63	268525.1	11.0126	1315.408
Observation	40	40	40	40

Table 3: Descriptive statistics [2]

	lexp	**lfgdp**	**reer**	**limpfc**	**Δlexp**	**Δlfgdp**	**Δreer**	**Δlimpfc**
Mean	10.1537	14.2051	90.9291	6.9016	0.0157	0.0010	-0.0569	0.0249
Maximum	11.2654	14.4849	106.5783	8.4346	0.4650	0.3656	45.3641	0.8647
Minimum	8.7766	13.8980	51.0274	4.4769	-0.4204	-0.4395	-10.2017	-0.4077
Std. Dev.	0.7464	0.1791	11.0126	1.1118	0.0946	0.07096	4.2471	0.1248
Observation	40	40	40	40	39	39	39	39
Note: "Δ" denotes lag operator. With a view to carrying out dynamic analysis for the model, descriptive statistics of the variables with first difference have been presented above.								

Correlation betwixt variables and explanatory power of the regressors are as is in Table 4.

Table 4a: Correlation matrix and multicollinearity for variables

	lexp	**lfgdp**	**reer**	**Limpfc**	**Δlexp**	**Δlfgdp**	**Δreer**	**Δlimpfc**
lexp	1.0000							
lfgdp	0.4847	1.0000						
reer	-0.6060	-0.3865	1.0000					
limpfc	0.9647	0.4527	-0.5756	1.0000				
Δlexp					1.0000			
Δlfgdp					0.4649	1.0000		
Δreer					-0.2677	0.2586	1.0000	
Δlimpfc					0.2163	0.1571	-0.1388	1.0000

Table 4b: Correlation matrix and multicollinearity for variables

Panel data correlation matrix [*Correlation matrix of coefficients of xtreg model*]								
e(V)	**lfgdp**	**reer**	**limpfc**	**syn2020Q$_3$**	**sabite**			
lfgdp	1.0000							
reer	0.1874	1.0000						
limpfc	-0.4063	-0.3423	1.0000					
syn$_{2020Q3}$	0.3636	0.2754	-0.3762	1.0000				
sabite	-0.9953	-0.2142	0.3388	-0.3522	1.0000			
"Variance Inflation Factor" for the multicollinearity								
Değişken	**VIF**	**1/VIF**						
lfgdp	1.65	0.6051						
reer	1.55	0.6433	**VIF$_{ava.}$=1.39**					
limpfc	1.32	0.7589						
syn$_{2020Q3}$	1.02	0.9759						
Note: "Δ" denotes lag operator. "syn" stands for the synthetic variable represent the structural shift at third quarter of 2020.								

In the correlation matrix illustrating the direction and power of the relationships among variables, is a positive association with a modest degree of 0.48 between regressor "lfgdp" and independent variable "lexp"; negative association with a high degree of 0.61 between regressor "reer" and independent variable of interest; positive association with a high degree of 0.96 between regressor "limpfc" and independent variable under investigation. All the correlation parameters among regressors are less than 0.80. In the second compartment of Table 4 for panel data regression examining the relationship between regressors, is shown that all of the correlation parameters between regressors are below 0.50. In the VIF analysis at the third compartment of Table 4 searching for the multiple linear relationship, the average VIF is well below 10, and the 1/VIF values are quite close to 1, a fact that there is a high degree of non-multicollinear relationship.

6.2. Traditional Unit Root Tests

The larger size of time and unit dimension is the further likely series become unstable. Notwithstanding the lack of stationarity in series refers to the necessity of carrying out lag operation to remove the instability rooted in the structure, this might also lead to data loss. In this context, MG (Mean Group) and PMG (Pooled Mean Group) estimators and ADL (Autoregressive Distributed Lag) technique come to the fore in eliminating the statistical instability and providing more dynamic analysis. Besides that, such frequently employed estimators as fixed effects and random effects can force slope parameters and error variances to be homogeneous across units, ushering in inconsistent and biased estimation of long-term coefficients. Such a problem exasperates as the time interval elongates (Bangake and Eggoh, 2011). With all these outcomes in the mind, we make, instead of such traditional techniques as random and fixed effects estimators, use of ADL models, one of which is MG estimator, and the second of which is PMG estimator following unit root test examination.

