How Has Coronavirus Outbreak Affected Regional Energy Integration? Lessons and Recommendations for Iran

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ABSTRACT

The agreement of Iran with an integrated bloc like the Shanghai Cooperation Organization or Eurasian Economic Union to boost energy trade is considered an efficient factor in improving the multilateralism and regionalism of the Iranian economy. However, the outbreak of COVID-19 has had caused serious and unprecedented consequences on globalization and regionalization. This research seeks to find out the relationship between COVID-19 and regional energy integration for two cases of South Asia and the Eurasian Economic Union (EEU). The panel data framework based on quarterly data over 2010Q1-2020Q2 is employed to estimate the coefficients of variables. The significant results reveal that the COVID-19 pandemic is a severe challenge for regional energy integration in these two unions. The integration of larger economies that are more developed and have a higher level of trade liberalization is disturbed by this pandemic. A policy implication based on the conclusions is that Iran may try to integrate regional energy with its neighbors and trading partners. However, to reduce the long-run negative impacts of the pandemic, Iran and its energy trade partners should plan to determine the types and magnitudes of adverse effects of the pandemic, regulating monetary and fiscal policies to encounter the negative influences. To the best of the author's knowledge, despite some earlier researches on the effects of COVID-19 on macroeconomic variables in different countries and regions, there is no existing literature focusing on how the coronavirus affects economic integration. Therefore, this paper tries to fill in this literature gap.

1. Introduction

The COVID-19 pandemic has become one of the leading global economic challenges and has harshly affected all countries' financial aspects. Gopalan and Misra (2020) argued that this pandemic has affected all economic segments and generated a domino effect on other aspects of society, such as health and welfare. Therefore, it can be pointed out that the world economy is experiencing a new and unpredictable economic phenomenon that, on the one hand, all countries are dealing with. On the other hand, it has challenged some accepted economic thinking.

One of the coronavirus's most critical economic issues is economic convergence and globalization. Dunford and Qi (2020) believe that the pandemic encourages countries to transform nationalism, de-liberalism, and even de-globalization. The global trade volumes between nations as an index for globalization fell by approximately 13%–32% in 2020 (WTO, 2020), indicating the adverse effects of this pandemic on trade activities among countries. Yaya et al. (2020) declared that under the COVID-19, governments are trying to limit their foreign trade and flows of people to lower economic vulnerability.

This unavoidable limitation on economic integration and globalization due to the pandemic disrupts macroeconomic variables of countries. Holod and Reed III (2004) argued that economic integration is reliable to reach stable and positive economic growth. In another study, Kreinin and Plummer (1992) expressed that economic integration can improve the global quality of industrial productions. Furthermore, economic integration can help countries reduce poverty and increase welfare (e.g., see Goto and Hamada 1998; Behrens et al. 2007; Stal and Zuberi 2010; Nissanke and Thorbecke 2010; Le Goff and Singh 2014).

As a developing and oil-based economy, Iran is experiencing the double jeopardy of western sanctions and pandemics, the two exogenous factors that have slowed the economic globalization of this country. Eurasian Economic Union, with which Iran has had a free trade agreement since 2018, and South Asia, with which Iran has common border and sea transportation routes, are two cases with huge potential to integrate energy trade with Iran. According to Bagherian and Mehranzamir (2020), energy integration is a process to reach a higher cooperation and trade level in renewable and non-renewable energy sources among integrated countries. This kind of integration would be addressed as an efficient tool for boosting the regionalization and multilateralism of the economy of Iran under unfair sanctions of the western bloc and the negative consequences of the pandemic. Moreover, Eurasian Union has the vision to establish a common market in oil, gas, and electricity (Mostafa and Mahmood, 2018), which helps the members engage in an integrated energy market to provide their consuming energy and sell their produced energy sources. Similarly, South Asian countries located in a region with different climate conditions (Shukla et al., 2017) have sought to integrate the energy market to make more affordable and favorable energy prices in their market (Murshed, 2021).

