CENTRE FOR EUROPEAN STUDIES

Working Papers Series

EDITORIAL BOARD

Volume XV, Issue 1, 2023

Table of contents

Towards "Digital Sovereignty": Explaining Digital Repression in Russia

Aram TERZYAN[*]

Abstract

This paper explores the main features of digital repression in Russia, especially in the context of the Russian invasion of Ukraine. The repression of digital activism is not a new phenomenon in Russia; however, it gained fresh momentum during the Russian-Ukrainian war. Security has been used as a pretext to expand the state's authority at the cost of individuals' rights and freedoms. To control political narratives, suppress online dissent and surveil regime critics, the government has significantly tightened the national legislation through its media regulator, Roskomnadzor. The aftermath of the war, harsh sanctions and increased anti-regime movements have also deepened Russia's aspirations toward 'digital sovereignty'. Meanwhile, regardless of a number of important initiatives in this direction, domestic digital space still remains an ambitious goal to be fulfilled. This paper concludes that, along with other devastating consequences, the war in Ukraine will provoke further digital repression in Russia aimed at achieving the Kremlin's goal of "digital sovereignty".

Keywords: Russia, digital repression, human rights, online space, 'digital sovereignty'

Introduction

Digitalization has affected politics in manifold ways and brought new dimensions to political repression. On the one hand, digital technologies empower civil society and provide additional platforms for the fulfillment of fundamental human rights and freedoms. On the other hand, these same technologies are deployed by autocrats to persecute, silence and punish regime critics, activists and other civil society members. This affects not only freedom of expression online, but also the rights to assembly and association, privacy, participation in political and public life, etc.

The suppression of digital activism through network disruptions, internet shutdowns and bans on social networks are on the rise globally. This is particularly evident in autocratic environments where repression is used to raise the costs of disloyalty, promote the favored stories and suppress mass mobilization movements against the regime. The COVID-19 crisis has further enhanced governments' capacities for digital repression (Bleyer-Simon, 2021). The resulting proliferation of censorship and surveillance technologies introduced in a number of countries under the guise of anti-

[*] Aram Terzyan, PhD is Research Director of Center for East European and Russian Studies, Eurasia Institutes- California, USA, e-mail: a.terzyan@eurasiainstitutes.org.

pandemic measures provided an opportunity to further promote their model of digital governance (Feldstein, 2021).

Since the Kremlin launched its "special military operation" in Ukraine, the authorities have significantly narrowed the space for online activism. Media censorship has reached new extremes with almost all independent media being banned, blocked or declared as 'foreign agents' by the Russian authorities. To endorse state narratives about the war, suppress online dissent and surveil critics, the government has adopted a series of vague and ill-defined laws causing dramatic deterioration in the already restrictive online environment in Russia.

Against this backdrop, two questions lie at the heart of this research:

1) What are the basic features of digital repression in autocratic environments?

2) What is the state of digital repression in Russia during wartime?

The paper is structured as follows. Firstly, the study discusses the core features of digital repression through providing main theoretical perspectives. Subsequently, it focuses on the specific forms and shapes that digital repression has tended to take in Russia. The conclusion briefly discusses the main findings.

On the theory of digital repression

The sharp rise of digital technologies in the past two decades has substantially increased the capacity for repression of digital activism and tools used for that purpose. More and more governments are deploying new technologies to silence critical voices, suppress anti-regime protest movements, enhance political control, seeking to ensure regime survival (Głowacka et al., 2021).

Feldstein defines digital repression as "the use of information and communications technology to surveil, coerce, or manipulate individuals or groups in order to deter specific activities or beliefs that challenge the state" (Feldstein, 2021). Davenport refers to it as "an actual or threatened use of physical sanctions against an individual or organization … for the purpose of imposing a cost on the target" (Davenport, 2007). Regardless of numerous definitions, it is commonly held that the purpose of repressive actions is to raise the "cost" of political participation to such a degree that citizens would not consider or be aware enough to engage in political actions deemed undesirable by state authorities. This could be accomplished in many forms - from online harassment, to disinformation, to internet shutdowns, cyberattacks and targeted surveillance using social media, artificial intelligence (AI) and facial recognition software (Lamensch, 2021).

Digital repression resembles traditional repression in many ways. Like traditional repression, digital repression allows identification of critical voices, and decreases the likelihood of mass mobilization against the regime. Nevertheless, despite considerable similarities, there is a number of dissimilarities between traditional and digital repression. Notably, digital repression considerably increases the effectiveness of longstanding repressive practices and tactics, while lowering the costs (Frantz *et al*., 2020, p. 2).

Feldstein (2021) identifies three important insights into the patterns of digital repression. Firstly, there is a strong statistical relationship between regime type and digital repression. Secondly, autocracies seek to enforce digital repression at a level greater than their capabilities, forcing them to make up the gap with external sources or reliance on less advanced digital tools. Conversely, digital repression capacity in democracies outstrips enactment, meaning that democracies choose to not to apply the excess capabilities they possess. Thirdly, not only do autocracies and democracies deploy contrasting digital strategies, but among autocracies there is significant variance regarding which digital methods these regimes choose to implement (Feldstein, 2021, pp. 62-63).

Though dictatorships vary in the extent to which they rely on repression, all regimes use it to some degree. Reliance on digital repression increases reliance on more "high intensity" forms of repression, such as the use of torture and imprisonment (Frantz *et al*., 2020, p. 1). Thus, it can be argued that autocratic governments are not totally substituting the new tools for their old ones, but they are merely using them to make the existing mechanisms more effective.

Digital repression has become the 'new frontier of the autocratic survival toolkit' (Frantz *et al*., 2020). Recent research has shown that where digital repression is highest, leaders survive in office longer than in places where it is less significant. The use of digital repression reduces the likelihood of authoritarian regimes facing internal protest or sustained mobilization efforts, which represents perhaps the most serious threat to dictatorships today (Kendall-Taylor *et al*., 2020, p. 103).

Autocratic governments mostly rely on such tools as online censorship, surveillance, and internet shutdowns to control online communications, selecting what they believe will be effective in the respective political situations on the ground (Weidmann and Dainotti, 2022, p. 60). Although these measures are generally applied under the name of defending national security, social morality, and public order, in a number of contexts they are being used for the personal advantages of those in power.

Online censorship involves government suppression of the free flow of information and ideas that threatens the *status quo*, and demarcation on what is acceptable and unacceptable communication in society (Liu and Wang, 2021). A recent study of cross-sectional time-series data of 153 countries

from 1995 to 2018 reveals that internet censorship is a reactive strategy used by autocracies to suppress civil society. It is argued that the use of censorship as a political reaction to technological diffusion and contentious politics worldwide has damaged the development of civil society (Chang and Lin, 2020).

Because of the nature of information, censorship can be disguised, making it difficult to notice that information is being manipulated. While fear-based censorship, aimed at intimidating and deterring, must be visible in order to be effective, more sophisticated forms of censorship that work through "friction and flooding", such as blocking of websites, reordering of search results, and covert information campaigns, can exert effects without alerting users (Roberts, 2020, p. 406).

Like censorship, digital surveillance creates an information imbalance between the citizen and his or her government. It may lead to an increase in information on dissidents and regime critics, particularly on the opposition leaders most likely to mobilize against the regime (Frantz *et al*., 2020, p. 14). Internet monitoring helps rulers observe patterns of human behavior that are unknown to the ruled and permits top-down governance structures but is fundamentally incompatible with securing the consent of the populace (Robbins and Henschke, 2017).

Using country- and multi-level analysis, Stoycheff *et al*. (2018) reveals the negative effect of digital censorship and surveillance on democratization, providing the first cross-national tests of the effects of online surveillance. By investigating 63 countries, the study evidenced that online government monitoring is negatively associated with democratization (Stoycheff et. al., 2018, p. 1).

Government-led internet shutdowns are also one of the tactics of digital repression. Researchers have illustrated that shutdowns take a toll on local economies, and they have been shown to correlate with higher levels of violence, undermining the argument that they are necessary to maintain peace and security (Freedom House, 2022, p. 23). In autocracies, they are widely used to push back against mass demonstrations and entrench military coups (Feldstein, 2022, p. 6). They are also frequently reported during armed operations, severely restricting reporting and human rights monitoring. The inability to access tools to document and rapidly report abuses contributes to further violence and may lead to atrocities. Some shutdowns may even be used with the intention of covering up human rights violations (Human Rights Council, 2022, p. 7). In Myanmar, for instance, shutdowns have blocked the capacity to report air strikes on civilians, the burning of houses, and extrajudicial killings and arrests, including of children (Myanmar Now, 2022).

Markedly, the level of control and censorship increases during the wartime. Conflict situations become fertile ground for mass disinformation campaigns intended to undermine the proper understanding of developments, as well as more generally, of security, public order and peaceful democratic processes (Council of Europe, 2022).

The groups most targeted and subjected to repression are commonly journalists, human rights defenders, whistle-blowers, political opposition, and other civil society activists. At the same time, for instance, expanding AI-driven data collection systems increasingly affects the wider population, among whom the most severely affected are the poor and other most disadvantaged groups in society (Glowacka, 2021, p. 4). Interestingly, the majority of people do not immediately feel the effect of crackdowns. The prevailing sense of indifference in autocracies goes a long way toward redefining the state-citizen relationship in favor of the regime, which progressively but methodically uses its heavy-handed approach as a deterrent to dissent. In such environments, "repression becomes an instinct, security an obsession, and social control a policy" (Zayani, 2015, p. 48).

While digital repression mostly affects freedom of expression (just as in the case of widespread surveillance), it also interferes with multiple other rights, such as the right of association and peaceful assembly, participation in political and public life, privacy, etc. (Glowacka, 2021, p. 14). Meanwhile, it is recognized that the laws on human rights are applicable to the internet and other digital technologies. In 2012, the UN Human Rights Council (2012) adopted a 'Resolution on the promotion, protection and enjoyment of human rights on the Internet', for example, affirming that 'the same rights that people have offline must also be protected online - in particular, freedom of expression, which is applicable regardless of frontiers and through any media of one's choice' (Human Rights Council, 2012). Thus, international human rights instruments, such as such as the International Covenant on Civil and Political Rights ('ICCPR') or the European Convention of Human Rights ('ECHR'), though not specific to new and emerging technologies, may be invoked to address the current human rights challenges posed by them (Human Rights Council, 2012).

Digital repression has gone so far so as to give rise to the term "digital authoritarianism", which is defined as "the use of digital information technology by authoritarian regimes to surveil, repress, and manipulate domestic and foreign populations" (Polyakova and Meserole, 2019). It is evident that there has been a rise in digital authoritarianism in the midst of the Covid-19 pandemic, which has significantly accelerated and expanded the implementation of advanced digital technologies that are aimed to tighten the authoritarian hold over society. In a number of countries, security has been used as a pretext to expand the state's authority at the cost of individuals' rights (Domańska, 2020, p. 21).

In recent years, more governments than ever have tightened control over what people can access and share online by blocking foreign websites, hoarding personal data, and centralizing their countries' technical infrastructure (Freedom House, 2022, p. 2). Fragmentation is also accelerating at a rapid pace and not only in authoritarian contexts. Some governments are cultivating domestic spaces in order to suppress critical information, promote disinformation, and access users' personal

information more easily. However, others contribute to fragmentation more carelessly in their efforts to tackle disinformation, protect user data, and deter genuine cybercrimes (Funk, 2022).

During 2022, online censorship reached an all-time high, with a record number of governments blocking political, social, or religious content, often targeting information sources based outside their own borders. The most severe manifestations of digital repression are currently traced in Russia, Myanmar, Libya, and Sudan, which have experienced the world's steepest declines in internet freedom (Freedom House, 2022).

The state of digital repression in Russia

Despite its long history of censoring traditional media, under President Putin's regime the Russian government for many years adopted a relatively liberal approach to online speech and the Russian Internet. That began to change in early 2012, after online news sources and social media played a central role in organizing protests following the parliamentary elections of December 2011 (Duffy, 2015). Russia started to expand its censorship capacities and has gradually updated its legal system to prevent dissent and to silence critical voices.

In the past, instead of blocking or censoring an overwhelming amount of content, Russian government actors simply flooded the information market with news stories supporting government endorsed narratives (Morgus, 2019, p. 94). However, the adoption of new and harsh laws and the government's endeavors to nationalize the Internet in Russia have significantly changed the Russian model of information control.

Since 2012, Russia has maintained a centralized Internet blacklist kept by the Federal Service for Supervision of Communications, Information Technology and Mass Media, commonly known as *Roskomnadzor*. Furthermore, the Duma granted the Prosecutor General the authority to block sites without a court order and expanded the blacklist to include sites publicizing unsanctioned mass events (Cebul and Pinckney, 2021, p. 12). Although Russian telecommunications surveillance (the SORM system) has been in operation since the 1990s, emerging technologies are enhancing these tools. The 2016 Yarovaya amendments require all "organizers of information dissemination" to archive user data for three years on Russian servers and to grant the Federal Security Service (FSB) access to these communications and to any encryption codes (Cebul and Pinckney, 2021, p. 14).

Overall, Roskomnadzor has played a significant role in slowly increasing the state's control over digital space. The agency was established on December 3, 2008, following presidential decree no. 1715, which granted only censorship powers (Sherman, 2022). Nevertheless, reporting on

thousands of leaked Roskomnadzor documents shows that it acts as an element in a repressive apparatus. A New York Times' investigation (2022) reveals that Roskomnadzor has gone far beyond what was publicly known on managing website blocklists and filing censorship orders. For a couple of years now, the internet censor has compiled dossiers on individuals and organizations posting regime-critical content. According to the New York Times, Roskomnadzor has "worked to unmask and surveil people behind anti-government accounts and provided detailed information on critics' online activities to security agencies" (New York Times, 2022).

Since 2014, to evoke fear and justify greater digital control, Putin's regime has repeatedly presented a scenario in which Russia finds itself switched-off from the global internet and hit by technological sanctions from the United States (Epifanova and Dietrich, 2022, p. 5). Thus, the Kremlin justified initiating a series of legal and technical procedures aimed at 'sovereignization' of the Internet. In May 2019, Putin signed new legislation banning fake news and the showing of 'blatant disrespect' for the state online. The law defines the status of and requirements for the "critical infrastructure" of the Runet, with a specific focus on international communication lines and internet exchange points. Their owners and operators are supposed to ensure centralized traffic management amidst "external threats". The latter is a vague term that the authorities can easily manipulate to tighten their grip on the relevant infrastructure for any reason (Freedom House, 2022). Critics have been concerned that legislation could create a mechanism for state censorship, whereas lawmakers argued that the new measures would be used to combat false news reports and abusive comments (Reuters, 2019).

'Sovereignization' of the Internet can be seen to be a common pattern in authoritarian regimes, where the internet is viewed by the authorities both as a threat to regime survival and as a tool to be used against state enemies. Thus, in an attempt to control the political narrative and suppress all dissent, authoritarian rulers are severely tightening national legislation on the internet.

The Russian-Ukrainian war has brought further deterioration in the already restrictive online space in Russia and has hastened the Kremlin's path toward digital isolation. Within several weeks, Russian digital space has been put into an unprecedented situation. One the one hand, international sanctions cut off many services from abroad, on the other hand the Russian government has harshly restricted online speech and access inside its borders.

Concerns about Russia's fractured Internet ecosystem have only grown since the war. Through its media regulator Roskomnadzor, which is included on the international Reporters Without Borders (RSF) list of digital press freedom predators (RSF, 2020), the government has been controlling independent mass media outlets since the start of the war (Amnesty International, 2022).