What is most important in cases with stationarity not taken into consideration is the results being biased, and "spurious regression" could emerge between the series (Yule, 1926). In such a case, the statistical value of F would not fit Fisher's F distribution under the null hypothesis (Granger and Newbold, 1973). All in all, it is considered necessary to perform unit root tests, results of all variables in which are illustrated in Table 5. In first compartment of the table at which neither individual constant nor individual linear trend is injected into the model, is shown that all variables are integrated at first order [I(1)]. In second compartment at which merely individual constant is exogenously injected into the model, is clear that variable "reer" and "limpfc are stationary at first order [I(1)] with the variables lexp" and "lfgdp" being integrated at level [I(0)]. In third compartment at which both individual constant and individual linear trend are introduced into the model, is crystal that variable "reer" and "lfgdp" are stationary at first order [I(1)] while the variable "lexp" and "limpfc" are integrated at level [I(0)].

Table 5: Traditional unit root tests

Exogenous: None					
	Levin, Lin&Chu t-stat	**Breitung t-stat**	**Im, Pesaran and Shin W-stat**	**ADF-Fisher Chi-square**	**PP-Fisher Chi-square**
lexp	4.35 [1.0000]	-	-	0.57 [1.0000]	0.10 [1.0000]
Δlexp	-7.83 [0.0000]	-	-	68.22 [0.0000]	187.28 [0.0000]
lfgdp	0.07 [0.5273]	-	-	5.00 [0.8917]	3.84 [0.9545]
Δlfgdp	-13.72 [0.0000]	-	-	167.79 [0.0000]	334.33 [0.0000]
reer	-0.50 [0.3094]	-	-	13.71 [0.1866]	21.00** [0.0214]
Δreer	-9.96 [0.0000]	-	-	107.94 [0.0000]	10832 [0.0000]
limpfc	3.06 [0.9989]	-	-	3.08 [0.9795]	3.14 [0.9780]
Δlimpfc	-8.84 [0.0000]	-	-	106.59 [0.0000]	210.90 [0.0000]
Exogenous: μ (unit constant)					
lexp	-3.83*** [0.0001]	-	-1.98** [0.0236]	18.91** [0.0415]	18.91 [0.3397]
Δlexp	-8.47 [0.0000]	-	-10.03 [0.0000]	95.72 [0.0000]	166.97 [0.0000]
lfgdp	-1.57* [0.0582]	-	-2.40*** [0.0082]	22.43*** [0.0131]	21.70** [0.0170]
Δlfgdp	-10.54 [0.0000]	-	-10.76 [0.0000]	106.83 [0.0000]	174.72 [0.0000]
reer	0.34 [0.6314]	-	1.36 [0.9124]	5.75 [0.8357]	4.79 [0.9048]
Δreer	-9.03 [0.0000]	-	-8.80 [0.0000]	81.30 [0.0000]	84.70 [0.0000]
limpfc	-1.45* [0.0735]	-	1.00 [0.8403]	6.40 [0.7809]	6.03 [0.8126]
Δlimpfc	-3.72 [0.0001]		-7.90 [0.0000]	75.41 [0.0000]	106.37 [0.0000]
Exogenous: μ (unit constant) and τ (unit linear trend)					
lexp	-3.50*** [0.0002]	-2.83*** [0.0023]	-0.10 [0.4611]	22.62*** [0.0122]	25.85*** [0.0040]
Δlexp	-5.04 [0.0000]	1.61 [0.9466]	-9.11 [0.0000]	81.10 [0.0000]	880.48 [0.0000]
lfgdp	1.55 [1.9393]	1.99 [1.9768]	4.39 [1.0000]	12.46 [0.2552]	13.21 [0.2122]
Δlfgdp	-5.23 [0.0000]	1.97 [0.9756]	-8.25 [0.0000]	84.05 [0.0000]	930.24 [0.0000]
reer	-0.05 [0.4784]	0.91 [0.8188]	1.24 [0.8929]	4.00 [0.8913]	5.13 [0.8820]
Δreer	-8.67 [0.0000]	-8.14 [0.0001]	-8.19 [0.0000]	69.73 [0.0000]	71.83 [0.0000]
limpfc	-3.00*** [0.0014]	0.69 [0.7541]	-4.15*** [0.0000]	50.14*** [0.0000]	51.11*** [0.0000]
Δlimpfc	-1.58 [0.0566]	-2.26 [0.0120]	-7.47 [0.0000]	69.55 [0.0000]	383.13 [0.0000]

Note: Results acquired from Eviews10 software package, Maximum lag is selected automatically, Schwarz criterion is employed. "**Δ**" denotes lag operator at first difference. "***", "**", and "*" stand for significance at %1, %5 and %10 respectively.