The potential advantages of energy convergence and the existence of threats of COVID-19 as a significant challenge for the global economy motivated this work. On the one hand, Iran needs to boost economic convergence to reach a higher rate of economic growth and development. On the other hand, it has to carry out different monetary policies of protectionism to control the greater prevalence of the coronavirus. Therefore, the coronavirus–energy integration paradox needs further investigation with actual data.

The paradox of the coronavirus–energy integration is the primary purpose of this research for two cases of member states of the Eurasian Economic Union (EEU) and the South Asia region, which have been trying to boost their level of economic integration with other countries in the world.

To the best of the author's knowledge, despite some earlier research related to coronavirus and energy integration in different countries and regions, there is no existing literature focusing on how coronavirus affects the energy trade integration. Therefore, this paper tries to fill in this literature gap.

This paper is organized as follows. The literature gap that it wants to fill is discussed in Section 2. Next, data description and research methodology are represented. Section 4 argues the empirical results, and the final section concludes the paper with some insights for policymakers.

2. Literature review

The existing studies can be classified under two strands to explore the literature gap. The first strand focuses on investigating the effects of the COVID-19 on different economic aspects, whereas the second strand of the literature concentrates on the advantages of energy integration.

The first strand of literature consists of studies about the direct and indirect impacts of the coronavirus outbreak on economic aspects of countries. Nicola et al. (2020) explore the socio-economic implications of the coronavirus on the global economy. They concluded that the pandemic increases the rate of poverty and unemployment, leading to a demand decrease in the commodities market. Laing (2020) argues that the impacts of COVID-19 on the industrial sector are so huge due to the decline in the demand side of the industrial commodities market. This argument is in line with the findings of Shafii et al. (2020), who found out the negative impact of COVID-19 on enterprises of Pakistan. Dunford and Qi (2020) defined COVID-19 as a major reason to change the global order and de-liberalism. Chakraborty and Maity's (2020) findings proved the pandemic's role in changing the global environment and human civilization. Brakman et al. (2020) and Schindler et al. (2020) discussed that the pandemic severely affects regional and international economic geography, leading to the de-globalization of nations. Yaya et al. (2020) explained that de-globalization under the pandemic is due to the spread of uncertainty in nations' economic and political relations. In another study, Kobrin (2020) argued that the pandemic increases income inequality and decreases

population mobility among countries, two main signals for de-globalization. Gereffi (2020) pointed out that market failure and protectionism are the leading causes of divergence between countries under pandemic circumstances. The concluding remarks of Elliott et al. (2020) revealed that the pandemic easily had lowered the international cooperation chain meaning the new concept of divergence of countries. Moreover, Howard (2021) expressed that the pandemic has changed consumers' tendencies to buy goods and services, pivoting the global economy to divergence.

The second strand of literature includes studies relating to countries' economic and energy integration. Sand-Zantman (2004), Dobrescu and Dobre (2014), and Geda and Hussein Seid (2015) argued that political interests could make regional solid economic communities that any unpredicted economic phenomenon cannot break. Gancia et al. (2020) believed that trade flows are the paramount necessity of establishing a monetary union. More trade between member states of an economic union ensures the stability of the union's structure in the future. In another study, Basnet and Pradhan (2017) concluded that economic size, investment, trade flows, exchange rate, and interest rate are variables building the structure of economic integration between countries. In addition, Micallef (2020) believed that strong economic growth might be a major reason to reach a high rate of economic convergence. Taghizadeh-Hesary et al. (2020) proposed the concept of "unity in diversity" as a policy to make a reliable regional economic integration. Thoumi (1989) expressed that economic integration depends on economic size and geographical distance. This expression is in line with Poulson (1990) and Rasoulinezhad (2017), who emphasized the impacts of integration on different macroeconomic variables. Chisik (2012) reported that production with higher quality and better marketing might lead to a more appropriate structure of economic integration. Regarding the EEU member states, Rasoulinezhad (2020) focused on the impacts of energy trade on the economic integration of the Commonwealth of Independent States (CIS) and concluded that, since the CIS member states had almost comparative advantages in mineral resources and fossil fuels, they could improve their economic integration via trading mineral resources and fossil fuels. Bagherian and Mehranzamir (2020) argued that energy integration could boost the process of energy

transformation worldwide as an efficient policy to combat environmental pollution.