Roskomnadzor launched an investigation against the Novaya Gazeta, Echo of Moscow, inoSMI, MediaZona, New Times, Dozhd (TV Rain), and other Russian media outlets for allegedly publishing false information about the Russian military actions in Ukraine (shelling of Ukrainian cities, casualties, etc.) within the Russian "special military operation" (Radio Free Europe, 2022).

Repression of the independent media has been exercised primarily through tightened censorship legislation. On March 4, 2022 Russia enacted two laws criminalizing independent war reporting, with penalties of up to 15 years in prison. The laws make it illegal to spread "fake news" about the Russian armed forces, to call for an end to their deployment and to support sanctions against Russian targets (HRW, 2022). Commenting on this legislation, Kremlin spokesperson Dmitry Peskov told reporters that "unprecedented conditions require unprecedented solutions." He explained that the current situation can be described as unprecedented "in terms of imposing absolute hatred on everything Russian, whether it is Russian missions, Russian citizens, or foreign citizens who are of Russian origin" (Russia Today, 2022). Nevertheless, the laws are not limited to the war in Ukraine but apply to any deployment involving Russian armed forces, such as those under the regional military alliance, the Collective Security Treaty Organization. These new laws have been regarded internationally as "part of Russia's ruthless effort to suppress all dissent and make sure the population does not have access to any information that contradicts the Kremlin's narrative about the invasion of Ukraine" (HRW, 2022).

Since the adoption of the March censorship legislation, the authorities have blocked access to a number of independent media outlets and opened criminal cases against those speaking out against the war. Kremlin blocked Facebook, Instagram, and Twitter, depriving Russians of access to reliable information about the war and limiting their ability to connect with users in other countries (Freedom House, 2022). Russian media regulator Roskomnadzor based its decision on claims that these popular platforms were discriminating against the Russian media and information resources, such as RT, RIA Novosti, and Sputnik (RFE/RL, 2022).

Furthermore, the government expanded its foreign agent law and mandated that media outlets refer to the war as a "special military operation" (Freedom House, 2022). Some human rights NGOs, such as Memorial and Civil Assistance Committee, "Pskovskaya Gubernia" newspaper and a number of human rights defenders have been subjected to persecution and punishment for their opposing views. This has had a disastrous effect on the human rights situation in the country, prompting hundreds of journalists, human rights defenders and civil society activists to seek refuge abroad (Council of Europe comments, 2022). It is estimated that at least 150 journalists, including both foreign and Russian reporters, fled Russia within two weeks of the start of the war (Amnesty International, 2022). As Morgus (2019) aptly argues, Russian censorship and surveillance technology

relies less on filtering information before it reaches citizens (as is the case in China) and more on a repressive legal regime coupled with tightening information control and intimidation of internet service providers (ISPs), telecom providers, private companies, and civil society groups (Morgus 2019, p. 91).

Despite the harsh March laws, which strictly limit the freedom of assembly, anti-war demonstrations began to appear across the country. Nearly 1,200 Russians were arrested in cities including Moscow and St. Petersburg, according to the independent Russian human rights group OVD-Info (Euronews, 2022). Particularly in the Russian region of Dagestan, protests continued for several days with hundreds of people taking to the streets of the capital, Makhachkala, where clashes erupted between demonstrators and the police. Dozens of people were reported to have been arrested (UN Office of the High Commissioner for Human Rights, 2022). The federal agencies significantly contribute to spying on protesters and anti-war activists. In the spring and summer of 2022, when the Russian government had not yet launched a massive crackdown on anti-war protests, activists in Moscow and St. Petersburg were identified by the city CCTV systems through facial recognition (Soldatov and Borogan, 2022). These systems (four of which are based in Moscow) are run by Moscow's Department of Information Technology (DIT) and aim at introducing and running new technologies in the Moscow administration. Thus, the DIT serves as a repressive tool in the hands of the Russian authorities (Soldatov and Borogan, 2022).

Notably, cyberattacks against state and state-affiliated websites increased significantly throughout the war. According to a Freedom House report (2022), at the end of February 2022, the hacking group Anonymous claimed responsibility for cyber-attacks that conveyed anti-war messages on the Russian government websites, Roskomadzor, and other state entities, along with other state-affiliated media outlets, such as RT, TASS, and Kommersant. Over 2,500 Russian- and Belarusian-linked websites have been targeted throughout the campaign, while experiencing the repercussions of cyberattacks (Freedom House, 2022).

Overall, internet freedom in Russia has declined by seven points, reaching an all-time low and representing the year's largest national decline in Freedom on the Net. "With loyalist security forces, a subservient judiciary, a controlled media environment, and a legislature consisting of a ruling party and pliable opposition factions, the Kremlin is able to suppress genuine dissent" (Freedom House, 2022).

Apparently, Russia is today seeking to export its state-controlled version of the internet on the global stage, promoting its own candidate to lead the United Nations International Telecommunications Union (ITU), the agency responsible for information and communication technology (Committee to Protect Journalists, 2022). Meanwhile, Russia's path to 'digital

sovereignty' has a long way to go. Currently, it is heavily dependent on external actors, especially the information and communications technology (ICT) of the United States and Europe. A number of externally owned hardware, software, and social media networks are widely used in Russia both the public and private sectors (Epifanova and Dietrich, 2022, p. 5). The dependence on foreign technologies challenges Russian both externally (the weaponization of digital technologies against Russia from abroad) and internally (the problem of controlling all levels of Russian political life to ensure regime survival).

Conclusion

The repression of digital activism is on the rise globally and significantly undermines international efforts toward democratization. In autocratic environments, digital technologies are increasingly used to reduce the likelihood of internal protests or sustained mobilization efforts, which represent the most serious threat to dictatorships today. While digital repression restricts mostly freedom of expression, it also interferes with multiple other rights, such as the right of association and peaceful assembly, participation in political and public life, privacy, etc.

The Russian-Ukrainian war has brought further deterioration in the already restrictive online space in Russia. Within several weeks, Russian digital space was in an unprecedented situation. One the one hand, international sanctions cut off many services from abroad, on the other hand the Russian government harshly restricted online speech inside its borders. Security has been used as a pretext to expand the state's authority at the cost of individuals' rights and freedoms.

In an attempt to control state-endorsed narratives and suppress dissent across the country, the Russian authorities have severely tightened national legislation on the network. A series of vague and ill-defined laws introduced in Russia severely narrowed the digital space and subjected the critics of the government to unjustified raids. This has mostly affected journalists, human rights defenders and civil society activists, prompting many of them to seek refugee abroad. Through its media regulator Roskomnadzor, which is a central element of the Russian repressive apparatus, the government surveilled people behind anti-government movements and obtained information on critics' online activities.

The war has also hastened Russia's path to 'digital sovereignty'. The aftermath of the war, tough international sanctions and increasing domestic unrest have made the 'sovereignization' of the Internet a priority for Kremlin. Although several important initiatives have been made in this regard, the cultivation of a sovereign digital space has still a long way to go in Russia. Clearly, Russian citizens are facing formidable challenges. While they have every right to express their dissenting

views, the Kremlin's massive crackdown on anti-regime activists is bound to further restrict the freedom of expression across the country. A question remains as to whether the Kremlin's repressive tools will suffice to silence dissent, amid mounting international sanctions on Russia, coupled with the Russian citizen's growing resentment towards the government's repressive practices. Further research is essential for exploring what other forms and shapes the Kremlin's digital repression will take amid the escalating war in Ukraine.

References

Amnesty International (2022), *Russia: Kremlin's Ruthless Crackdown Stifles Independent Journalism and Anti-War Movement* (retrieved December 27, 2022 from https://www.amnesty.org/en/latest/news/2022/03/russia-kremlins-ruthless-crackdown-stifles-independent-journalism-and-anti-war-movement/).

Bleyer-Simon, K. (2021), Government repression disguised as anti-disinformation action: Digital journalists' perception of covid-19 policies in Hungary, *Journal of Digital Media & Policy*, 12(1), pp. 159-176.

Cebul, M. and Pinckney, J. (2021), *Digital Authoritarianism and Nonviolent Action: Challenging the Digital Counterrevolution*, United States Institute of Peace, Special Report (retrieved December 27, 2022 from https://www.usip.org/sites/default/files/2021-07/sr_499-digital_ authoritarianism_and_nonviolent_action_challenging_the_digital_counterrevolution.pdf).

Chang, Ch., and Lin, Th. (2020), Autocracy Login: Internet Censorship and Civil Society in the Digital Age, *Democratization*, 27(5), pp. 874-895.

Committee to Protect Journalists (2022), *'Disastrous for Press Freedom': What Russia's Goal of an Isolated Internet Means for Journalists* (retrieved December 27, 2022 from https://cpj.org/2022/05/disastrous-for-press-freedom-what-russias-goal-of-an-isolated-internet-means-for-journalists/).

Council of Europe (2022), *Freedom of Expression in Times of Conflict* (retrieved December 27, 2022 from https://www.coe.int/en/web/freedom-expression/freedom-of-expression-in-times-of-conflict#).

Council of Europe comments (2022), *Support Russian and Belarusian Civil Societies and Human Rights Defenders* (retrieved December 27, 2022 from https://www.coe.int/en/web/ commissioner/-/support-russian-and-belarusian-civil-societies-and-human-rights-defenders).

Davenport, Ch. (2007), State Repression and Political Order, *Annual Review of Political Science*, 10 (1), pp. 1-23.

Domańska, M. (2020), Russian Digital Authoritarianism at the Time of COVID-19. *New Eastern Europe*, 5 (43), pp. 21-27.

Duffy, N. (2015), Internet Freedom in Vladimir's Putin Russia: The Noose Tightens, *AEI Papers* (retrieved December 27, 2022 from https://www.aei.org/wp-content/uploads/2015/01/Internet-freedom-in-Putins-Russia.pdf).

Epifanova, A. and Dietrich, Ph. (2022), Russia's Quest for Digital Sovereignty: Ambitious, Realities, and Its Place in the World, *DGAP Analysis*, 1 (retrieved December 27, 2022 from https://dgap.org/sites/default/files/article_pdfs/DGAP-Analyse-2022-01-EN_0.pdf).

Euronews (2022), *Ukraine War: Hundreds Arrested in Russia After Putin's Troops Call-Up Order Sparks Protests* (retrieved December 27, 2022 from https://www.euronews.com/2022/09/21/russian-protesters-take-to-the-streets-over-putins-mobilisation-order).

Feldstein, S. (2021), *Digital Technology's Evolving Role in politics, protest and Repression*, United States Institute of Peace (retrieved December 27, 2022 from https://www.usip.org/publications/2021/07/digital-technologys-evolving-role-politics-protest-and-repression).

Feldstein, S. (2021), The Rise of Digital Repression: How Technology is Reshaping Power, Politics, and Resistance, US: Oxford University Press.

Feldstein, S. (2022), Government Internet Shutdowns Are Changing. How Should Citizens and Democracies Respond. *Carnegie Papers* (retrieved December 27, 2022 from https://carnegieendowment.org/2022/03/31/government-internet-shutdowns-are-changing.-how-should-citizens-and-democracies-respond-pub-86687).

Frantz E., Kendall-Taylor, A., and Wright, J. (2020), *Digital Repression in Autocracies*, V-Dem Institute, Working Papers 27 (retrieved December 27, 2022 from https://www.v-dem.net/media/publications/digital-repression17mar.pdf).

Freedom House (2022), *Freedom on the Net 2022: Countering an Authoritarian Overhaul of the Internet* (retrieved December 27, 2022 from https://freedomhouse.org/report/freedom-net/2022/countering-authoritarian-overhaul-internet).

Funk, A. (2022), *Digital Repression is Deepening, But Civil Society Wins Give Reason for Optimism*, Freedom House articles (retrieved December 27, 2022 from https://freedomhouse.org/article/digital-repression-deepening-civil-society-wins-give-reason-optimism).

Glowacka, D., Youngs, R., Pintea, A., Wołosik, E. (2021), Digital Technologies as a Means of Repression and Social Control, *EU Papers* (retrieved December 27, 2022 from https://www.europarl.europa.eu/RegData/etudes/STUD/2021/653636/EXPO_STU(2021)6536 36_EN.pdf)

HRW (2022), *Russia Criminalizes Independent War Reporting, Anti-War Protests* (retrieved December 27, 2022 from https://www.hrw.org/news/2022/03/07/russia-criminalizes-independent-war-reporting-anti-war-protests).

Human Rights Council (2012), *Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development* (retrieved December 27, 2022 from https://documents-dds-ny.un.org/doc/UNDOC/LTD/G12/147/10/PDF /G1214710.pdf).

Human Rights Council (2022), *Internet shutdowns: trends, causes, legal implications and impacts on a range of human rights* (retrieved December 27, 2022 from https://www.ohchr.org/en/press-releases/2022/06/internet-shutdowns-un-report-details-dramatic-impact-peoples-lives-and-human).

Kendall-Taylor, A. Frantz, E., and Wright, J. (2020), The Digital Dictators: How Technology Strengthens Autocracy, *Foreign Affairs*, 99 (2), pp. 103-115.

Lamensch, M. (2021), *Authoritarianism Has Been Reinvented for the Digital Age*, Centre for International Governance Innovation (retrieved December 27, 2022 from https://www.cigionline.org/articles/authoritarianism-has-been-reinvented-for-the-digital-age/).

Liu, S., and Wang, D. (2021), Censorship: State Control of Expression, in: Valverde M., Clarke K., Darian-Smith E., Kotiswaran P. (eds.), *Routledge Handbook of Law and Society*, New York, NY: Routledge.

Morgus, R. (2019), The Spread of Russia's Digital Authoritarianism, in: Wright, N. D. (ed.), *AI, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives*, Washington, DC: United States Department of Defense.

Myanmar Now (2022), *Myanmar junta cuts off internet access 'indefinitely' to resistance stronghold of Sagaing* (retrieved December 27, 2022 from https://www.myanmar-now.org/en/news/myanmar-junta-cuts-off-internet-access-indefinitelyto-resistance-stronghold-of-sagaing).

New York Times (2022), *'They are Watching': Inside Russia's Vast Surveillance State* (retrieved December 27, 2022 from https://www.nytimes.com/interactive/2022/09/22/technology/russia-putin-surveillance-spying.html).

Polyakova, A. and Meserole Ch. (2019), Exporting digital authoritarianism: The Russian and Chinese models, *Brookings*, August 2019 (retrieved December 27, 2022 from https://www.brookings.edu/research/exporting-digital-authoritarianism/).

Radio Free Europe (2022), *Russian Government Orders Media Outlets to Delete Stories Referring to 'Invasion' Or 'Assault' On Ukraine* (retrieved December 27, 2022 from https://www.rferl.org/a/roskomnadzor-russia-delete-stories-invasion/31724838.html).

RFE/RL (2022), *Russian Media Watchdog Blocks Facebook after Limiting Access to Multiple Other Sites* (retrieved December 27, 2022 from https://www.rferl.org/a/russia-rferl-bbc-facebook-google-twitter-blocked/31735597.html).

Robbins, S., and Henschke, A. (2017), The Value of Transparency: Bulk Data and Authoritarianism. *Surveillance & Society*, 15(3–4), pp. 582–589.

Roberts, M. (2020), Resilience to Online Censorship, *Annual Review of Political Science*, 23, pp. 401-421.