6.3. Unit Root Tests with Structural Shift

Structural shift common in a series means that all unit root tests omitting the existence of any structural change is having no inconsequential bear on the results. In case that the breaking points are not reckoned with, the unit root test (without structural shift) tends to reject alternative hypothesis even if it actually belongs to a stationary process, which is why the structural shifts pervasive in the series stand for a specific phenomenon that would have significative-negative results if not taken into account. In the studies with no consideration of structural shift, is inevitable that results would lead to illative errors, biased estimations and misleading policy recommendations (Hansen, 2001). It is another focal point to note that apart from sudden (sharp) breaks, gradual (smooth) structural breaks are almost ubiquitous in macroeconomic time series. For such a series, a novel generation of unit root tests with structural shift, called smooth transition approach, would be exploited (Nazlioglu and Karul, 2017).

Table 6: Unit root tests with smooth transitional characteristic of structural shift

Structural shift at level				
	lexp	**lfgdp**	**reer**	**limpfc**
Bulgaria	0.3354	0.7750	1.0191	0.6077
Romania	0.2051	0.6276	0.7253	0.3980
Hungary	0.1666	0.9154	0.3587	0.7307
Turkiye	0.3032	0.8346	0.8756	0.9091
Poland	0.7605	0.9854	0.6028	0.4633
Panel$_{ist.}$	2.9677	10.2046	8.5033	7.0580
Prob.:	0.0015	0.0000	0.0000	0.0000
Structural shift at level and trend				
	lexp	**lfgdp**	**reer**	**limpfc**
Bulgaria	0.1512	0.0435	0.2256	0.0800
Romania	0.1822	0.0393	0.3035	0.4163
Hungary	0.1527	0.0472	0.3319	0.2864
Turkiye	0.3086	0.0402	0.1758	0.0906
Poland	0.0800	0.1087	0.1219	0.1313
Panel$_{ist.}$	5.8856	-0.3967	8.8772	7.2525
Prob.:	0.0000	0.6542	0.0000	0.0000
H_0: *Panel stationary (Temporal shock)* H_A: *Panel unit root (Permanent shock)*				
Note: Results of unit root obtained in gratitude towards the technique innovated by Nazlioglu&Karul in 2017 on AptechGauss21 software.				

Unit root test with gradual structural shift developed by Nazlioglu & Karul reckons with the cross-sectional dependence and allows for the heterogeneity among units. In this technique employed Fourier approach is not merely not obligatory to specify the break dates a priori, but the dates germane to the structural shifts could be determined. At this model with Fourier approach there is no necessity to get a beforehand information of the breaking dates, instead, dates of structural shifts are identified by making use of combination frequencies, which is why Fourier technique renders possible the large elasticity in the imitation of structural breaks whose dates are unknown, a feature of which is highly practical in the panel data analysis (Nazlioglu and Karul, 2017).

In the first compartment of table 6 illustrating gradual structural shift at level, is rejected the stationary panel with temporal shock under the null hypothesis H0. In the second compartment of table 6 illustrating gradual structural shift at both level and trend, is rejected the stationary panel with temporal shock under the nul hypothesis H0 for all variables except the variable “lfgdp”. Both compartments

overwhelmingly illustrate that the series are of the unit roots and permanent shocks, which is the indication of the case that the impact of the externally determined structural break in the 2020Q3 is no ephemeral, rather, having permanent effects on the data trajectory. It is safe to say that the parameter of the synthetic variable exogenously injected into the model is significant as well.

6.4. Panel ADL

After specific statistical examinations, due mostly to the fact that it allows us to perform dynamic analysis Panel ADL approach, the use has been made of the Mean Group (MG) and Pooled Mean Group (PMG) estimators introduced and developed by Pesaran in 1995 and 1999 respectively. With the unit root tests performed above has been proven that some variables are integrated at the level [I(0)] and some integrated at the first order [I(1)], which is the reason why ADL technique is significantly convenient for our framework.