3. Data and model specification

A vast number of scholars on energy, such as Peng et al. (2006), Rasoulinezhad (2017), Geldi (2012), He et al. (2018), and Van Tran et al. (2019), studied the influences of labor quality, the difference in income, bilateral exchange rate, inflation rate, economic growth, and trade openness in their empirical estimations on different aspects of economic integration. Their significant findings showed that these independent variables are statistically significant and impact energy aspects. Hence to be consistent with the earlier studies, our econometric model, by adding the COVID-19 variable, takes the following equation:

$$ETI = f(LQ, DI, EXC, INF, GRO, TO, COVID) \qquad (1)$$

Equation (1) expresses that energy trade integration (ETI) is a function of labor quality (LQ), the difference in income (DI), the bilateral exchange rate (EXC), inflation rate (INF), economic growth (GRO), trade openness (TO), and the dummy variable of COVID-19 pandemic (COVID).

Since our samples are two panels of South Asian countries and Eurasian Economic Union (EEU), Equation (1) can be written as Equations (2) and (3):

Model I: South Asian energy integration

$$\begin{aligned} LETI_{i,t} = \alpha_0 &+ \alpha_1 LLQ_{i,t} + \alpha_2 LDI_{i,t} + \alpha_3 LEXC_{i,t} \\ &+ \alpha_4 LINF_{i,t} + \alpha_5 LGRO_{i,t} \qquad (2) \\ &+ \alpha_6 LTO_{i,t} + \alpha_7 COVID_{i,t} + \varepsilon_{i,t} \end{aligned}$$

Model II: EEU energy integration

$$\begin{aligned} LETI_{i,t} = \beta_0 &+ \beta_1 LLQ_{i,t} + \beta_2 LDI_{i,t} + \\ &\beta_3 LEXC_{i,t} + \beta_4 LINF_{i,t} + \beta_5 LGRO_{i,t} + \qquad (3) \\ &\beta_6 LTO_{i,t} + \beta_7 COVID_{i,t} + \varepsilon_{i,t} \end{aligned}$$

The data for the variables in Equations (2) and (3) are gathered from quarterly public sector debt (QSPD) database, trade map quarterly time series, and statistics and research coronavirus pandemic[1] and cover the period of 2010Q1-2020Q1 due to the reason of data availability. The variables used are energy trade (HS code 27), economic growth (%), the official exchange rate (LCU per US$), the dependency ratio (the percentage of working-age population) as a proxy for labor quality, inflation rate (%), differences in per capita income

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(current US$), trade openness (the sum of a country's trade of commodities except for energy sources as a share of country's GDP in %), and a dummy variable of coronavirus pandemic. *COVID* takes one in the first and second quarters of 2020 and zero in the other quarters. The specific samples for this study include five Eurasian Economic Union member states, namely Russia, Kyrgyz Republic, Kazakhstan, Belarus, and Armenia, and eight South Asian countries, namely Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan, and Sri Lanka.

The typical signs of our variables are presented in Table 1. The difference in income is expected to positively impact the Heckscher-Ohlin (H-O) theory emphasizing that countries with dissimilar incomes may have a higher trade interaction (Rasoulinezhad, 2016 and 2018; Fu et al., 2020). Furthermore, there is an expectation of negative signs for inflation and bilateral exchange rates. This expectation aligns with several existing studies, such as Watson (2016) and Khalighi and Shoukat Fadaei (2017). Moreover, a higher rate of labor quality, trade openness, and economic growth is expected to affect our estimated model positively. In contrast, coronavirus may negatively impact energy integration of the South Asia region and EEU due to the policy of protectionism by states and lockdown to reduce the spread of the pandemic.

Table 1. Expected signs of coefficients.