RSF (2020), *RSF Unveils 20/2020 List of Press Freedom's Digital Predators* (retrieved December 27, 2022 from https://rsf.org/en/rsf-unveils-202020-list-press-freedom-s-digital-predators).

Russia Today (2022), 'Fake News' about Russian State Bodies Abroad Criminalized, *Russia Today* (retrieved December 27, 2022 from https://www.rt.com/russia/552481-lawmakers-criminalize-fake-news/).

Sherman, J. (2022), Russia's Internet Censor is Also a Surveillance Machine, *CFR Papers* (retrieved December 27, 2022 from https://www.cfr.org/blog/russias-internet-censor-also-surveillance-machine).

Soldatov, A. and Borogan, I. (2022), Russia's Surveillance State, *CEPA papers* (retrieved December 27, 2022 from https://cepa.org/article/russias-surveillance-state/).

Stoycheff, E., Burgess, S., and Martucci, M. C. (2018), Online Censorship and Digital Surveillance: The Relationship between Suppression Technologies and Democratization across Countries, *Information, Communication & Society*, 23 (4), pp. 1-17.

UN Office of the High Commissioner for Human Rights (2022), *Arrests in Russia at Protests Over Troop Mobilization* (retrieved December 27, 2022 from https://reliefweb.int/report/russian-federation/arrests-russia-protests-over-troop-mobilization).

Weidmann, N. and Dainotti, A. (2022), Attack or Block: Repertoires of Digital Censorship in Autocracies, *Journal of Information Technology & Politics*, 20(1), pp. 60-73.

Zayani, M. (2015), *Networked Publics and Digital Contention: The Politics of Everyday Life in Tunisia*, US: Oxford University Press.

The effects of the COVID-19 pandemic on real convergence of the European Monetary Union

Tudor-Mugurel AURSULESEI[*]

Abstract

The COVID-19 pandemic has placed the European Monetary Union (EMU) in front of a new economic reality. All the health restrictions enforced at the EU level had repercussions on the real convergence of the Eurozone. In the present article, we aimed to observe how real convergence in the Euro area was affected by the analysis of the main economic indicators extracted from the scientific literature. Furthermore, we created an aggregate index of real convergence to determine how it was affected during the pandemic period. We put all this analysis in the context of the effects arising as a result of the pandemic and the various measures implemented at the union level for economic recovery. In the proposed article, we conclude that following the pandemic period, EMU member states abandoned the real convergence criterion. The main policy recommendation emerges from this conclusion: the need for coordination at the EMU level regarding all economic and financial policies adopted.

Keywords: pandemic crisis, economic crisis, real convergence, euro zone

Introduction

One of the biggest and most complicated contemporary events, which had a significant impact on the world, was the COVID-19 pandemic. What we call today the global pandemic COVID-19 is the result of the global spread of the SARS-CoV-2 virus and the end of 2019, the beginning of 2020. One of the main areas where the pandemic made its presence feel was the economy. Our analysis focuses on the European Monetary Union, which faced new economic challenges generated by the various social distancing or isolation measures adopted at the EMU level or individually by each of the 19 member states (Ahmad *et al*., 2019).

Through this study we aim to analyse the effects of the COVID-19 pandemic on the EMU. We explore the various fiscal and monetary policy measures adopted at the union level to mitigate the effects of the crisis as well as the impact on real convergence.

As the pandemic spread worldwide and an increasing number of restrictions began to appear in society, its effects began to become more pronounced (Goniewicz, 2020). Social distancing measures

---

[*] Tudor-Mugurel AURSULESEI is postdoctoral researcher and associate professor at Alexandru Ioan Cuza University of Iasi, Romania, e-mail: aursulesei.tudor.mugurel@gmail.com.

and the limitations of various economic activities have brought about effects, such as the interruption of supply chains or the closure of some economic sectors. The labour market was also affected, thus generating a new type of shock in the EMU. In response, governments and monetary authorities have taken swift and innovative measures to support the business environment, jobs and financial stability (Marti, 2021).

Although the consequences are complex and still unfolding, this scientific analysis aims to provide a deeper understanding of how the pandemic has shaped and continues to shape the Eurozone economy, thereby contributing to the foundation of more informed decision-making and more effective policies in the future.

The purpose of this scientific article is to analyse how real convergence in the European Monetary Union was influenced during the Covid-19 crisis. Furthermore, we aim to observe the effects of the crisis on the economy and the measures have been implemented to reduce the negative effects. As a novelty, the proposed study, in addition to the separate analysis of each indicator of real convergence and the effects produced on the economy, aims to create an aggregate index of real convergence and put it in the context of the pandemic crisis. To create the aggregate index of real convergence, we use data on the most important indicators of real convergence: GDP per capita, unemployment rate, trade openness and price index (Aursulesei, 2023).

1. Real convergence - literature review

This section aims to clarify the meaning of real economic convergence. Real convergence implies a reduction in structural disparities that can influence competitiveness and competition in respective economies. These criteria complement the provisions of the Maastricht Treaty, which stipulate nominal convergence criteria. Although it is not a mandatory requirement for joining the euro zone, it is desired that they are met, because they reflect the real situation of national economies. The purpose of real convergence is to promote economic development so that the states wishing to join the union reach the economic level of member states. In addition, after joining the European Monetary Union, the aim is to synchronize the economic cycles of the member states because significant differences in growth can lead to major imbalances within the union.

The theory of optimal monetary areas suggests that, as long as the economic cycles of the member countries do not synchronize with those of their partners, the abandonment of autonomous monetary policy may have negative economic effects (Boješteanu and Manu, 2011, p. 31). Thus, a crucial condition for joining a monetary union is that business cycles are aligned between member countries (Mongelli, 2002, pp. 31-33). If there is no synchronization of economic cycles within the

monetary union, common monetary policy may affect member states differently, increasing the risk of misunderstandings between states when making monetary policy. Each state will want to promote its own economic agenda, which may not coincide with the vision of other states on the subject (Artis, 2003, pp. 10-12).

However, the scientific literature in the field of the theory of optimal monetary areas offers solutions for protecting national economies in the event of the occurrence of asymmetric shocks as a result of the abandonment of autonomous monetary policy. These protection criteria, the criteria of real convergence, include aspects such as the mobility of production factors (Mundell, 1961, p. 660), international economic openness (McKinnon, 1963, p. 723), diversification of national production (Kenen, 1969, p. 57), financial integration (Ingram, 1973, pp. 6-8), inflation similar to that of other member states (Fleming, 1971, p. 480), wage flexibility and political commitment (Dyson, 2000, pp. 203-209).

The scientific literature emphasizes that the countries that adapt best to abandoning their own monetary policy in favour of the common one are those whose incomes and prices are closely correlated with the other states in the union (Alesina, *et al.*, 2002, p. 9). However, it has been observed that the Euro area is not characterized by similar developments in the economic cycles of member states (Acedo Montoya and De Haan, 2009, p. 2012). If we follow the evolution of the EMU from its establishment to the present, we can see that there are gaps between states in terms of the onset of economic or financial crises, as well as the time of recovery from the crises. We can mention here the different crises that different member states went through, such as: Greece, Ireland, Portugal or Italy; crises that were less felt by other members (Aursulesei, 2021).

The recent crises experienced in the euro area, whether they were of a financial nature or specific to the area itself, have shown that the member states of the monetary union have not registered a real sustainable convergence, because the politician at the national level will always put his own interest first, leaving the "common good" of the union on the back burner. For political decision makers, it is more important to adopt measures that will please the national electorate, even if these decisions can affect the steps taken up to that point in the path of economic convergence (Dăianu, *et al.*, 2017, p. 50).

The effects felt by the member states following various crises, as well as the lack of decision-making unity, can be observed by analysing real convergence. In order to deepen the problem of real convergence at the EMU level, we have identified in the specialized literature 4 indicators that are the most representative in the study of real convergence: trade openness (Mundell, 1961; McKinnon, 1963; Kindleberger, 1971); unemployment rate (Mundell, 1961; Davies, 2011; Sensier *et al.*, 2016);

GDP per capita (Davies, 2011; Kaitila, 2013) and price index (Mundell, 1961; Fleming, 1971; Williamson, 1974).

2. Measures adopted at the level of the European Monetary Union in the context of the COVID-19 pandemic

During the COVID-19 pandemic, the member states of the European Monetary Union adopted a series of measures to be able to protect the national economy from the harmful effects of the crisis. There was no full synchronization of all the measures adopted. Some measures were taken at the European institution level, but many decisions were made at the national level. Thus, from the start, we cannot discuss a priority in terms of economic convergence as a result of the implementation of these measures. Following the analysis of the economic measures implemented at the European level during the COVID-19 crisis, we extracted a series of decisions that had a more significant influence on economies.

The first measure taken at the European Monetary Union level was the emergency procurement program in the context of the pandemic (PEPP) of the European Central Bank. In March 2020, the European Central Bank launched this program with the aim of maintaining market stability and keeping under control favourable financing conditions for both governments and the population. More specifically, bonds, both sovereign and corporate, were purchased through this program to reduce borrowing costs, while simultaneously encouraging lending (Grund, 2020).

States have also taken several fiscal measures at the national level. Thus, each state decided to adopt some fiscal incentive packages to stimulate the economy. The adopted packages had a diverse component, such as: measures to support companies affected by the various restrictions, compensation for employees affected by the sanitary measures adopted, or various other types of social aid to support the population affected by the various restrictions.

Another joint measure was the creation of the European Union Recovery and Resilience Fund. This financial package agreed in July 2020 had a value of 750 billion euros (Vanhercke, 2023). The purpose of the fund was to support reforms and investments in the European Union, especially in states affected by the pandemic. This package aims to strengthen resilience and accelerate economic recovery. These funds were accompanied in the euro area by loans granted through the European Stability Mechanism. Thus, the member states of the European Monetary Union were able to obtain emergency loans of up to 2% of GDP to finance various expenses associated with the COVID-19 crisis.

Moreover, to support member states, the European Commission and European Council applied temporary measures that allowed member states to exceed certain budget deficits and public debt

limits. Thus, derogation from the fiscal discipline of the union and the Stability and Growth Pact appeared (Corti, 2023). Countries that have been affected more by the pandemic have received increased aid from the European Commission. The main criteria in this discrimination were the vulnerability of the health system and degree of economic development.

These are only part of the measures adopted at the European level with the aim of reducing the negative effects of the COVID-19 pandemic on the economy. From the study of the measures adopted both at the level of the entire euro zone, but also at the individual level of each state, we expect to observe an influence on real convergence as well. For this reason, the main hypothesis from which we start in this article emerges: all the measures adopted at the Eurozone level as a result of the pandemic crisis have led to a decrease in the real convergence between the member states. In what follows, we propose to analyse the evolution of real convergence in the European Monetary Union during this pandemic crisis.

2.1. The economic effects of the COVID-19 pandemic

The Covid-19 pandemic has had a significant impact on the entire world map. This epidemic spread rapidly worldwide and had effects not only on the sanitary level, but also on the social or economic level. In the present research we have chosen to focus on the economic effects of the pandemic on the economy of the European Monetary Union. Looking back at all the measures implemented by the member states, but also by the institutions of the European Union, we can delineate several effects that were also felt in the economy (Aursulesei, 2023).

One such economic effect is the occurrence of an economic recession. The health crisis has created an unprecedented situation in recent history, namely the closure of key sectors of the economy. The most affected sectors were by far that of: tourism, hotels, restaurants or the organization of events. Considering that among the members of the European Monetary Union, we find that states have the tourism industry as their main activity sector, their receipts to the state budget have decreased significantly (Pavaluc *et al.*, 2020). Furthermore, the limitations imposed on businesses in affected areas have led to supply chain problems. The closure of factories has led to delays in the delivery and supply chains, thus affecting the production of goods and services. This pronounced decrease in the demand for tourism services and events during the pandemic was also reflected in the economic statistics of the union which triggered a period of economic recession (Ahmad *et al.*, 2019).

At the level of the European Union, there was also talk of an increase in unemployment as a

result of the decisions implemented during the pandemic. Because of the isolation measures and various restrictions imposed, people were laid off during this period. The most affected were temporary workers and those in closed sectors of the economy. Many states have resorted to the term technical unemployment, a form of unemployment that did not necessarily mean a different dismissal of employees, but rather a suspension of employment contracts during the period when the restrictions imposed by governments were in force (Akbulaev *et al*., 2020).

The social distancing measures imposed by governments have led to an increase in government spending (Tiliuță and Diaconu, 2020). States had to allocate significant amounts of money to support the health system, to grant various social aids to people affected by the government measures implemented, or to support companies affected by the situation in society. Support for companies came through the allocation of various grants and loans to overcome the crisis situation or through the implementation of various fiscal policies to stimulate business (Marti and Puertas, 2021). All of these budget allocations led to an increase in the budget deficit and public debt. The states had to turn to different lines of financing to be able to cover these unforeseen expenses.

It is true that among all these negative effects, we can also identify effects with a beneficial character to society. First, the most important benefit of this crisis period was the forced acceleration of digitization (Cone *et al*., 2022). Both the state and private companies had to accelerate efforts to implement new technologies in the economy, in order to be able to maintain that important social distance during such a pandemic (Pinzaru *et al*., 2020).

Another effect that we could pass to the category of positive effects, but equal to that of negative effects, is the change in consumer preferences. Starting from the emergence of new technologies in the economy, consumers have learned that there are new work opportunities, new methods of satisfying needs or new typologies of products and services (Goniewicz *et al*., 2020). All these changes are also reflected on different economic indicators.

Finally, we must emphasize that governmental measures, as well as the economic effects of the pandemic, were different from one state to another. Even if we are discussing a union in our case, the measures were not necessarily coordinated at the level of the entire community block. There are several common measures, but many of them have been taken individually at the state level (Casquilho-Martins *et al*., 2022). Starting from this non-unitary policy at the European level, it is opportune to analyse how the economic convergence of the EMU has been affected. Has it been brought to the front or has it been abandoned to meet the monetary needs of each member state?

3. Methodology

To design the methodology of this article, we selected a total of 19 member states of the European Monetary Union (we excluded Croatia, which only joined the euro zone on January 1, 2023). In the analysis of these states, we selected statistical data from the Eurostat database, for the period 2011-2022. The reason why we started our analysis from the year 2011 is not to interfere with the data due to the financial crisis of the year 2007. We consider that the year 2011 marks for most member states the end of the world financial crisis and the start of a period of economic growth. In the selection of the relevant indicators for our analysis, we selected from the scientific literature the 4 indicators most used in the study of real convergence. Thus, in our research, we used the following indicators: GDP per capita, unemployment rate, trade openness and price index.

Table 1. Real convergence indicators

Indicator	Indicator's description	Indicator's relevance	References
GDP per capita	Current prices, euro per capita. Gross Domestic Product (GDP) per capita shows a country's GDP divided by its total population.	Real convergence aims at economic development, the states that want to join to reach the economic level of the Member States. The amplitude of Member States' business cycles is being monitored, as major differences in growth between them can lead to major discrepancies and the imbalance of the Union. Other indicators (excluding nominal convergence indicators) are targeted at real convergence, in particular macroeconomic indicators: price level, GDP per capita, unemployment level, level of imports and exports.	Davies (2011); Kaitila (2013).
Unemployment rate	Percentage of population in the labor force; aged 15 to 74 years (16 to 74 years in Estonia and Italy) unemployed during the reference week, had actively sought work during the past four weeks and were available to begin working immediately or within two weeks.		Mundell (1961); Davies (2011); Sensier *et al.* (2016).
Price index	Index 2015=100 The Harmonized Index of Consumer Prices (HICP) gives comparable measures of inflation for the countries and country groups. It measures the change over time of the prices of consumer goods and services acquired by households.		Mundell (1961); Fleming (1971); Williamson (1974).
Trade openness	Exports plus imports as percent of GDP		Mundell (1961); McKinnon (1963); Kindleberger (1971).