Table 7: Cross sectional dependence

Regression: $lexp = \alpha + \omega_1 lfgdp_{it} + \omega_2 reer_{it} + \omega_3 limpfc_{it} + \omega_4 syn_{it} + \upsilon_{it}$			
	Statistic	**d.f.**	**Prob.**
Breuch-Pagan LM	1.0993	10	0.9997
Pesaran CD	0.7516	-	0.4523
Pesaran Scaled LM	-1.9903	-	0.0666
Bias-Corrected LM	-2.0710	-	0.0384
H_0: *Cross-sectional dependence does not exist* H_A: *Cross-sectional dependence does exist*			
Note: Results obtained through Eviews10 software. Regression is built upon the fixed effects model and the generalized least square (GLS) weights with cross section seemingly unrelated regression (SUR).			

In table 8 is illustrated cross-sectional dependence test. The Pesaran CD and Breusch-Pagan LM tests do strongly not reject the existence of cross-sectional independence hypothesis under the null hypothesis H0, while the Pesaran Scaled LM test is indecisive and only the Bias-Corrected Scaled LM test does reject the H0 hypothesis by 5% significance level. Majority sides with the rejection of cross-sectional dependence. Additionally, in the table 9 is pointed out that null hypothesis H0, as the indicator of presence of normal distribution, cannot be rejected.

Table 8: Normality test

Regression: $lexp = \alpha + \omega_1 lfgdp_{it} + \omega_2 reer_{it} + \omega_3 limpfc_{it} + \omega_4 syn_{it} + \upsilon_{it}$	
	Statistics
Skewness	0.067970
Kurtosis	3.766706
Jarque-Bera	4.042115
Prob.	0.132515
Note: Results obtained through Eviews10 software. Regression is built upon the fixed effects model and the generalized least square (GLS) weights with cross section seemingly unrelated regression (SUR).	

Pesaran & Shin& Smith proposed two useful techniques for the estimation of non-stationary dynamic panels at which parameters are considered heterogeneous between units: MG and PMG. The MG estimator relies on the average values of the parameters with N number of time series regressions, whereas the PMG estimator hinges upon a combination of pooled and averaged parameters (Blackburne and Frank, 2007). In a dynamic model where slope parameters vary across the countries, and despite the fact that both unit and period size are large enough, outcomes can still be modelled directly by means of MG estimator even if average effects cannot be produced consistently through traditional pooled estimators, i.e., random effect and fixed effect estimators (Pesaran and Smith, 1995). Although, and on one hand, the MG estimator consistently estimates the averages of the parameters, it does not take into account the possibility that may some parameters be homogeneous across countries-MG estimator

considers all parameters heterogeneous, to wit, constants, short and long-term parameters and error variances vary across units (Pesaran et al., 1997). On the other hand, PMG estimator, as an "intermediate procedure," subsuming both pooling and averaging group techniques, enables the constant, short-term parameters, and error variance terms to differ across countries, while keeping long-term parameters homogeneous at the same time (Pesaran et al., 1997).

If the ADL model with two variables is considered as the following:

$$\gamma_{it} = \mu_i + \varphi_1 \gamma_{it-} \ + \phi_i X_{it} + \varepsilon_{it} \quad \textbf{(3)}$$

For each "i" unit or country, i=1, 2, 3, ..., N.

For each "i" unit or country, long-term parameter (η_i) would be:

$$\omega_t = {}^{\phi_i}/_{1-\varphi_i} \quad \textbf{(4)}$$

When it comes to whole panel, MG estimator is bifurcated as the following:

Slope parameters $\rightarrow \hat{\eta} = {}^{1}/_{N} \sum_{i=1}^{N} \eta_i$

Constant parameter $\rightarrow \hat{\mu} = {}^{1}/_{N} \sum_{i=1}^{N} \mu_i$

Besides that, considering the period dimension t = 1, 2, 3, ..., T, and unit dimension i = 1, 2, 3, ..., N, non-restricted panel ADL formulae would be:

$$\gamma_{it} = \sum_{j=1}^{p} \varphi_{ij} Y_{it-j} + \sum_{j=1}^{q} \phi_{ij} X_{it-j} + \mu_i + \varepsilon_{it} \quad \textbf{(5)}$$