Variable	Expected sign
Difference in income	+
Inflation rate	−
Bilateral exchange rate	−
Labor quality	+
Trade openness	+
Economic growth	+
Coronavirus pandemic	−

For estimating coefficients, it is necessary to check the preliminary tests. The first test is checking the existence of cross-sectional dependence among countries. Since the paper considers countries from economic unions, they have the same economic cooperation representing the probability of the presence of cross-sectional dependency. The statistic of the test of Pesaran (2004) with H0 of no cross-sectional dependence, written in Equation (4), is applied to check it. In addition, to do robustness checking, Breush-Pagan's (1980) CD test is carried out to ensure the reliability of the cross-sectional dependency test.

$Pesaran\ CD\ test$

$$= \sqrt{\frac{2T}{N(N-1)}}(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}) \quad (4)$$

$Breusch - Pagan\ CD\ test \quad (5)$

$$= T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2$$

where $\hat{\rho}_{ij}$ denotes the correlation between the residuals. Next, the slope homogeneity test should explore the heterogeneity of the cross-sectional units. In this paper, Pesaran and Yamagata's (2008) test based on two statistics represented in Equations (6) and (7) is applied to check the slope homogeneity.

$$\hat{\Delta} = \sqrt{N}(\frac{N^{-1}\tilde{S} - k}{\sqrt{2k}}) \quad (6)$$

$$\hat{\Delta}_{adj} = \sqrt{N}(\frac{N^{-1}\tilde{S} - E(\tilde{z}_{it})}{\sqrt{var(\tilde{z}_{it})}}) \quad (7)$$

After that, the stationarity of variables should be checked. The cross-sectionally augmented Dickey-Fuller (CADF) (Equation 5) proposed by Pesaran (2007) is carried out here, which considers the cross-sectional dependency among countries. If the results of the panel unit root test prove the existence of integration of series, we can perform a panel cointegration test. To this end, the LM panel cointegration test of Westerlund and Edgerton (2007) with the following statistic (H0: there is cointegration) is conducted.

$$LM_N^+ = \frac{1}{NT^2}\sum_{i=1}^{N}\sum_{t=1}^{T}\hat{w}^{-2}_i s_{it}^2 \quad (8)$$

where s_{it}^2 and $\hat{w}_i^{-2}$ represent the partial sums and long-run variances of residuals, respectively. The next step is to estimate the long-run coefficients of variables done by augmented mean group (AMG) estimators proposed by Eberhardt and Bond (2009).

4. Results and discussion

The first step before running the estimation is to find out the presence of cross-sections among series and slope homogeneity test. The findings of these two tests, reported in Tables 2 and 3, state that cross-sectional dependence exists in all series and that the coefficients of the units are heterogeneous.

Table 2. The results of the cross-sectional dependence test.

Sample	Variables	Bruesh-Pagan CD test	Pesaran CD test
The panel of EEU members	Energy integration	152.810*	28.903*
	Difference in income	161.482*	35.229*
	Inflation rate	68.848*	12.105*
	Bilateral exchange rate	130.192*	25.727*
	Labor quality	201.588*	41.692*
	Trade openness	178.492*	31.903*
	Economic growth	211.092*	46.355*
The panel of South Asian countries	Energy integration	142.493*	25.943*
	Difference in income	123.892*	24.110*
	Inflation rate	150.017*	26.511*
	Bilateral exchange rate	211.660*	40.101*
	Labor quality	129.493*	24.092*
	Trade openness	148.065*	30.770*
	Economic growth	63.594*	13.155*

Note: * denotes the H0 rejection at the 5% significance level. All variables are considered in the logarithmic form.
Source: Author's compilation

Table 3. The results of the cross-sectional dependence test.

Sample	Tests	Stat.	Prob.
The panel of EEU members	$\tilde{\Delta}$	13.116*	0.00
	$\tilde{\Delta}_{adj}$	19.498*	0.00
The panel of South Asian countries	$\tilde{\Delta}$	15.044*	0.00
	$\tilde{\Delta}_{adj}$	23.204*	0.00

Note: * denotes the H0 rejection at the 5% significance level. All variables are considered in the logarithmic form.
Source: Author's compilation

Next, the panel unit root test of CIPS is employed to determine whether the series is stationary. The results are listed in Table 4. The findings of the panel unit root test reveal that the series becomes stationary after the first differences.