Source: Developed by authors based on the research in May 2023

We considered it appropriate in the analysis to also use an index of real convergence, starting from the 4 selected indicators. For each variable that is a component of the real convergence index, the yearly EU average is computed. For each country, the difference between the value of a variable and its EU average, for each year, was calculated. These differences were further considered when calculating the aggregated index of the real convergence. To create this index, we started with the methodology proposed by Nardo *et al*. (2008). The aggregate index of true convergence is a weighted average of the loading scores of the principal components extracted by applying Panel Principal Components analysis. In other words, we calculate the weights for each indicator using the squared loadings in the variance explained by each component.

$$I_i = \frac{1}{v}\sum_{j=1}^{v} x_{ij}\, w_j$$

$$w_j = \sum_{m=1}^{M}\left[\frac{Explained\ variance_m\left(loading_{j,m}\right)^2}{\sum_{l=1}^{M} Explained\ variance_l \sum_{n=1}^{v}\left(loading_{n,m}\right)^2}\right]$$

Where:

M - is the number of selected components and the load

j,m- is the loading score of variable j for component m and is zero when the variable does not contribute to the formation of the component. The criterion considered for selecting the number of components, M, is that its eigenvalues are greater than 1.

After calculating the weights, we obtained the following results, which we use in the calculation of the aggregate index of real convergence for each member state of the European Monetary Union.

Table 2. Variables' weights for the real convergence index

Variable	Weights
GDP per capita	0.4349
Unemployment rate	0.1170
Price index	0.0163
Trade openness	0.4316

Source: Developed by authors based on the research in May 2023

After the weights were calculated, the variables were normalized using the min-max method, as follows:

$$x_{norm_i} = \frac{x_i - x_{min}}{x_{max} - x_{min}}$$

for variables in which small values indicated low performance, and

$$x_{norm_i} = \frac{x_i - x_{max}}{x_{min} - x_{max}}$$

for the variables for which small values indicate high performance.

Using the normalized variables, the final indexes will take values in the [0, 1] interval. We can continue the analysis by normalizing the results obtained, in order to be able to group the member states of the euro zone into different clusters according to their resilience in the face of the pandemic crisis. However, this stage will be part of a future study. In this article, we summarize the calculation of an aggregate indicator of real convergence and its application to the average of the indicators of the euro area.

4. The evolution of real convergence indicators in the context of the COVID-19 pandemic

In what follows, we propose to observe how the main indicators of real convergence behave during a pandemic crisis. Our goal is to identify if during that period we observe a contraction of the economy and then to see if the analysed indicator returns to an upward trend.

Figure 1. Exports of goods and services in % of GDP - Euro area - 19 countries
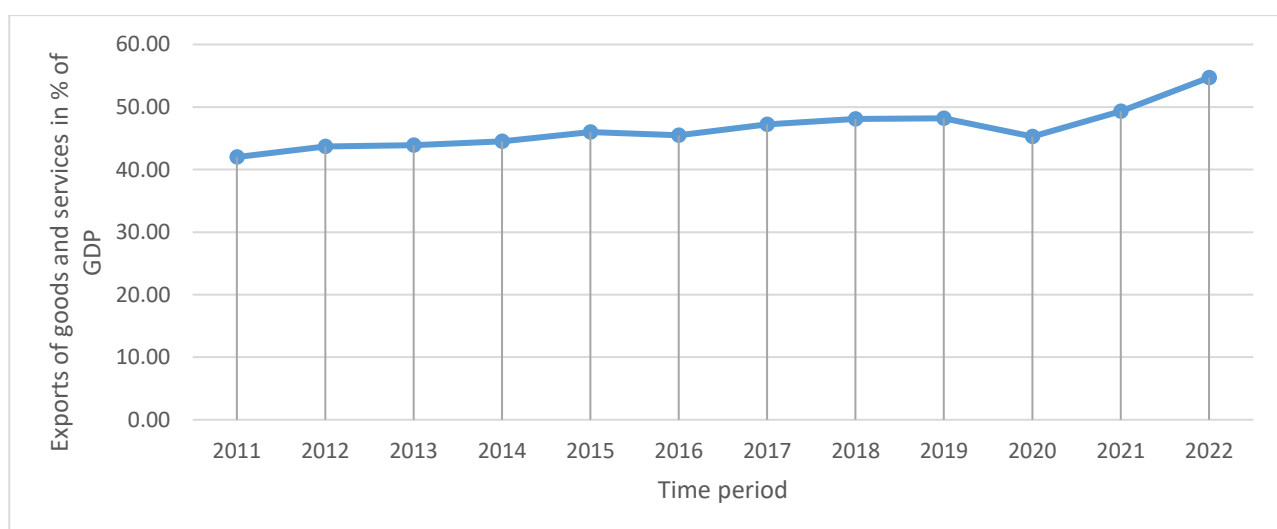
Source: Developed by authors based on the research in May 2023

The first indicator analysed is the export of goods and services as % of GDP. As we can see, the period 2011 – 2019 captures an upward trend of this indicator. Growth is suddenly interrupted in 2020, the year that coincides with the onset of the COVID-19 pandemic and the main restrictions adopted at the European level. Thus, the year 2020 records an export value of only 40.3% of GDP. We can see that later, in the years 2021 and 2022, exports return to an upward trend, one that is even more pronounced compared to the period before the crisis.

Figure 2. Imports of goods and services in % of GDP - Euro area - 19 countries
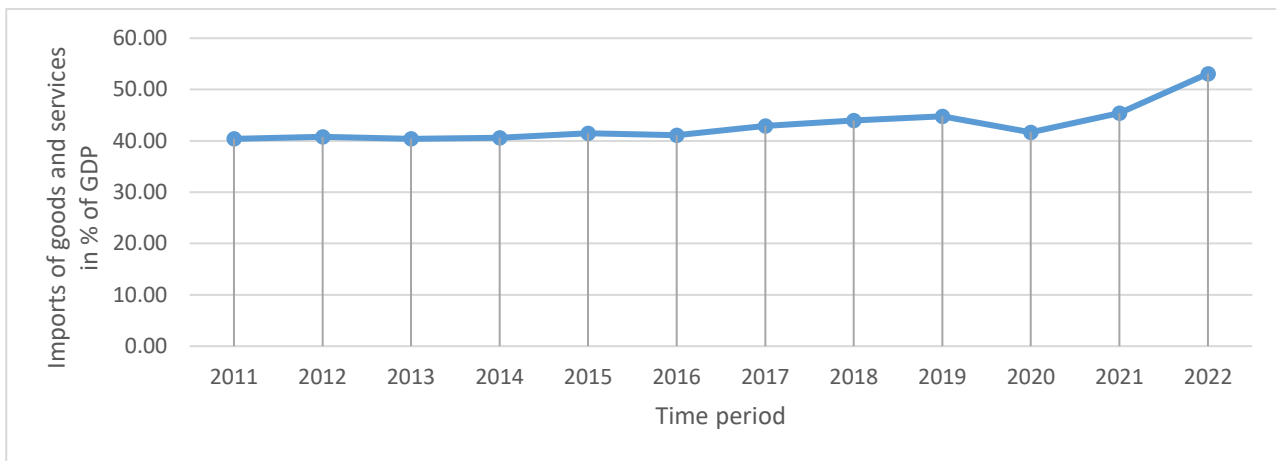
Source: Developed by authors based on the research in May 2023

Regarding imports, we can observe that in the period 2011-2016 the trend is relatively constant. From 2016 to 2019, the trend is upward, and the crisis period is marked by a decrease in imports to a value of 41.7% of GDP. After this period, the trend becomes upward again.

Figure 3. Trade openness - Euro area - 19 countries
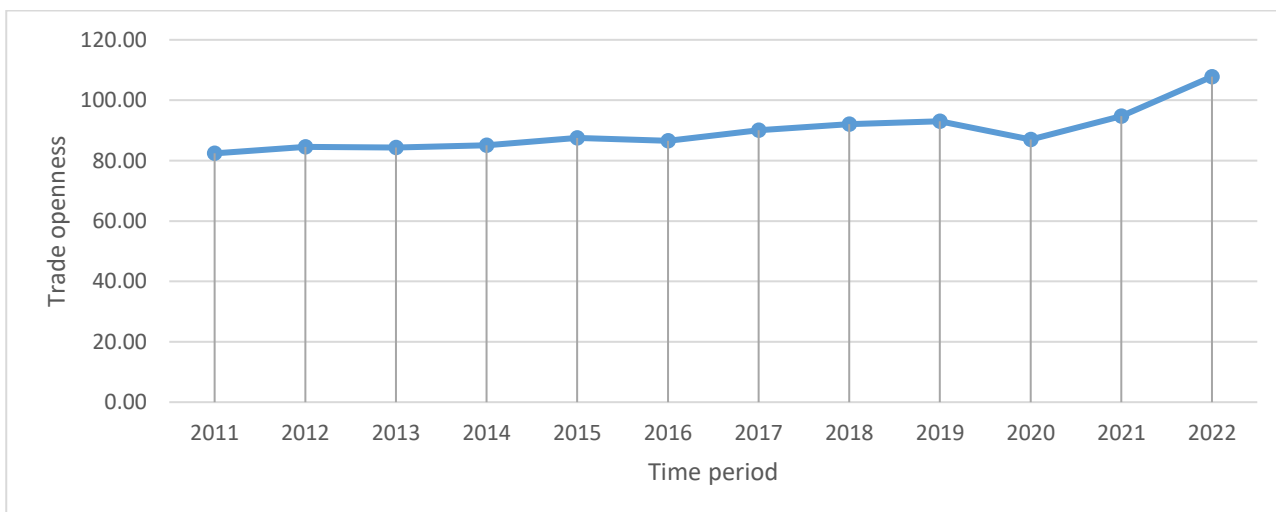
Source: Developed by authors based on the research in May 2023

If we observed how imports and exports evolved at the level of the European Union, we considered it appropriate to observe the overall evolution of trade openness. Therefore, the period 2011 – 2019 is marked by an upward trend of this indicator. The year 2020 stands out due to the decrease in economic openness to a value of 87% of GDP. The period of negative effects of the pandemic crisis was quickly overcome, the 2021-2022 period brought this indicator back on an upward trend, a much more pronounced one.

Figure 4. Real GDP per capita - Euro area - 19 countries
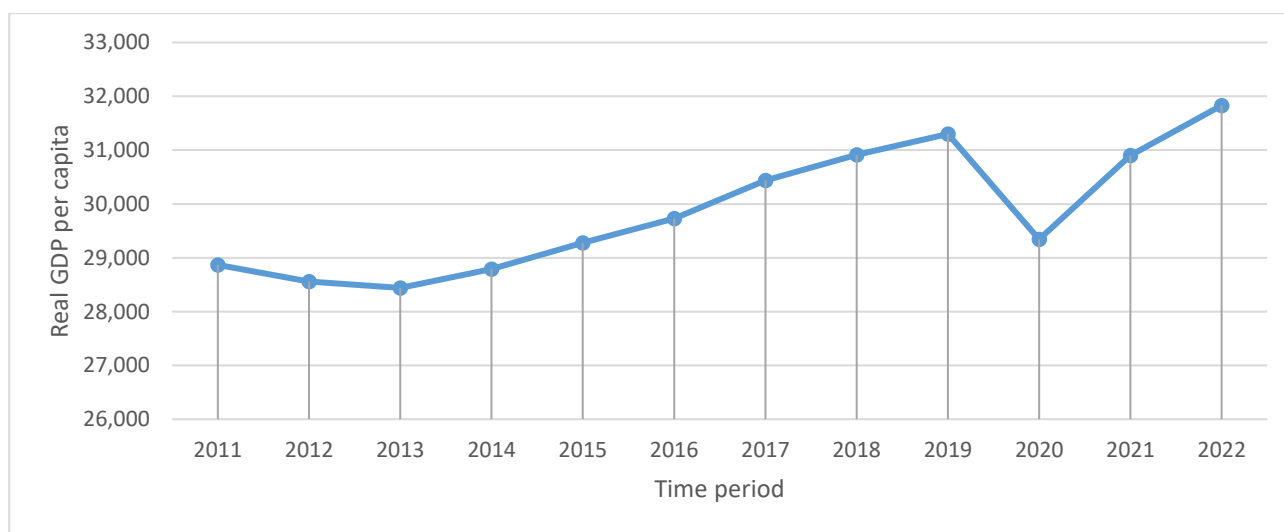
Source: Developed by authors based on the research in May 2023

The next indicator analysed is real GDP per capita. As we can see from figure no. 4, this indicator best presents the depth of the pandemic crisis in 2020. We can observe a decrease in the value of the indicator in the period 2011-2013, followed by a sustained increase until 2019, when the value of GDP per capita was 31,300 euros. The year 2020 brings a sudden drop in GDP per capita, up to a value of 29,340 euros. Again, we can see how from 2021, the value of the indicator re-enters an upward trend.

From figure number 5, we can see a somewhat surprising evolution of the unemployment rate at the level of the European Monetary Union. Starting from 2013, until 2019 the value of the unemployment rate is downward, reaching a value of 4.9%. As we anticipated, the year 2020 marks an increase in the unemployment rate, but not as much as expected. The increase was relatively small. This year, the unemployment rate reached a value of 5.1%. Again, after 2020, a return of the indicator to the normal trend can be observed.

Figure 5. Total unemployment rate - Euro area - 19 countries
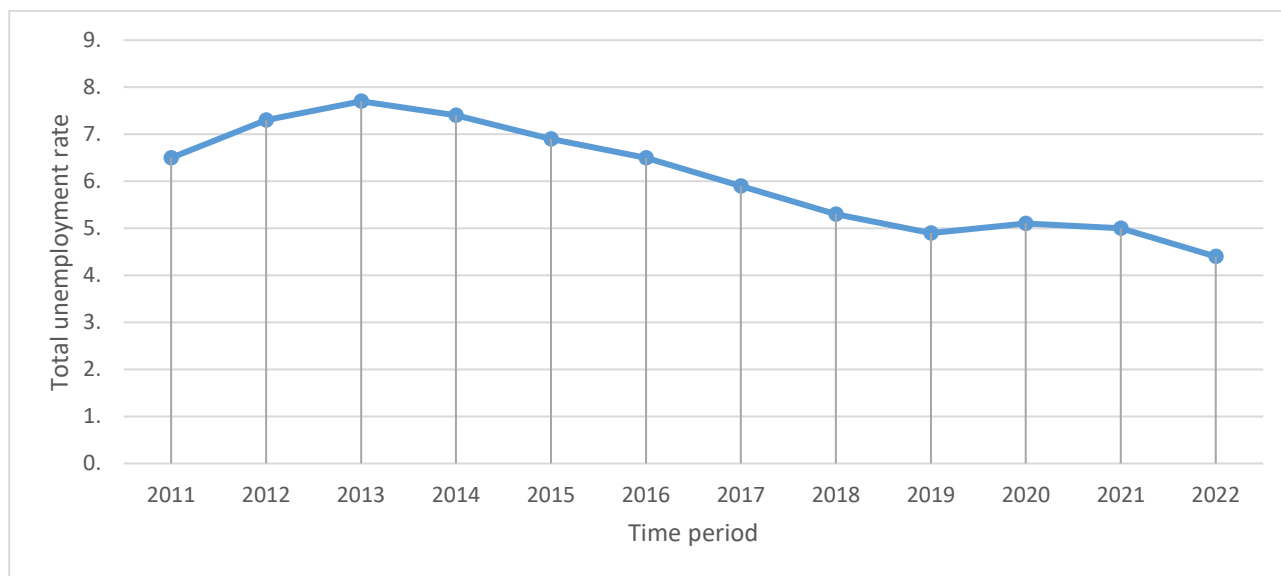
Source: Developed by authors based on the research in May 2023

It is surprising to note that the period of the pandemic brings an increase in the unemployment rate at the level of the European Monetary Union of only 0.2 percentage points. From this we can deduce that the peak period of the pandemic crisis was not accompanied by real unemployment. Even though many economic activities were suspended during that period, we did not face a mass layoff of employees, but rather a suspension of employment contracts, that technical unemployment. With the reopening of the economy and the relaxation of restrictions, much of the economic activities have been reopened and employees have resumed their activities.