"X_{it-j}" denotes (k x 1) vector of all regressors for each "i" country; "μ_i" stands for the fixed effect. Equation of the Error Correction Model (ECM) would be parameterized as below:

$$\Delta\gamma_{it} = \vartheta_i(\gamma_{it-1} - \omega_1' X_{it-1}) + \sum_{j=1}^{p} \varphi_{ij} \gamma_{it-j} + \sum_{j=1}^{q} \phi_{ij} X_{it-j} + \mu_i + \varepsilon_{it} \quad \textbf{(6)}$$

"ω_i" represents long-term parameters, and "ϑ_i" is the correction parameter. In addition, PMG estimator considers "ω_i" parameters homogenous across units and countries:

$$\Delta\gamma_{it} = \vartheta_i(\gamma_{it-1} - \omega' X_{it-1}) + \sum_{j=1}^{p} \varphi_{ij} \gamma_{it-j} + \sum_{j=1}^{q} \phi_{ij} X_{it-j} + \mu_i + \varepsilon_{it} \quad \textbf{(7)}$$

All the dynamics and error correction terms are subject to modification as per PMG estimator. Under some considerations, PMG is capable of producing estimation of parameters which is consistent for both stationary and non-stationary regressors (Chu and Sek, 2014). The unrestricted panel ADL equation for our model, where the dependent variable is "lexp" and the regressors are "lfgdp", "reer" and "limpfc", is as follows:

$$\widehat{lexp}_{it} = \mu + \sum_{j=1}^{p} \alpha_{ij} lexp_{it-j} + \sum_{j=0}^{q} \beta_{ij} lfgdp_{it-j} + \sum_{j=0}^{m} \gamma_{ij} reer_{it-j} + \sum_{j=0}^{l} \delta_{ij} limpfc_{it-j} + \epsilon_i + \varepsilon_{it} \quad \textbf{(8)}$$

The long-term equation of the model in interest at which dependent variable is "lexp", and regressors are "lfgdp", "reer" and "limpfc", is below:

$$\widehat{lexp}_{it} = \hat{\varrho}_i + \hat{\phi}_1 lfgdp_{it} + \hat{\phi}_2 reer_{it} + \hat{\phi}_3 limpfc_{it} + \hat{\varphi}_i syn_{2020Q3} + \hat{\varepsilon}_{it} \quad \textbf{(9)}$$

ECM with which short- and long-term parameters are estimated, and at which dependent variable is "lexp", and regressors are "lfgdp", "reer" and "limpfc", is the following:

$$\Delta\widehat{lexp}_{it} = \hat{\varrho}_i + \hat{\rho}_i lexp_{it-1} + \hat{\phi}_{1i} lfgdp_{it} + \hat{\phi}_{2i} reer_{it} + \hat{\phi}_{3i} limpfc_{it} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta lexp_{it-j} + \sum_{j=0}^{q-1} \beta_{ij} \Delta lfgdp_{it-j} + \sum_{j=0}^{m-1} \gamma_{ij} \Delta reer_{it-j} + \sum_{j=0}^{l-1} \delta_{ij} \Delta limpfc_{it-j} + \hat{\varphi}_i syn_{2020Q3} + \varepsilon_{it} \quad \textbf{(10)}$$

It is necessarily expected that the Error Correction Term (ECT) is significative-negative, that is:

$$\rho_i = -\left(1 - \sum_{j=1}^{p} \omega_{ij}\right) \quad \textbf{(11)}$$

Under table 9 is shown the results of MG estimator.

Table 9: Panel ADL model convenient estimator test [1]

MG Estimator				
Long-term values				
Dependent variable: lexp and Δlexp				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
lfgdp	3.4868	0.61	5.76	0.000
reer	-0.0137	0.01	0.12	0.908
limpfc	0.0351	0.13	0.27	0.786
Short-term values				
HDT	-0.6556	0.11	-6.16	0.000
Δlfgdp	-0.8998	0.83	-1.09	0.277
Δreer	-0.0056	0.00	-3.39	0.001
Δlimpfc	-0.1319	0.05	-2.60	0.009
sabite	0.2613	0.15	1.70	0.089
syn_{2020Q3}	-27.031	8.52	-3.17	0.002
Note: Results are acquired through Stata14 software. "**Δ**" denotes lag operator, ECT error correction term, and "syn_{2020Q3}" is the synthetic variable stands for the structural shift come to pass in the third quarter of 2020.				