Table 4. The results of the panel unit root test.

Sample	Variables	CIPS panel unit root test	
		At level	At first differences
The panel of EEU members	Energy integration	−1.87	−3.690*
	Difference in income	−2.69	−4.173*
	Inflation rate	−0.582	−2.760*
	Bilateral exchange rate	−2.011	−2.544*
	Labor quality	−1.50	−3.950*
	Trade openness	−0.616	−2.618*

Sample	Variables	CIPS panel unit root test	
		At level	At first differences
	Economic growth	−1.49	−3.763*
A panel of South Asian countries	Energy integration	−2.16	−5.104*
	Difference in income	−2.59	−4.519*
	Inflation rate	−0.669	−2.493*
	Bilateral exchange rate	−1.49	−3.805*
	Labor quality	−0.793	−2.511*
	Trade openness	−1.90	−3.859*
	Economic growth	−1.59	−3.807*

Note: * denotes the H0 rejection at the 5% significance level. All variables are considered in the logarithmic form.
Source: Author's compilation

The results of the panel unit root test allow conducting the panel cointegration test. Table 5 reports the findings of the LM bootstrap panel cointegration test of Westerlund and Edgerton. It can be concluded that there exists a long-run linkage between the variables.

Table 5. The results of the panel cointegration test.

Sample	-	LM stat.	Bootstrap Prob.
The panel of EEU members	With constant	−1.691	0.977
	With constant and trend	−2.058	0.964
The panel of South Asian countries	With constant	−1.782	0.981
	With constant and trend	−2.194	0.987

Note: The bootstrap is calculated based on 1000 replications.
Source: Author's compilation

The AMG estimator is employed in this paper to explore the coefficients of the long-run relationships between variables, which considers heterogeneity and cross-sectional dependency among countries. The results of AMG estimation for the South Asian countries and EEU are represented in Tables 6 and 7.

According to Table 6, the estimated signs are in line with the expected ones. Labor quality has positive impacts on the economic integration of South Asian members, particularly the magnitudes of effects are more prominent for the more significant economies such as India and Pakistan in this union. Regarding differences in income, the energy integration pattern in South Asia follows the H-O theory declaring that dissimilarity in income per capita is a significant reason for dealing trade between countries. Moreover, the bilateral exchange rate and inflation rate negatively impact the energy trade integration of countries in this union. The magnitude of impacts is more substantial for larger economies like India and Pakistan. GDP growth is an accelerator for energy integration in this region.

Furthermore, trade liberalization has a positive coefficient depicting the positive relationship between trade openness and energy integration in the South Asia region. The impact of COVID-19 on the energy trade integration of countries in this Asian region is negative. The magnitude of negative impact is more extensive for stronger economies like India, Pakistan, and Bangladesh. For instance, the COVID-19 outbreak has decelerated economic integration in India and Pakistan by approximately 0.18% ([exp(−0.21)−1]) and 0.17% ([exp(−0.19)−1]), respectively.

Table 6. The results of AMG estimation concerning South Asia.

Country	LLQ	LDI	LEXC	LINF	LGRO	LTO	COVID
Afghanistan	0.04	0.25	–0.08	–0.17	0.03	0.02	–0.02
	(0.00)**	(0.01)**	(0.00)**	(0.04)**	(0.00)**	(0.06)*	(0.00)**
Pakistan	0.41	0.52	–0.32	–0.29	0.41	0.36	–0.19
	(0.01)**	(0.00)**	(0.00)**	(0.01)**	(0.03)**	(0.00)**	(0.00)**
India	0.39	0.49	–0.47	–0.36	0.24	0.27	–0.21
	(0.00)**	(0.05)**	(0.06)*	(0.09)*	(0.01)**	(0.03)**	(0.00)**
Nepal	0.04	0.21	–0.10	–0.05	0.03	0.09	–0.02
	(0.00)**	(0.01)**	(0.00)**	(0.04)**	(0.00)**	(0.00)**	(0.04)**
Bangladesh	0.19	0.45	–0.16	–0.26	0.25	0.21	–0.14
	(0.04)**	(0.06)*	(0.00)**	(0.00)**	(0.02)**	(0.04)**	(0.00)**
Bhutan	0.03	0.09	–0.04	–0.00	0.03	0.09	–0.06
	(0.00)**	(0.00)**	(0.00)**	(0.01)**	(0.00)**	(0.00)**	(0.01)**
Maldives	0.11	0.03	–0.09	–0.09	0.00	0.04	–0.03
	(0.08)*	(0.01)**	(0.07)*	(0.07)*	(0.00)**	(0.00)**	(0.00)**
Sri Lanka	0.00	0.07	–0.05	–0.01	0.04	0.00	–0.05
	(0.01)**	(0.00)**	(0.03)**	(0.00)**	(0.00)**	(0.00)**	(0.01)**