Figure 6. Harmonised index of consumer price (index: 2015 = 100) (HICP) - annual data - Euro area - 19 countries
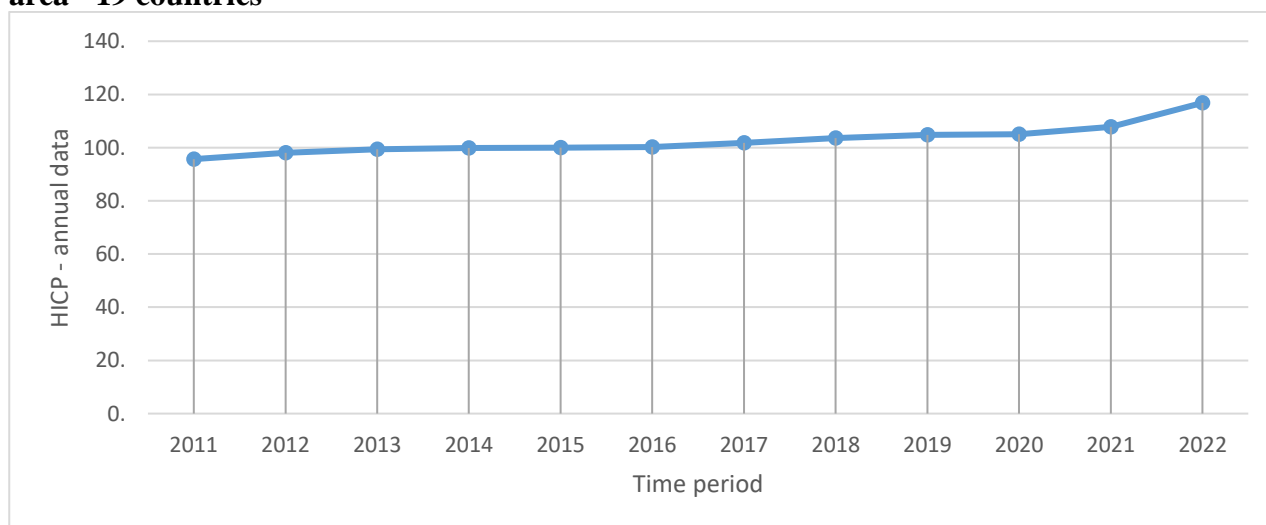
Source: Developed by authors based on the research in May 2023

The last indicator analysed is the price index. As we can see, throughout the analysed period the trend of this indicator was an upward one. The year 2020 brings only a very slight slowdown in growth.

Our research continues by calculating the value of the aggregate index of nominal convergence for the average of the European Monetary Union in the analysed period.

Table 3. The average of the real convergence indicators in the Euro Area – 19 countries

Time	Trade openness	GDP per capita	Unemployment rate	Price index
2011	82.4	28.870	6.5	95.67
2012	84.5	28.560	7.3	98.06
2013	84.3	28.440	7.7	99.38
2014	85.1	28.790	7.4	99.81
2015	87.5	29.280	6.9	100.00
2016	86.6	29.730	6.5	100.23
2017	90.1	30.440	5.9	101.78
2018	92.1	30.910	5.3	103.56
2019	93	31.300	4.9	104.80
2020	87	29.340	5.1	105.06
2021	94.7	30.900	5.0	107.78
2022	107.8	31.830	4.4	116.82

Source: Developed by authors based on the research in May 2023

Table 4. Aggregate index of real convergence and standard deviation for the Eurozone

TIME	2011	2012	2013	2014	2015	2016
Real convergence index	0.248498	0.242408	0.237899	0.243098	0.2528	0.257214
Standard deviation	0.165131	0.168703	0.170078	0.171517	0.17773	0.17885
TIME	2017	2018	2019	2020	2021	2022
Real convergence index	0.269878	0.27914	0.285174	0.264525	0.283228	0.306864
Standard deviation	0.176898	0.17658	0.183172	0.1861	0.187763	0.184329

Source: Developed by authors based on the research in September 2023

In table 4 we calculated the aggregate index of real convergence for the average values in the euro area. Therefore, we applied the weight of the variables resulting from the formula proposed by Nardo *et al*. (2008) and present in the OECD guide for building composite indexes, on the average value of each indicator at the level of the entire EMU. This article only aims to analyse the evolution of this index in the context of the COVID-19 pandemic.

Figure 7. Real convergence index - Euro area (19 members) average
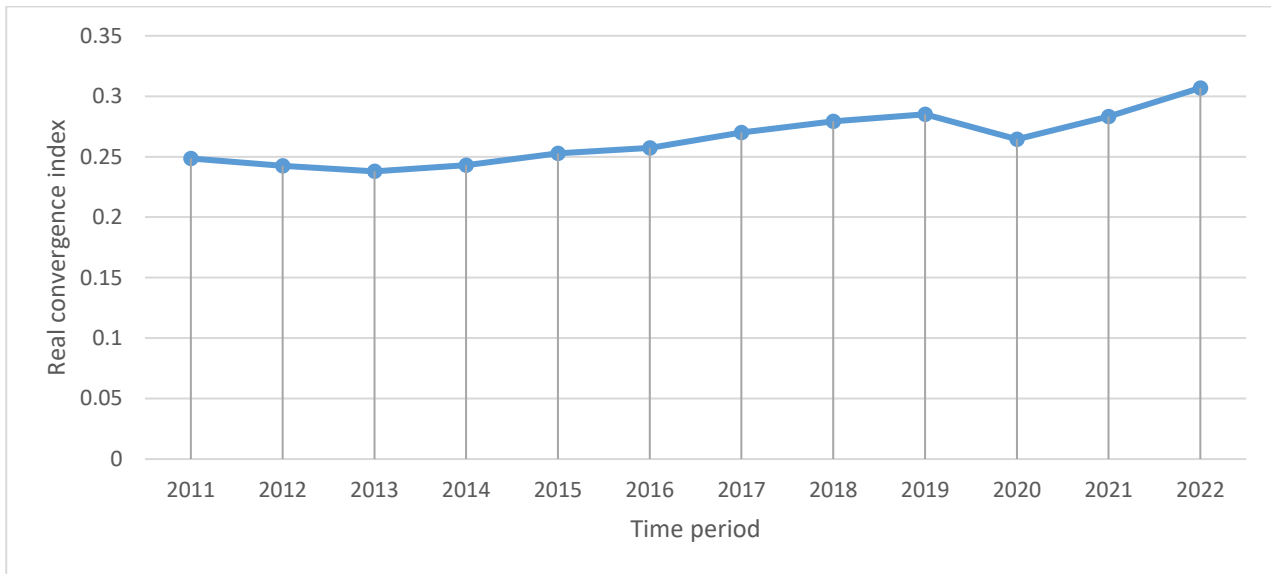
Source: Developed by authors based on the research in May 2023

Based on the values of the aggregate index of real convergence, from table no. 4, we built figure number 7 to be able to graphically visualize how this index evolved during the analysed period. The period 2011 – 2013 reveals a decrease in the value of the index at the level of the European Monetary Union, while the period 2013 – 2019 marks an increase in this index. As we anticipated, the year 2020 brings a decrease in the value of the aggregate real convergence index. Therefore, social distancing measures and various restrictions adopted at the level of the member states of the euro zone also affected the value of this index.

Figure 8. Evolution of real convergence in Eurozone (standard deviation of real convergence index)
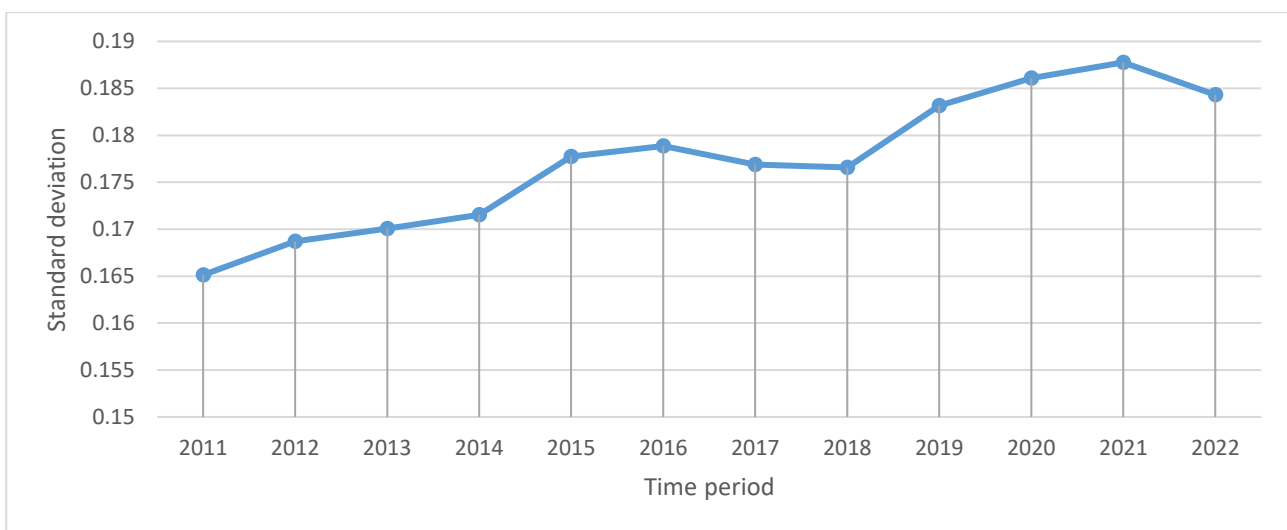
Source: Developed by authors based on the research in September 2023

For better relevance regarding the evolution of real convergence at the level of the Eurozone, we calculated the standard deviation of the aggregate index of real convergence between states, for each year of the analysed period. The higher the value of the standard deviation, the greater the disparities between the states, so we are moving away from a convergence of the economies of the member states. As we can see from table number 4, the general trend at the level of the euro zone is rather an increase in the disparity between economies. Only the period 2016-2018 and the year 2022 bring an increase in real convergence at the level of the euro zone. We can see that the moment of the pandemic crisis is on a trend of increasing disparity, so the measures adopted by each individual member state have led to an increase in them. There has not been full coordination among members to limit the effects of the pandemic in a way that does not affect the real convergence of national economies.

Conclusions

Following the analysis undertaken, we reached a series of conclusions, which can create an overview of what the influence of the COVID-19 pandemic meant on the economy of the European Monetary Union. These conclusions can be the basis of future scientific research and at the same time can be a benchmark for political decision-makers both at the central European level and at the national level of the member states or in the process of accession.

First of all, we could observe that the COVID-19 pandemic had a multitude of effects on the economy at the level of the European Monetary Union. Starting from the closure of economic sectors to rethinking the way of doing business. The effects were felt by all member states of the euro area. It is true that some felt these effects more strongly, others that had an economy much more anchored in reality faced a smaller shock.

Following the analysis of the main representative indicators for real convergence, we could observe that trade openness (where we included both imports and exports as a percentage of GDP) and GDP per capita had the most drastic decreases during the peak period of the pandemic. The effects of the pandemic were also seen in the analysis of the unemployment rate. We could observe how in the year 2020, unemployment had an upward trend. However, we were faced with an interesting situation. The increase in the unemployment rate in 2020 was not of the caliber we expected. On the other hand, we could observe that the price index was not affected by the crisis, registering only a small decrease in the growth trend.

Following the creation of the aggregate index of real convergence, starting from the scientific

literature, we were able to draw several conclusions. First of all, GDP per capita and economic openness have the greatest weight in the composition of the index. Calculating the value of the index in the analysed period for the average of the European Monetary Union, we could see how there is a tendency towards a real convergence of the member states most of the time. However, in 2020, the value of the aggregate real convergence index registered a noticeable decrease. Regarding real convergence, we could observe that at the level of the euro zone, there is a trend of increasing disparity. Even during the pandemic crisis, the implemented measures failed to stop this trend, but rather accentuated it.

A final conclusion concerns the measures adopted both at the central level by the European Monetary Union and at the level of each member state. I could see that there was some unity in the implementation of the measures. The European Monetary Union and the European Union tried to create as many levers of support as possible for the European states. We can deduce that the measures helped to keep the unemployment rate under control, but also the short period (of only one year) of the decrease in the value of the real convergence indicators.

This scientific article provides new research opportunities for us. We propose to continue the study through an analysis of the economic effects of the COVID-19 crisis of each member state. Moreover, we want to see if we could group the member states into different clusters in terms of the intensity of the effects felt and at the same time if we can identify a series of adopted measures that had a greater influence in the economic recovery.

References

Acedo Montoya, L., De Haan, J. (2009), Regional business cycle synchronization in Europe?, *International Economics and Economic Policy,* 29, no. 4, pp. 2996-3014.

Ahmad, T., Haroon, Baig, M., and Hui, J. (2020). Coronavirus Disease 2019 (COVID-19) Pandemic and Economic Impact, *Pakistan journal of medical sciences*, 36(COVID19-S4), pp. S73–S78. https://doi.org/10.12669/pjms.36.COVID19-S4.2638.

Akbulaev, N. and Mammadov, I. and Aliyev, V. (2020), Economic Impact of COVID-19, *SYLWAN*, 164(5). http://dx.doi.org/10.2139/ssrn.3649813

Alesina, A., Barro, R. J., and Tenreyro, S. (2002), Optimal Currency Areas, *Discussion Paper*, Issue 1958.

Alexa, O. A. (2021), Students' perception of online education during the COVID-19 pandemic, *CES Working Papers,* XIII(3), pp. 306-318.

Artis, M. J. (2003), Is there a European business cycle?, *CESifo Working Paper 1053*. doi: 10.2139/ssrn.462424.

Aursulesei, T. M. (2018), The sustainability of Romania's accession to the Euro Area – A political project anchored in economic reality, *CES Working Papers*, X(4), pp. 480-490.

Aursulesei, T. M. (2021), *Zona euro, zonă monetară optimă?,* Editura Economică, București, ISBN: 978-973-709-981-5.

Aursulesei, T. M. (2023), The influence of the COVID-19 pandemic crisis on the real convergence of the member states of the European Monetary Union, *Junior Scientific Researcher*, IX(1-2), pp. 1-10.