Under table 10 is shown the results of PMG estimator.

Table 10: Panel ADL model convenient estimator test [2]

PMG Estimator				
Long term values				
Dependent variable: lexp and Δlexp				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
lfgdp	3.1287	0.22	14.14	0.000
reer	-0.0043	0.00	-2.86	0.004
limpfc	0.1320	0.03	4.67	0.000
Short-term values				
HDT	-0.5168	0.08	-6.36	0.000
Δlfgdp	-0.2019	0.37	-0.54	0.586
Δreer	-0.0042	0.00	-1.69	0.091
Δlimpfc	-0.1240	0.06	-2.08	0.038
sabite	-18.0783	2.95	-6.13	0.000
syn_{2020Q3}	0.1671	0.06	3.01	0.003
Note: Results are acquired through Stata14 software. "**Δ**" denotes lag operator, ECT error correction term, and "syn_{2020Q3}" is the synthetic variable stands for the structural shift come to pass in the third quarter of 2020.				

It is not possible that homogeneity of the long-term variables is identified a priori. However, by means of Hausman test renders possible the identification as to whether the average of parameters is homogenous. In case parameters are homogenous, PMG estimator would be more efficient than would MG estimator (Chu and Sek, 2014). In table 11 is illustrated the results of Hausman test.

Table 11: Panel ADL model convenient estimator test [3]

Hausman test				
	Parameters		**Difference**	**sqrt(diag(V_b-V_B))**
	Mean Group (MG)	Pooled Mean Group (PMG)	SE-TE	S. E.
lfgdp	3.486762	3.128669	0.3580924	0.90091
reer	0.0005915	-0.0042871	0.0048786	0.00768
limpfc	0.0350543	0.1319869	-0.0969327	0.19624
H_0: *Difference betwixt parameters is not systematic-long term homogeneity (PMG estimator convenient)* **H_A**: *Difference betwixt parameters is systematic-long term heterogeneity (MG estimator convenient)*				
$Chi^2(3)$ = 1.91				
Prob. = 0.5907				
Note: Outcomes are acquired through Stata14 software.				

Table 11 leads us to the evidence that under the alternative hypothesis HA difference between parameters is systematic-they are not homogenous, would be rejected, rather, under the null hypothesis H0 difference between parameters is not systematic-they are homogenous In the long-run, would not be rejected, insinuating that table 11 results of PMG estimator is convenient, and suit the model fine.

6.5. PMG Estimator Outcomes

Having negative sign and falling between 0 and -1, parameter of ECT fits the prerequisites. It is also indicative that there is a cointegration relationship among variables. It is estimated by the PMG techniques that parameter ECT is approximately "-0.52", which stands for the fact that short run deviations in the equilibrium would be rectified by 52% in the long-run, to wit, after a shock that ushers in a deviation from the long-term equilibrium, it starts converging to the equilibrium at a speed approximately of 52%.

The parameter of the synthetic variable which represents the structural shift occurred in the third quarter of 2020 is approximately 0.17, being statistically significative at 1% significance level. It turns out to be that the effect of the shock incited by the COVID-19 pandemic on the exports level in the third quarter of 2020 is permanent.

In the short-run, signs of all parameters belonging to the regressors are negative-not significative, unlike that of the "limpfc" whose sign is significative and approximately -0.12, which means the superfluous fact that 1% increment in the variable "limpfc" would be producing negative outcome, and causing approximately a drop by 0.12 on the variable "lexp".

In the long-run, parameters of all the variables are significative. An increase by 1% in the variable "lfgdp" would be ushering in approximately 3.13% increment in the variable "lexp". By 1 unit increase in the variable "reer" would lead to approximately by 0.4% decrement in the same variable. In addition, in case of 1% increase in the variable "limpfc", approximately 0.13% increment in the variable "lexp" would be an expected outcome.

In table 12 are illustrated the ECTs of each country and short-term parameters produced by the PMG estimator.

Despite the long-term parameters being all homogenous, it keeps the heterogeneity in short-term slope parameters as well as constant and error variances, which is one of PMG estimator's features convenient to make use of. In table 12 is illustrated the short-term values of constant, slope and control variable belonging to export regression of 5 countries, i.e., Bulgaria, Romania, Hungary, Turkiye and Poland. With the significative ECT parameters of all countries, while country with the highest speed of adjustment rate by 73% is Bulgaria, the country with the lowest speed of adjustment rate by 31% is Poland.