Note: LLQ, LDI, LEXC, LINF, LGRO, and LTO are logarithmic forms of labor quality, the difference in income, exchange rate, inflation rate, economic growth, and trade openness, respectively. Moreover, COVID denotes the dummy variable of coronavirus outbreak. Numbers in parentheses are p-value. In addition, * and ** are H0 rejection at 1% and 5% significance levels.
Source: Author's compilation

Regarding the estimation results for Eurasian Economic Union, it can be expressed that labor quality positively impacts the economic integration of all member states of this union. However, this positive impact is more substantial for larger economies in this union, such as Russia and Kazakhstan. The main reason is that the economic production in larger economies in this union is labor-intensive than in the smallest economies. Moreover, the difference in income shows a positive coefficient, implying that the countries in the Eurasian economic union deal with countries with different income levels in trading. This result proves the existence of the H-O theory in the economic integration of the Eurasian Economic Union.

Furthermore, the estimation demonstrates the negative coefficient of the bilateral exchange rate, pointing out the positive relationship running from the depreciation of national currency on economic integration in this union. According to Table 7, the impact of the inflation rate on the economic integration of all member states in the Eurasian Union is negative and statistically significant, indicating that any increase in the general price level of commodities may deaccelerate the economic integration process of the Eurasian Economic Union member states. In addition, economic growth and trade openness, as expected, play a significant role in accelerating the economic integration of the union's member states.

Regarding the coefficient of the COVID-19 variable, the estimation reveals the negative impact of this pandemic on the economic integration of Russia, Kazakhstan, Kyrgyz Rep., Belarus, and Armenia. As a highlighted point, the findings show the larger magnitudes of pandemic's negative impact for smaller economies in this union. Based on coefficients, the COVID-19 outbreak has deaccelerated economic integration of Russia, Kazakhstan, Kyrgyz Rep., Belarus, and Armenia by nearly 0.28% ([exp(–0.34)–1]), 0.25% ([exp(–0.29)–1]), 0.41% ([exp(–0.54)–1]), 0.26% ([exp(–0.31)–1]), and 0.47% ([exp(–0.64)–1]), respectively, proving that all the economic limitations like lockdown and demand shortage disturb the financial markets of smaller economies of the Eurasian Union.

Table 7. The results of AMG estimation concerning Model II (Eurasian Economic Union).

Country	LLQ	LDI	LEXC	LINF	LGRO	LTO	COVID
Russia	0.34	0.68	–0.03	–0.14	0.09	0.51	–0.34
	(0.00)**	(0.03)**	(0.02)**	(0.00)**	(0.00)**	(0.09)*	(0.00)**
Kazakhstan	0.25	0.43	–0.00	–0.17	0.23	0.49	–0.29
	(0.00)**	(0.06)*	(0.00)**	(0.04)**	(0.02)**	(0.00)**	(0.01)**
Kyrgyz Rep.	0.04	0.33	–0.25	–0.14	0.01	0.06	–0.54
	(0.00)**	(0.00)**	(0.08)*	(0.03)**	(0.00)**	(0.00)**	(0.06)*
Belarus	0.10	0.39	–0.19	–0.52	0.05	0.19	–0.31
	(0.07)*	(0.00)**	(0.00)**	(0.00)**	(0.06)*	(0.01)**	(0.00)**
Armenia	0.02	0.45	–0.23	–0.42	0.00	0.10	–0.64
	(0.00)**	(0.00)**	(0.02)**	(0.00)**	(0.00)**	(0.00)**	(0.08)**

Note: LLQ, LDI, LEXC, LINF, LGRO, LTO are logarithmic forms of labor quality, the difference in income, exchange rate, inflation rate, economic growth, and trade openness, respectively. Moreover, COVID denotes the dummy variable of coronavirus outbreak. Numbers in parentheses are p-value. In addition, * and ** are H0 rejection at 1% and 5% significance levels.