Bojeșteanu, E., and Manu, A. S. (2011), Empirical analysis of business cycle synchronization an shock similarity between Romania and the euro zone, *Munich Personal RePEc Archive,* 31295, pp. 1-49.

Casquilho-Martins, I., and Belchior-Rocha, H. (2022), Responses to COVID-19 Social and Economic Impacts: A Comparative Analysis in Southern European Countries, *Social Sciences*, 11(2), pp. 36. https://doi.org/10.3390/socsci11020036.

Cone, L., Brøgger, K., Berghmans, M., Decuypere, M., Förschler, A., Grimaldi, E., Hartong, S., Hillman, T., Ideland, M., Landri, P., van de Oudeweetering, K., Player-Koro, C., Bergviken Rensfeldt, A., Rönnberg, L., Taglietti, D., and Vanermen, L. (2022), Pandemic Acceleration: Covid-19 and the emergency digitalization of European education, *European Educational Research Journal*, 21(5), pp. 845–868. https://doi.org/10.1177/14749041211041793.

Corti F., Vesan, P. (2023), From austerity-conditionality to a social inclusive post pandemic recovery: Social Europe after Next Generation EU, *Social Policy and Administration*, Epub ahead of print 20 February 2023. https://doi.org/10.1111/spol.12906.

Dăianu, D., Kallai, E., Mihailovici, G., Socol, A. (2017), *România şi aderarea la zona euro: întrebarea este ÎN CE CONDIŢII!,* Institutul European din România (Studii de strategii și politici SPOS 2016).

Davies, S. (2011), Regional resilience in the 2008-2010 downturn: comparative evidence from European countries, *Cambridge Journal of Regions, Economy and Society,* 4, pp. 369-382. doi: 10.1093/cjres/rsr019.

Diaconu (Maxim), L. (2021), The behaviour of airlines' passengers in the context of COVID-19 pandemic, *CES Working Papers*, XIII(2), pp. 230-242.

Dyson, K. (2000), *The Politics of the Euro-Zone, Stability or Breakdown?,* New York: Oxford University Press Inc.

Fleming, J. M. (1971), On Exchange Rate Unification, *The Economic Journal*, 81, pp. 467-488.

Goniewicz, K., Khorram-Manesh, A., Hertelendy, A., Goniewicz, M., Naylor, K., Burkle, Jr., F. (2020), Current Response and Management Decisions of the European Union to the COVID-19 Outbreak: A Review, *Sustainability*, 12(9), pp. 3838. https://doi.org/10.3390/su12093838.

Grund, S. (2020), Legal, Compliant and Suitable: The ECB's Pandemic Emergency Purchase Programme (PEPP), *YPFS Documents* (Series 1). 12427

Ingram, C. J. (1973), The Case for the European Monetary Integration, *Essays in International Finance* (Princeton University), no. 98.

Kaitila, V. (2013), Convergence, income distribution and the economic crisis in Europe, *The Research Institute of the Finnish Economy (ETLA) Working Papers 14*.

Kenen, P. (1969), The theory of optimum currency areas - An ecletic view, in: Mundell, A. and Swoboda, A. (Eds.) *Monetary problems of the international economy*, pp. 41-60. University of Chicago Press.

Kindleberger, C. (1971), Optimal Economic Interdependence, *North American and Western European Economic Politicies,* pp. 491-502.

Marti, L, Puertas, R. (2021), European countries' vulnerability to COVID-19: multicriteria decision-making techniques, *Economic Research-Ekonomska Istraživanja*, 34(1), pp. 3309-3320, doi: 10.1080/1331677X.2021.1874462.

McKinnon, R. (1963), Optimum currency areas, *The American Economic Review*, 53(4), pp. 717-725.

Mongelli, P. F. (2002), *New views on the optimum currency area theory: What is EMU telling us?*, ECB Working Paper 138 (retrieved from https://www.ecb.europa.eu// pub/pdf/scpwps/ecbwp138.pdf).

Mundell, R. (1961), A theory of optimum currency areas, *The American Economic Review*, 51(4), pp. 657-665.

Namani, A. (2021), The rebirth of Keynes during the COVID-19 pandemics – a theoretical approach, *CES Working Papers*, XIII(4), pp. 347-366.

Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., and Giovannini, E. (2008), *Handbook on constructing composite indicators. Methodology and user guide*, Paris: OECD Publishing.

Pavaluc (Melinte), C., Brinza, G., Anichiti, A., Butnaru, G.I. (2020), COVID-19 pandemic and its effects on the tourism sector, *CES Working Papers*, XII(2), pp. 111-122.

Pinzaru, F., Zbuchea, A., Anghel, L. (2020), The impact of COVID-19 pandemic on business a preliminary overview, *Strategica – Preparing for Tomorrow, Today*, International Academic Conference, eight edition, Bucharest, pp. 721-730

Sensier, M., Bristow, G., and Healy, A. (2016), Measuring regional economic resilience across Europe: operationalizing a complex concept, *Spatial Economic Analysis,* 11, 128-151. doi: 10.1080/17421772.2016.1129435.

Talmaciu, M., Manolescu, I. T. (2021), Enhancing competitiveness and resilience of tourism in crises condition. Experiences from Eastern Partnership countries, *CES Working Papers*, XIII(4), pp. 381-399.

Tiliuță, B. A., Diaconu, I. R. (2020), Coronavirus - The Moment for Helicopter Money?, *CES Working Papers*, XII(4), pp. 244-256.

Vanhercke, B., and Verdun, A., (2022), The European semester as goldilocks: Macroeconomic policy coordination and the recovery and resilience facility, *Journal of Common Market Studies*, 60(1), 204–223.

Williamson, O. (1974), The economics of antitrust: transaction cost considerations, *University of Pennsylvania Law Review, 122*(6), 1439-1496. doi: 10.2307/3311505.

The European Union's trade disputes. The case of energy sector

Stefan-Catalin TOPLICEANU[*]

Abstract

Although there are some issues and concerns about the World Trade Organization dispute settlement system, it remains an effective tool for countries to find reasonable solutions for their trading problems. This paper aims to identify the mechanisms of the settlement process between WTO members and to provide a relevant review of the European Union's trade disputes, in particular for energy sector cases. For this purpose, the paper implies a conceptual and descriptive framework and a qualitative approach regarding the EU's trade disputes, especially for energy sector. The results show that the EU is one of the most frequent members in trade disputes, but most of them are concluded. At the same time, most of the cases in the energy sector remain in the consultation phase, the EU being complained by Argentina, Indonesia, Russia, China and Malaysia for sectors related to biodiesel, renewable energy generation and oil palm-based biofuels.

Keywords: energy crisis, WTO dispute settlement, oil trade, Russian fuels, renewable energy

Introduction

The General Agreement on Tariffs and Trade (GATT) defines the rules of the world trade since its foundation in 1948, even if the World Trade Organization (WTO) succeeded it in 1995. The current dispute settlement system (known as Dispute Settlement Understanding and abbreviated-DSU) is an effective mechanism in order to achieve reconciliation between member states of the WTO in terms of trade. This system was established during the Uruguay Round of multilateral trade negotiations in order to prevent unresolved trade disputes and to reduce the imbalances between developed countries and developing ones. Generally, a trade dispute starts when one member adopts trade measures considered improper with WTO rules by one or more other members. Only the WTO member states can participate in the dispute settlement system either as parties or as third parties. There are three important players in the trade dispute settlement, namely the complainant, the respondent and the third party. The complainant is the country that initiates the consultations, while the respondent is the member that is called upon to consult on a trade dispute. A WTO member can be a third party to a trade dispute as long as it has a substantial trade interest in the case. In this situation, the third party may be present at the discussions on any mutually agreed solution if such an outcome affects its

---

[*] Stefan-Catalin TOPLICEANU is teaching assistant and postdoctoral researcher at Alexandru Ioan Cuza University, Iasi, Romania, e-mail: tstefan.catalin@yahoo.com.

interest. Even if companies, people or non-governmental organizations are the most affected by trade measures, they do not have access to this system. However, they can influence and request from a member state to start a dispute. The dispute settlement system is compulsory for each WTO member following the signing of the WTO accession agreement, while both parties involved in a trade dispute must accept any rulings taken because of the reconciliation process as binding (WTO Secretariat, 2017; Madhumitha, 2020).

Since 1995, WTO managed more than 615 trade disputes, while more than 110 members have been involved in dispute settlement as a major party or a third party. At the same time, more than 140 cases reached a mutually agreed solution or the complainant withdrawn the consultations request. On the other hand, when parties had been unable to reach a mutually agreed solution, a panel had been established, being the case of 316 disputes (almost 51% of all disputes initiated). This led to 202 panel reports adopted, whereas the number of Appellate Body reports adopted had exceeded 120 cases. In addition, between 2020 and 2023, the WTO members have initiated less than 10 trade disputes each year by requesting for consultation, whereas the annual average of mutually agreed solutions was four cases (WTO, 2023a).

The purpose of this article is to identify the mechanisms through which WTO manages the settlement process of trade disputes between member states and to provide a relevant review of the EU's trade disputes since WTO replaced GATT in 1995, in particular for energy sector cases.

Energy became an important and priority theme for the EU member states starting with the 1970s, more precisely because of the first oil crisis that happened between 1973 and 1974. Since there, the EU made great efforts and large progress, while the single market of the EU was able to provide energy access to all producers and customers. Moreover, the EU has a particular interest for a sustainable use of energy, while the energy supply remained one of the most urgent challenges, especially in times of war and uncertainty such as the Ukrainian war.

The energy crisis triggered in the EU by the war between Russia and Ukraine has the potential to generate multiple economic effects on European economies, especially in terms of energy supplies. The EU countries are facing a new challenge, designed to test their energy dependence on major external energy suppliers and the vulnerability of their trade relations with these suppliers. In this respect, the EU is making continuous efforts and has made great progress in energy access and sustainable energy use.

The paper structure is as follows. The next section presents the literature review regarding the positive impact of the WTO, the main problems of the dispute settlement, possible alternatives, and other studies related to the EU trade disputes. The second section provides a conceptual and

descriptive framework framework regarding the dispute settlement process. The last two parts focus on the EU's trade disputes so far and, in particular, on energy sector. Finally, the conclusions are presented.

1. Literature review

The WTO's positive impact on trade is well known, considering the successfully reduced tariffs and trade barriers, promoting multilateralism and market competition, the reconciliation of trade disputes, and a more transparent, secure and predictable trade environment (Gil-Pareja *et al.,* 2016; Bown and Keynes, 2020; Madhumitha, 2020). Gallardo-Salazar and Tijmes-Ihl (2021) have highlighted the WTO dispute settlement's unique attributes regarding the legitimacy of multilateralism, the technical support offered by the Secretariat, and the mechanism to balance power differences among disputing parties. However, these institutional strengths are minimized in times of functional crisis. Shin and Ahn (2019) have suggested that WTO dispute settlement system contributes to multilateral trade liberalization and provides better market access. Reynolds (2009) have stated that the WTO dispute settlement is more effective than we thought, although there are many trade disputes inactive. In fact, these cases are initiated by countries involved in similar disputes and the WTO took no further action.

Despite its contribution, many scholars have stated that the WTO dispute settlement has some systematic and legitimacy problems in terms of panel competence, transparency, cases reported undecided, the compliance with deadlines and their extended, and consistency between domestic legislation and WTO regulations. Moreover, they have mentioned the existence of an imbalance between the benefits to developed countries and those to less developed countries, to the extent that the latter had a weaker capacity to threaten tariff or non-tariff retaliation (Elsig *et al.*, 2012; Singh and Tara, 2019; Bown and Keynes, 2020; Madhumitha, 2020; Altemoller, 2021). At the same time, the functioning of the WTO dispute settlement can be disturbed by various events, such as the Appellate Body crisis, started in December 2019 (Bown and Keynes, 2020; Raj and Mohan, 2021).

In the context of malfunctioning or collapses of the Appellate Body, both policymakers and scholars came with alternative dispute settlements (Lo *et al.*, 2020; Gao, 2021; Papaconstantinou and Pedreschi, 2022; Singh, 2022; Miranda and Miranda, 2023). The trade partners must focus on dispute settlement mechanisms within free or preferential trade agreements, as potential alternatives to the multilateral mechanism. At the same time, some of the WTO members had accepted the EU's proposal for the Multiparty Interim Appeal Arbitration Arrangement (MPIA) as an alternative. Gallardo-Salazar and Tijmes-Ihl (2021) have compared the Pacific Alliance (PA), and the Comprehensive and the Progressive

Agreement for Trans-Pacific Partnership (CPTPP) as alternatives to WTO dispute settlement. They have suggested that PA and CPTPP offer incentives for countries to choose them for trade disputes instead of WTO. Both regional forums can guarantee the same great degree of legal certainty as WTO when the WTO encounters functional difficulties or crises. In addition, PA and CPTPP have an extended scope of application, are more flexible regarding the dispute settlement procedures and have an automatic system in the non-compliance stage facilitating the suspension process of concessions.

As regards the European Union (EU), Mayr *et al.,* (2021) have analyzed how the EU's Renewable Energy Directive complies with WTO/GATT provisions, suggesting that there are some critical aspects regarding this compatibility and doubting the justification of the European measures on environmental grounds. At the same time, Rovnov (2021) and Dolle and Medina (2020) have reviewed the dispute case between the EU and Ukraine regarding the Ukraine's exports restrictions on timber and unprocessed wood. This case is special because considers a bilateral preferential trade agreement within the Association Agreement between the EU and Ukraine, being the first trade dispute of this kind. On the other hand, Kastner and Pawsey (2002) have investigated the dispute between the EU and the United States on American exports of hormone-treated beef within the WTO-SPS Framework. At the same time, Raju (2019) has presented six WTO disputes, including the case DS593 between Indonesia and the EU on palm oil and oil palm crop-based biofuels Yildrim (2018) has suggested that the behavior of the EU towards WTO disputes depends on the level of integration of targeted sectors into global value chains. In this sense, either the EU responds within a short timeframe to the demands of its trading partners; or the EU postpones the resolution of some disputes.

The research methodology implies a conceptual and descriptive framework regarding the dispute settlement process and a qualitative approach regarding the status of the European Union's trade disputes, in particular for energy sector. The research is based on practically informed findings resulted through authors' professional experience and consultation of the literature, mainly primary sources. A review of this topic is important and necessary in order to create further directions of study and new approaches regarding trade disputes and the WTO settlement process for understanding the implications of this process between WTO members, and, in particular, for the EU member states in terms of energy.

2. The dispute settlement process

The dispute settlement process between member states can go through several stages according to Figure 1. The main purpose of the dispute settlement system is to help the member states to achieve

reconciliation between themselves based on WTO rules. Therefore, *the first stage of the reconciliation process is bilateral consultations between the parties*. Using this system, WTO is looking to reconcile the member states through a mutually agreed solution in accordance with international rules rather than to pronounce judgments. According to Article 4.5 of the DSU, parties have the opportunity to find together an advantageous solution for both without employing to judicial proceedings (WTO Secretariat, 2012).