At the short term and on the country basis, the least significative parameter is that of the regressor "reer". At the short term and on the country basis, it is only the Bulgaria where the variable "reer" is significative. Increments in the variable "reer" would be producing significative-negative outcomes for

the exports of Bulgaria. In the short-run, regressor "reer" negatively affects all countries' exports, except for Turkiye.

Table 12: Panel ADL model short term results per countries

PMG Estimator				
Short-term parameters and ECTs for each country				
Dependent variable: Δlexp				
Bulgaria				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
ECT	-0.7329255	0.0988817	-7.41	0.000
Δlfgdp	-0.7975067	0.3168073	-2.52	0.012
Δreer	-0.0128065	0.0054819	-2.34	0.019
Δlimpfc	-0.0452087	0.0354443	-1.28	0.202
sabite	-25.77444	3.151654	-8.18	0.000
syn_{2020Q3}	0.0686346	0.0252333	2.72	0.007
Romania				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
ECT	-0.6339969	0.1136387	-5.58	0.000
Δlfgdp	-0.0373488	0.3988223	-0.09	0.925
Δreer	-0.001082	0.0058584	-0.18	0.853
Δlimpfc	-0.3261289	0.0991555	-3.29	0.001
sabite	-22.52615	3.934029	-5.73	0.000
syn_{2020Q3}	0.1495008	0.0276727	5.40	0.000
Hungary				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
ECT	-0.3443277	0.1195281	-2.88	0.004
Δlfgdp	0.9427225	0.4086551	2.31	0.021
Δreer	-0.0048378	0.0026646	-1.82	0.069
Δlimpfc	-0.0729669	0.036641	-1.99	0.046
sabite	-11.7771	3.988187	-2.95	0.003
syn_{2020Q3}	0.0650266	0.0207341	3.14	0.002
Turkiye				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
ECT	-0.5566344	0.2284206	-2.44	0.015
Δlfgdp	-1.191867	0.7179866	-1.66	0.097
Δreer	0.001897	0.0039319	0.48	0.629
Δlimpfc	-0.1849911	0.1338874	-1.38	0.167
sabite	-19.53255	8.205652	-2.38	0.017
syn_{2020Q3}	0.369321	0.0665369	5.55	0.000
Poland				
	Parameter	**Std. Error**	**Z_{sta}**	**Prob.**
ECT	-0.316153	0.0884028	-3.58	0.000
Δlfgdp	0.0747022	0.3260969	0.23	0.819
Δreer	-0.0039716	0.0030277	-1.31	0.190
Δlimpfc	0.0091558	0.0748478	0.12	0.903
sabite	-10.78112	3.073924	-3.51	0.000
syn_{2020Q3}	0.1828946	0.0303036	6.04	0.000
Note: Results are acquired through Stata14 software.				

At the short term and on the country basis, regressor "limpfc" puts significative-negative influence on the exports of 2 Countries-Romania and Hungary. In the short-run, regressor "limpfc" affects all countries' exports negatively, except Poland, and when it comes to synthetic variable representing structural shift in the third quarter of 2020, it turns out to be significative for all countries.

7. Conclusion and Recommendation

At the last quarter of 2019 new sort of Coronavirus case detected for the first time in Wuhan city of Hubei province in the PRC have produced beleaguering and incapacitating effects on the income level of CWECs (lfgdp), fluctuations in the reel exchange rate (reer), and imports from PRC (limpfc) as a consequential part of the global supply chain. Having rapidly gained international dimension as a consequence of idiosyncratic contagious characteristics as well as expansion of global supply chain and globalization per se, COVID-19 outbreak has been of importance in terms of the special features defragmenting both demand and supply-side shocks: Global epidemic has actuated demand-side shock by the virtue of negative effects caused by "lockdown" policies, on the other hand, the global supply chain rupture, particularly attempts of firms to move production epicentre out of PRC, layoffs resulted from the decisions made by the companies to postpone orders and operations, and decrements in output level-all they have been the locomotive of global supply shock.