Source: Author's compilation

5. Conclusions

Energy integration has been considered one of the critical and existing goals of economies globally. Nevertheless, the unprecedented crisis of the COVID-19 pandemic has posed a severe challenge to the goal of economic and energy integration since the end of 2019. This problem is more considerable for Iran, trying to establish and improve a stable and reliable economic integration pace under sanctions and pandemic circumstances.

Regarding this problem, the paper seeks to explore the impacts of COVID-19 on energy integration in South Asia and the EEU member states for quarterly data over the period 2010Q1–2020Q2. In doing so, firstly, the Breush-Pagan and Pesaran cross-sectional dependence tests and the slope homogeneity test of Pesaran and Yamagata were carried out. Then, the presence of unit root among series was examined by the cross-sectionally augmented Dickey-Fuller approach. Afterward, the LM panel cointegration test of Westerlund and Edgerton (2007) was performed to explore cointegration among series. Finally, the long-run relationships were estimated by augmented mean group estimators Eberhardt and Bond (2009) proposed.

The main concluding remarks based on the empirical findings are as follows:

- Labor quality is a significant factor in improving energy integration in South Asia and the EEU.

However, the influence of this factor on energy integration is more considerable for larger economies. The key reason is that the highly skilled labor force has played a more significant role in production processes in the larger economies.

- The integration pattern in South Asia and the EEU is based on the Heckscher-Ohlin (H-O) theory. In other words, dissimilarity in income per capita motivates the energy trade between member countries in these two unions.

- The relationship between the official exchange rate and energy integration is harmful to both unions, implying that any depreciation in national currency may accelerate the energy trade between countries.

- Inflation is an influential factor in energy integration in South Asia and EEU. An increase in the general price level of commodities in member countries of these two unions may reduce the speed of economic integration.

- Economic growth and trade liberalization are two significant motivations for energy integration in these two unions. Hence, any strategies and policies to increase GDP growth and trade openness may lead to stronger energy ties between member states.

- The COVID-19 pandemic is a severe challenge to energy integration in these two unions. Notably, the integration of larger economies that are more

developed and have a higher level of trade liberalization is disturbed by this pandemic. The finding of the negative impact of the pandemic on economic integration is in line with Brakman et al. (2020), Schindler et al. (2020), Yaya et al. (2020), and Gereffi (2020).

A significant policy implication based on the conclusions for Iran is that:

- Iran needs to regulate and make a timeline for managing regionalization and multilateralism in and post-coronavirus periods. Establishing energy integration with regional countries and blocs such as EEU and South Asia is highly recommended due to its impacts on Iran's economic security and economic resilience.

- Iran should plan to determine the types and magnitudes of negative impacts of the pandemic, regulating monetary and fiscal policies to overcome the long-run implications of the pandemic. This recommendation is in line with the findings of Ahmadyan and Nasr Esfahani (2020), who proved the necessity of efficient policies to combat the negative consequences of COVID-19 on the energy sector.

- Another policy implication is that due to the similar conclusions for the South Asian countries and the EEU, Iran can expand its interactions with them to enjoy the benefits of more efficient experiences in controlling the pandemic impacts.

- Moreover, to accelerate economic integration, strategies for controlling the inflation rate and boosting the virtual economy as a powerful instrument to increase trade openness under the pandemic in Iran are strongly recommended.

- It is an essential policy to boost cooperation with the South Asia Subregional Economic Cooperation (SASEC) and Eurasian Union, where various programs like energy market integration and common energy market are gradually developed.

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