Figure 1. Overview of the reconciliation process
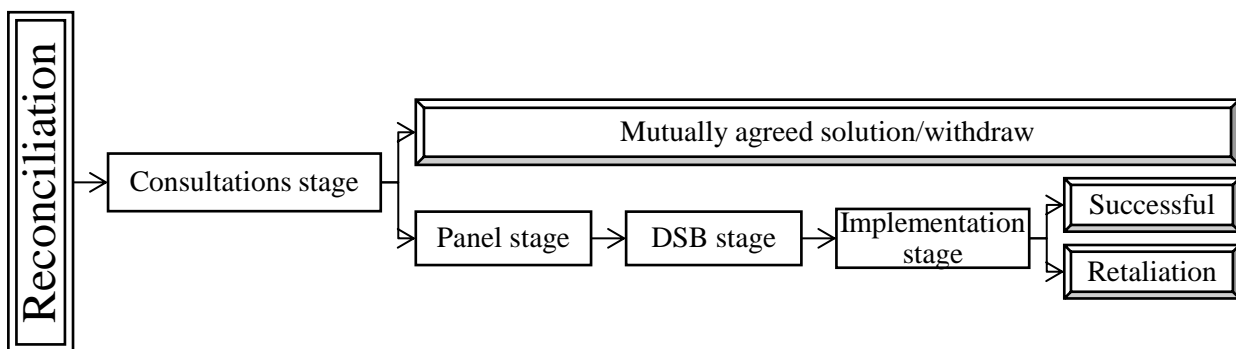
Source: own representation

This is an effective tool of dispute resolution, considering that most of disputes are finished in the consultation stage due to a mutually solution or due to the withdrawal of the complaint. In more than 140 cases, both parties reached a mutually agreed solution or the complainant withdrawn the consultations request (WTO, 2023). This suggests that consultations are a more effective instrument than juridical proceedings and enforcement. In fact, the primary objective of WTO is that parties to reach a mutually solution regardless the stage of dispute settlement process. For this purpose, WTO provides assistance through good offices, conciliation and mediation at any time if the involved parties accept this proposal (WTO Secretariat, 2017).

Only if the parties cannot reach a mutually agreed solution after formal consultations facilitated by DSU within 60 days or if both parties consider that consultations are not enough for a solution, the complainant has the option to request a panel for judging that case by sending a single text to the WTO Secretariat (Article 4.7). This term can be even shorter in cases of urgency or for perishable goods (Article 4.8). Even so, parties have always the possibility to find a mutually solution during the dispute settlement process (WTO Secretariat, 2012; Madhumitha, 2020). The complainant has the possibility to accept the access of other third parties or to refuse it when he requests for consultations. On the other hand, the respondent must give his consent for the participation of third parties.

Therefore, another WTO member may join consultations if he has the consent of both parties and if he has a trade interest (WTO Secretariat, 2017). Figure 2 represents the entire procedure for this stage.

Figure 2. Reconciliation process. Consultations stage
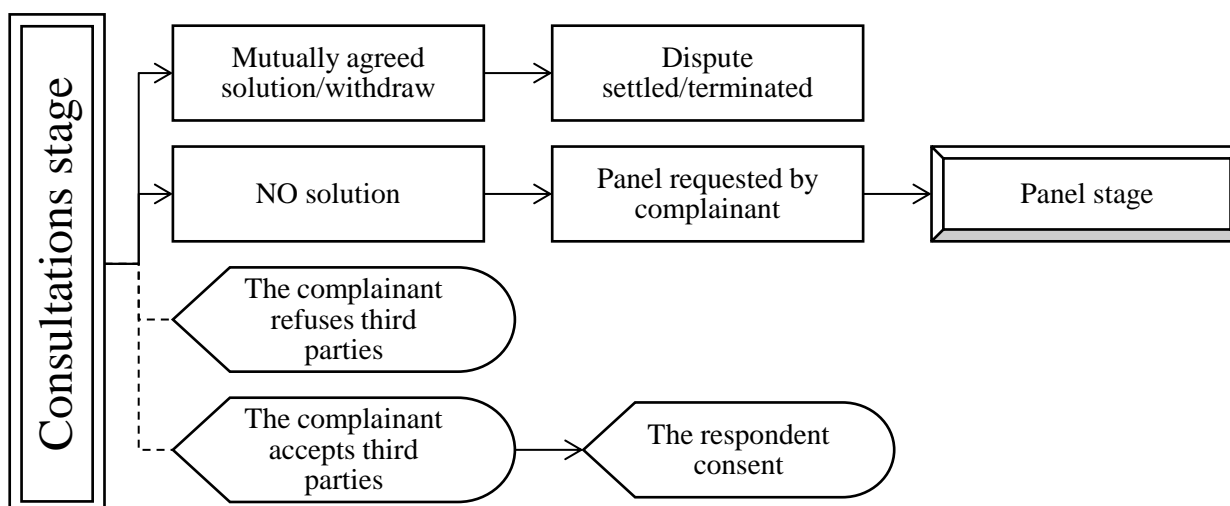
Source: own representation

The refereeing stage starts with the request for panel. *In the panel stage*, both parties have the possibility to uphold or defend their interests, while the complainant can also request the panel suspension for a maximum of one year hoping to find a mutually solution. For this stage, other members can participate as third parties in the panel proceedings based on a substantial or systematic interest and without needing the consent of the parties' involved (WTO Secretariat, 2017). Generally, a panel is composed of three or five governmental and non-governmental individuals that must meet several conditions mentioned in Article 8.1 and 8.2 of the DSU. Persons that belong to a party involved or to a third party has the opportunity to be panelist only with the parties consent (Article 8.3). Moreover, in trade disputes between a developed country and a developing one, the last can request a person from a developing country to be part of the panel, according to the Article 8.10 of the DSU (WTO Secretariat, 2012).

After the panel examines the involved parties and third parties in accordance with the existing WTO law through several meetings, including oral statements, he prepares a descriptive draft with the involved parties' arguments. In this preliminary stage, the involved parties have two weeks to form remarks. After this term, the panel composes an interim report, including the revised descriptive part, findings and possible recommendations. Again, the involved parties have the possibility to request a review of certain aspects from the report or a new meeting of the panel. After this revision

phase, the panel presents the final report to the parties in at most six months or within three months in cases of urgency (WTO Secretariat, 2017; Madhumitha, 2020). The entire procedure for panel stage is presented in Figure 3. So far, since 1995, the panel had been established for 316 cases, while the panelists have been selected for 282 cases (WTO, 2023).

Figure 3. Reconciliation process. Panel stage
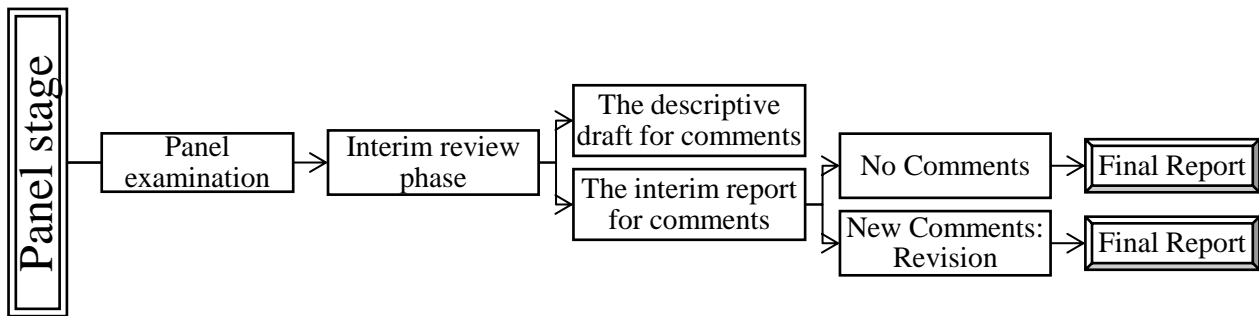
Source: own representation

However, the final report becomes mandatory after the Dispute Settlement Body (DSB) approval. *In the DSB stage* (Figure 4), each party in the dispute has the opportunity to appeal regarding legal aspects covered by the panel final report (Article 16 of the DSU). The appeal is limited to law issues and interpretations and is not taking into consideration new evidences. A division of three members from the Appellate Body (ABD) examines the appeal through a short oral hearing, those being selected by rotation regardless national origin. After the appeal has been resolved, the DSB adopts the final report. In the absence of an appeal, the report is adopted within 60 days and passes directly in the implementation phase. Starting from this point, the parties in the dispute must unconditionally accept the report (WTO Secretariat, 2012; Bown and Keynes, 2020).

Figure 4. Reconciliation process. DSB stage
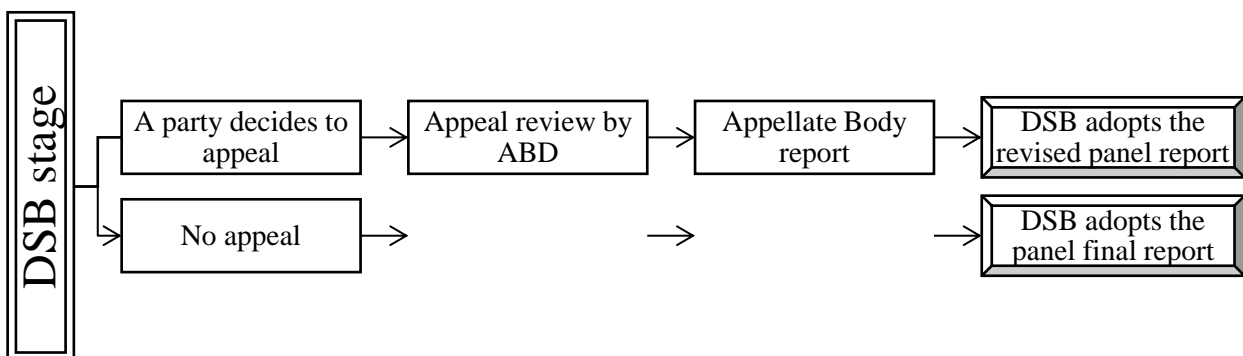
Source: own representation

In the implementation stage, DSB supervises the implementation of panel and/or Appellate Body reports by the losing party. This means that the losing party must withdraw the improper trade measures found during the refereeing stage or that both parties must find a mutually satisfactory adjustment in compliance with WTO rules. The time-period for implementation is established within a meeting in no more than 30 days from the adoption of the panel/Appellate Body reports. At this meeting, the losing party informs the DSB about its intention to implement the rulings and about the time needed (WTO Secretariat, 2017). However, the losing party can benefit from a grace period that implies a reasonable time to bring its trade measures into compliance with WTO rules. The grace period can be determined in three ways: mutually agreed between parties, proposed by the losing party and approved by the DSB or established by a referee from the Appellate Body (Article 21.3 of the DSU). Generally, the grace period implies at most 15 months for implementation, but the Appellate Body can provide at most another 3 months as additional time (WTO Secretariat, 2012).

In case of dispute over implementation, either of parties can request a special panel. The compliance panel has 90 days to analyze the implementing process and the consistency with WTO rules of measures taken by losing party (WTO Secretariat, 2012). When the losing party fails to implement the rulings from panel/Appellate Body reports or the grace period expires, both parties negotiate a mutually agreed compensation in the form of an equivalent trade benefit such as tariff reductions or a trade benefit in an important sector of complainant exports. In case of no agreement on compensation within 20 days, DSB authorizes retaliation pending full implementation. The retaliation stage involves a permission for complainant to temporary suspend concessions and other WTO obligations in relation with the respondent (losing party). Thus, in less than 30 days after the grace period expiration, the DSB give permission for complainant to impose temporary trade countermeasures or sanctions against the respondent in order to compensate the losses incurred and to rebalance reciprocal trade benefits (WTO Secretariat, 2017). Each of the parties involved has the possibility to request arbitration when disagrees on retaliation form. In this case, the arbitration must end within 60 days and the arbitrator decision is accepted as final (WTO Secretariat, 2012). Figure 5 presents the entire procedure for implementation stage.

Figure 5. Reconciliation process. Implementation stage

The retaliation stage is the final step of the reconciliation process, but implies the sternest consequences for non-implementing member. Trade barriers are economically harmful for both parties, making the retaliation phase an exception for a trade dispute. Thus, this phase is mostly avoided in trade disputes since the WTO is looking to achieve reconciliation between parties through more constructive methods.

3. The European Union's trade disputes

The EU member countries have become GATT or WTO members in several waves of accession. Belgium, Czechoslovakia, France, Luxembourg, Netherlands, and the United Kingdom are among the 23 founding members of GATT. At the same time, most of the EU member states have become GATT members before the WTO replaced GATT, starting with Denmark, Finland, Greece, Italy, and Sweden in 1950 and finishing with Slovenia in 1994. Only Bulgaria, the Baltic States and Croatia have become direct WTO members after 1995, the last being Lithuania in 2001.

Since the WTO replaced GATT, the EU had been involved in more than 400 trade disputes. However, in most of these disputes, the EU figures as third party, whereas 110 cases are as complainant and 93 cases as respondent. These 110 cases are the number of cases in which the entire EU was complainant, while the other 10 cases from Czech Republic, Denmark, Hungary and Poland are cases in which these countries were complainant before being member of the EU. A special attention is the case of Denmark, in which the complaint was made by Denmark in the respect of the

Faroe Islands. To these disputes are added those involving the EU member countries, most of them as respondent, according to Table 1.

Table 1. Trade disputes by the EU-27 and the member states

EU member	Cases as complainant	Cases as respondent	Cases as third party
Belgium	-	3	-
Croatia	-	1	-
Czech Rep.	1	2	-
Denmark	1	1	-
France	-	5	-
Germany	-	2	-
Greece	-	3	-
Hungary	5	2	2
Ireland	-	3	-
Italy	-	1	-
Lithuania	-	1	-
Netherlands	-	3	-
Poland	3	1	1
Portugal	-	1	-
Romania	-	2	-
Slovakia	-	3	-
Spain	-	3	-
Sweden	-	1	-
EU-27	110	93	216

Source: WTO (2021) and WTO (2023a), Disputes by member

Table 2 summarizes the cases in which the EU member states appear as complainant. Most of them are against other EU members before these countries became members of the EU. A special situation is trade dispute number DS469, where Denmark, in respect of the Faroe Islands requested consultations with the EU. At the same time, half of these trade disputes are finished by mutually agreed solution, whereas four are in consultations. As regarding the sector, most of these trade disputes had implied food products.

Table 2. Trade disputes by the EU member states as complainant

Case no	EU member	Respondent	Product	Request for consultations	Status
DS122	Poland	Thailand	Iron, Non-Alloy Steel and H Beams	6.04.1998	Mutually agreed solution on implementation on 21.01.2002
DS143	Hungary	Slovakia	Wheat	19.09.1998	*Panel established on 21.10.1998*

DS148	Hungary	Czech Rep.	Wheat	12.10.1998	*In consultations*
DS159	Czechia	Hungary	Steel products	21.01.1999	*In consultations*
DS235	Poland	Slovakia	Sugar	11.07. 2001	Mutually agreed solution on 11.01.2002
DS240	Hungary	Romania	Wheat and Wheat Flour	18.10.2001	Mutually agreed solution on 20.12.2001
DS256	Hungary	Turkey	Pet Food	3.05.2002	*In consultations*
DS289	Poland	Czech Rep.	Pig-Meat	16.04.2003	*In consultations*
DS297	Hungary	Croatia	Live Animals, Meat Products	9.07.2003	Mutually agreed solution on 30.01.2009
DS469	Denmark	European Union	Herring and Northeast Atlantic mackerel	4.11.2013	Mutually agreed solution on 21.08.2014

Source: WTO (2021) and WTO (2023a), Disputes by member

Table 3 summarizes the cases in which the EU member states appear as respondent, excluding the cases between the EU members presented in Table 2. The United States are the main complainant in most of the cases. More than a half of trade disputes in which the EU member states are respondent are ongoing, whereas 12 are in consultations and one in the panel stage. The United States are, also, the main complainant of cases in consultations. Special situation is the case DS347 with the United States where the panel had suspended its work for more than 12 months, leading to the lapse of the panel's authority for establishment. At the same time, there are cases in which the United States requested consultations with more EU member states at once, such those regarding the intellectual property rights (DS83, DS86, and DS125) or those related to income tax measures constituting subsidies (from DS127 to DS131).