It has also incorporated the effects of exchange rate depreciation exasperated since 2018 on the economies into the impacts of supply chain rupture in PRC on international trade, which stand for another remarkable characteristic of COVID-19 pandemic. Countries most affected by the depreciation of national currencies against dollar and the supply chain disruption in PRC were the CEE-DCs due mostly to their efforts to develop an intimate trade structure with PRC back in the 2000s. The upward movements in the exchange rate and the supply chain rupture have put negative impacts on the export sector.

In this paper are inquired into the impacts of COVID-19 outbreak on the exports of CEE-DCs, is made use of PMG estimator of ADL that allows for a dynamic analysis and enables testing for cointegration among series integrated at different orders. After all, it turned out to be that series under review are cointegrated, and short-run deviations from the equilibrium would be rectified by 52% In the long-run.

In the short-run, results of PMG estimator have contradicted the postulate that export is an increasing function of the real exchange rate and foreign income level as does economic theory assume, and pointed out that the variable "limpfc" has produced positive outcome for the export. Additionally, the reason why imports from PRC does negatively affect the exports of CEE-DCs is because there is a dynamic association between exchange rate fluctuations and imports from PRC. Above all, imports mean the transfer of exchange into the foreign countries. Having coupled with the exchange rate fluctuations, the transfer of currency is to exacerbate the "currency bottleneck" in domestic markets. The impact of imports from PRC on exports being reversed at the short term is due to which the outflow of foreign currency coincides with the "currency bottleneck" problem, with the uptrend in the exchange rate and the mounting demand for foreign currency at local markets. Another notable result of this paper, and unlike what the economic theory postulates, is the increments in the exchange rate led to producing unsignificant outcomes in the short-run and significative-negative effects in the long-run on export sector.

In the long-run, the impact of imports from PRC on exports has positively reversed, and by 1% increment in foreign income level would lead to approximately by 3.13% increase in the CEE-DCs' exports. By the same token, by 1% increment in imports from PRC would lead to approximately by 0.13% increase in the CEE-DCs' exports. In addition, by 1-unit increment in real exchange rate would lead to approximately by 0.4% contraction in the CEE-DCs' exports. This contraction probably arises from the fact that countries in question are highly dependent on the imports, particularly intermediate imports, and the share of imported goods in the exported products along with the import-based output and import-dependent growth policy.

The parameter of the synthetic variable represents the structural shift in the third quarter of 2020 is significant, supporting the hypothesis of permanent shock under HA unit root test with structural shift, in other words, the COVID-19 pandemic has been the driving force of a lasting shock on the export

sector. Rather than the upward movement in the exchange rate accelerated since the first quarter of 2018, it is that shock passing through the channel of imports from PRC, representing the supply chain disruption triggered by the COVID-19, which got off the ground at the last quarter of 2019 and gained a global dimension by the first quarter of 2020. So much so, it is merely the parameter of the regressor "limpfc" that is significative not only In the short-run but In the long-run. Holistically, under the HA2 it is primarily due to supply chain rupture in PRC that COVID-19 outbreak has negatively affected the exports of CEE-DCs. Besides that, In the long-run, regressor "reer" has been producing more robust effects on the variable "lexp", which represents the export level of CEE-DCs, than has been the regressor "limpfc". Therefore, insofar as the problems associated with the currency bottlenecks are not dealt with properly, exchange rate fluctuations are likely to continue having produced negative incomes for exports.

To sum up, the postulation of exports in the economic theory does not work for the CEE-DCs, resulted from the economic substructure of underdeveloped nations, particularly CEE-DCs. The currency bottlenecks to which developing countries are highly vulnerable and their dependence on intermediate imports of goods seem to be the main reason of why economic theory does not function. Preventing from "currency hemorrhage and wastage" in international trade, having bilateral trade agreements to reduce the cost of imports of intermediate goods, alleviating the negative effects of currency bottlenecks not just on exports but on the total economy as a whole, putting in place the import substitution trade policy based on the domestic production of imported products-all constitute the national dimension of our recommendation. International dimension is to establish close ties and side with the PRC in fighting the US tariffs and aggression. It is primarily this way that nations can secure the supply chain, sustain resilience and the international flows of goods and services.

Author statements/ Yazar beyanları

This article was prepared in accordance with research and publication ethics. The authors declare that there is no conflict of interest. Authors' contributions: Conceptualization (Hakan Erpolat, Nurtaç Yıldırım), Methodology (Hakan Erpolat), Writing (Hakan Erpolat), Editing (Nurtaç Yıldırım).

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