Table 3. Trade disputes by the EU member states as respondent

Case no	EU member	Complainant	Sector	Request for consultations	Status
DS19	Poland	India	Automobiles	28.09.1995	Mutually agreed solution on 26.08.1996
DS35	Hungary	Argentina; Australia; Canada; New Zealand; Thailand; US	Agricultural products	27.03.1996	Mutually agreed solution on 30.07.1997
DS37	Portugal	United States	Patent production	30.04.1996	Mutually agreed solution on 3.10.1996
DS68	Ireland	United States	Computer equipment	14.02.1997	Appellate Body report adopted on 22.06.1998

DS80	Belgium	United States	Commercial telephone services	2.05.1997	*In consultations*
DS82	Ireland	United States	Copyright and neighboring rights	14.05.1997	Mutually agreed solution on 6.11.2000
DS83	Denmark	United States	Intellectual property rights	14.05.1997	Mutually agreed solution on 7.06.2001
DS86	Sweden			28.05.1997	Mutually agreed solution on 2.12.1998
DS125	Greece			4.05.1998	Mutually agreed solution on 20.03.2001
DS127	Belgium	United States	Income tax measures constituting subsidies	5.05.1998	*In consultations*
DS128	Netherlands				
DS129	Greece				
DS130	Ireland				
DS131	France				
DS133	Slovakia	Switzerland	Dairy Products and Cattle	7.05.1998	*In consultations*
DS173	France	United States	Flight management system	21.05.1999	*In consultations*
DS198	Romania	United States	Minimum import prices	30.05.2000	Mutually agreed solution on 26.09.2001
DS210	Belgium	United States	Rice	12.10.2000	Mutually agreed solution on 18.12.2001
DS316	France, Germany, Spain	United States	Large civil aircraft	6.10.2004	Implementation following compliance proceedings on 25.08.2020
DS347				31.01.2006	*Authority for panel lapsed on 7.08.2007*
DS408	Netherlands	India	Generic drugs	11.05.2010	*In consultations*
DS409		Brazil		12.05.2010	*In consultations*
DS443	Spain	Argentina	Biodiesels	17.08.2012	*In consultations*
DS452	Greece, Italy	China	Renewable energy	5.11.2012	*In consultations*
DS600	France, Lithuania	Malaysia	Palm oil and biofuels	15.01.2021	*Panel composed on 29.07.2021*

Source: WTO (2021) and WTO (2023a), Disputes by member

Since the WTO replaced GATT, the EU had been involved in 110 cases as complainant, according to Table 4. More than a half of these trade disputes had been finished and almost half of them are ongoing. At the same time, in 14 cases, the EU and the second party reached a mutually agreed solution and 33 ongoing cases are still in consultations stage. The United States are the main

respondent with 35 cases, most of them being finished and nine in consultations. The BRICS countries (excepting South Africa), and other countries from Asia, North America and Latin America follow the American economy in terms of number of cases.

Table 4. Trade disputes by the EU as complainant

Respondent	Number of cases	Status			
		Finished	Mutually agreed solution	Ongoing	In consultations
United States	35	21	4	14	9
China	11	6	1	5	2
India	11	3	1	8	5
Argentina	8	4	-	4	3
Canada	6	5	1	1	1
Japan	6	3	3	3	3
Russia	6	2	-	4	1
Brazil	5	2	-	3	3
South Korea	4	4	1	-	-
Chile	3	3	1	-	-
Indonesia	3	2	1	1	-
Mexico	3	1	-	2	2
Colombia	2	1	-	1	-
Australia	1	1	1	-	-
Egypt	1	-	-	1	1
Pakistan	1	-	-	1	1
Philippines	1	1	-	-	-
Thailand	1	-	-	1	1
Turkey	1	1	-	-	-
United Kingdom	1	-	-	1	1
TOTAL	**110**	**59**	**14**	**51**	**33**

Source: WTO (2021) and WTO (2023a), Disputes by member

Among the ongoing cases, some trade disputes need special attention. For example, DS591 against Colombia regarding the anti-dumping duties on frozen fries from Belgium, Germany and the Netherlands. Although, there is a final decision regarding this case, both the EU and Columbia had agreed for additional time for implementation until November 2023. At the same time, some cases are at the panel stage. The EU made a panel request in the case D120 against India, whereas a compliance request was made in the case DS577 against the United States regarding the anti-dumping and countervailing duties on ripe olives from Spain. In addition, the panel had been established for DS214 (against the US on steel products), for DS462 (against Russia on recycling fee), for DS502 (against Colombia on spirits), and for DS509 (against China on raw materials). In some cases, the panel had been composed, such as trade disputes against the United States (DS317 on large civil

aircraft) and against China (DS610 and DS611 on goods and intellectual property rights). In the case DS582 against India regarding the ICT sector, the panel report had circulated to the DSB, whereas the panel report is under appeal in the case DS592 against Indonesia on raw materials (WTO, 2023a). It is assumed that all these cases will be resolved eventually, either by mutually agreed solution, either by successful implementation through adopted reports.

On the other hand, some trade disputes are blocked since the panel had suspended its work for more than 12 months, leading to the lapse of the panel's authority for establishment. There are six cases in this situation, two against the United States (DS38 and DS88), two against Russia (DS475 and DS604), one regarding Argentina measures affecting textiles, clothing and footwear (DS77), and one (DS352) against India related to wines and spirits (WTO, 2021; WTO, 2023a).

As respondent, the EU had been involved in 93 trade disputes, according to Table 5. More than 56% of these trade disputes had been finished and 41 of cases are ongoing. At the same time, in 24 cases, the EU and the second party reached a mutually agreed solution and 26 ongoing cases are still in consultations stage. The United States are the main complainant with 20 cases, most of them being finished and three in consultations. Among the American cases, there are three trade disputes with multiple complainants. For example, trade case DS16 involves the United States, Guatemala, Honduras and Mexico as complainants. All of these countries appear in disputes DS27 and DS158 as complainants, to which is added Ecuador for the first and Panama for the latter.

Table 5. Trade disputes by the EU as respondent

Complainant	Number of cases	Status			
		Finished	Mutually agreed solution	Ongoing	In consultations
United States	20*	11	7	9	3
Canada	9	6	4	3	2
Brazil	8	4	-	4	4
India	7	3	1	4	4
Argentina	6	2	1	4	4
China	5	3	1	2	1
Indonesia	5	2	-	2	-
Russia	4	-	-	4	-
Thailand	4	2	-	2	2
Norway	3	2	1	1	1
South Korea	3	2	1	1	1
Australia	2	2	-	-	-
Chile	2	2	2	-	-
Panama	2	2	2	-	-
Peru	2	2	2	-	-
Colombia	1	1	1	-	-

Faroe Islands	1	1	1	-	-
Japan	1	1	-	-	-
Malaysia	1	-	-	1	-
New Zeeland	1	1	1	-	-
Pakistan	1	1	-	-	-
Saudi Arabia	1	-	-	1	1
South Africa	1	-	-	1	1
Taiwan	1	1	-	-	-
Turkey	1	1	-	-	-
Uruguay	1	-	-	1	1
TOTAL	**93**	**52**	**24**	**41**	**26**

* In three cases appear more complainants, including Ecuador, Guatemala, Honduras, Mexico, and Panama.
Source: WTO (2021) and WTO (2023a), Disputes by member.

Among the ongoing cases, some trade disputes need special attention. For example, DS316 requested by the United States regarding large civil aircraft. Although, there is a final decision regarding this case, the EU has decided to appeal some issues of law and legal interpretations developed by the compliance panel. At the same time, some cases are at the panel stage. The panel had been established for five cases, such as DS9 (requested by Canada on cereals), for DS260 and DS389 (requested by the United States on steel and poultry meat products), for DS474 (called by Russia regarding anti-dumping measures), and for DS616 (requested by Indonesia on steel products). In two cases (DS593 and DS600) requested by Indonesia and Malaysia regarding the palm oil and biofuels, the panel had been composed. In addition, the panel reports are under appeal in the cases DS476 and DS494, both requested by Russia regarding anti-dumping measures and energy sector (WTO, 2023a).

On the other hand, some trade disputes are blocked since the panel had suspended its work for more than 12 months, leading to the lapse of the panel's authority for establishment. There are two cases in this situation, one requested by the United States (DS347 on large civil aircraft), and one regarding price comparison methodologies requested by China (DS516). At the same time, in the case DS521 called by Russia regarding steel products, the panel work had been suspended. Moreover, in two cases (DS291 and DS559) requested by the United States against the European Union, both parties had agreed to resort to arbitration and, after its composition, to suspend it immediately and indefinitely (WTO, 2023a).

4. The EU's trade disputes on energy sector

The European Union had been involved in ten trade disputes regarding biofuels and energy sector, as it can be seen in Table 6. In most of them, the European economy appears as respondent,

while the EU has only one case as complainant against the United Kingdom. In some cases, other EU member states appear alongside the EU as respondents, such as Spain (case DS443), Greece and Italy (DS452), and France and Lithuania (DS600). Most complaints came from Argentina and Indonesia, while China, Russia, and Malaysia have one case each against the EU. As regarding the sector or the product involved, five cases are related to biodiesels, three about energy sector and two about oil palm crop-based biofuels. In terms of status, five cases are still in the consultations stage, in two cases the panel had been composed, whereas the panel report is under appeal for case DS476 requested by Russia. On the other hand, only two cases are finished after the successful implementation of panel or Appellate Body reports.

Table 6. Trade disputes on energy sector

Case no	Complainant	Respondent	Sector/Product	Request for consultations	Status
DS443	Argentina	EU, Spain	Biodiesels	17.08.2012	*In consultations*
DS452	China	EU, Greece, Italy	Renewable energy generation	05.11.2012	*In consultations*
DS459	Argentina	EU	Biodiesels	15.05.2013	*In consultations*
DS473	Argentina	EU	Biodiesels	19.12.2013	Successful implementation
DS476	Russia	EU	Energy sector	30.04.2014	*Panel report under appeal*
DS480	Indonesia	EU	Biodiesels	10.06.2014	Successful implementation
DS593	Indonesia	EU	Palm oil and oil palm crop-based biofuels	09.12.2019	*Panel composed on 20.11.2020*
DS600	Malaysia	EU, France, Lithuania	Palm oil and oil palm crop-based biofuels	15.01.2021	*Panel composed on 29.07.2021*
DS612	EU	United Kingdom	Low Carbon Energy Generation	28.03.2022	*In consultations*
DS618	Indonesia	EU	Biodiesels	15.08.2023	*In consultations*

Source: WTO (2021) and WTO (2023a), Disputes by member.

Starting with trade disputes on *biodiesels*, Argentina had requested three cases and Indonesia two, whereas in one case Spain appears as respondent alongside the European Union. More than a half of these trade disputes are in consultations. In the case DS443, Argentina had contested the Spanish Ministerial Order regarding the allocation of quantities of biodiesel. This order affects the Argentinian exports of biodiesels, being a national measure to achieve the mandatory targets regarding renewable energy according to the EU regulatory framework related to energy from renewable sources. Although Argentina had requested for a panel establishment, the DSB had

deferred its request and the case remained in the consultations stage since December 2012 (WTO, 2023b). Further, in the case DS459, Argentina had requested consultations with the EU on May 2013 regarding two types of measures that affects its exports of biodiesels. On the one hand, Argentina had contested that the European economy had taken measures for promoting the use of renewable energy and for adopting a mechanism for controlling and reducing greenhouse emissions. On the other hand, Argentina had disagreed the EU's measures for support schemes in the biodiesel sector. As in the previous case, this trade dispute remained at the consultation stage (WTO, 2023c). Nevertheless, both cases have an example of a successful concluded trade dispute; the case DS473 started in December 2013 by Argentina against the EU. In this case, Argentina had contested the EU imposition of provisional and definitive anti-dumping on biodiesel, affecting its exports. At the same time, Argentina had complained the determination method of dumping margins considering the adjustment of production and sale costs for biodiesel. Since the both parties had not reached a mutually agreed solution, the DSB had established a panel in April 2014, being composed in June 2014. The panel report was released in March 2016, whereas both parties had decided to appeal the report in May. In October 2016, the Appellate Body had released its report through which upheld the Panel's findings, according to which the EU acted inconsistently with GATT/ WTO agreements. Both the EU and Argentina had decided to implement the rulings and recommendations in this dispute, although both asked for additional time in two rounds. After one year, the EU had informed the DSB about the full implementation of the rulings and recommendations through annulling the anti-dumping measure imposed (WTO, 2023d). A similar case is DS480 started in June 2014, in which Indonesia had complained the EU about the same anti-dumping measures on biodiesel imports. Failing a mutually agreed solution, the DSB had decided to establish the panel in August 2015 and to compose it in November. During its session, the panel had suspended its work in the waiting of a decision regarding the case DS473 between Argentina and the EU. Having a precedent in the case DS473, the panel had finished its report in January, being adopted in one month. The panel findings were similar with those from DS473, while the EU and Indonesia had agreed on an implementation period of 8 months. Therefore, in November 2018, the EU informed the DSB about the complete implementation following the annulment of anti-dumping measure imposed. The most recent trade dispute, at the time of writing, is the case DS618 between the EU and Indonesia. Again, Indonesia had complained the EU about the European measures on Indonesian exports of biodiesels, namely the definitive countervailing measures imposed on biodiesel imports and how the EU investigation leading to their imposition (WTO, 2023f).

As regards the *palm oil and oil palm crop-based biofuels*, the EU had decided in 2018 to eliminate palm oil by 2021 and to limit the consumption levels of palm oil-based biofuels (Michalopoulos, 2018). This decision had led to two trade disputes of Indonesia and Malaysia against the EU, both being ongoing. The case DS593 had started in December 2019, but both Indonesia and the EU had not reached a mutually agreed solution. Thus, the DSB had decided to establish a panel in July 2020, which had been composed in November (Mayr *et al.,* 2021). The panel had extended the deadline for its report twice to the third quarter of 2023, invoking the complexity of the legal issues. The second case is similar. In DS600, started in January 2021, Malaysia had complained the EU, France and Lithuania regarding the same measures imposed on palm oil and oil palm crop-based biofuels. Similar with DS593, the parties had not reached a mutually agreed solution, leading to an established panel in May 2021 and a composed one in July 2021. The decision was similar; the panel had extended the deadline for its report twice to the third quarter of 2023, invoking the complexity of the legal issues. It is assumed that both cases will be solved at the same time (WTO, 2023g).

In the case of the energy sector, there are two trade disputes in which the EU is respondent and one in which it is complainant. In DS452, China had complained against the EU, Italy and Greece regarding the feed-in tariff programs as domestic restrictions on renewable energy generation sector (WTO, 2023a). Although this case is still in consultations, it has a precedent in respect of the case DS476 between Russia and the EU. As an effect of Euromaidan and in the context of signing the Ukraine-EU Association Agreement, Russia had complained the EU in April 2014 about trading measures on energy sector through the `Third Energy Package`. This legislative package aims to liberalize and integrate Europe's gas and electricity markets, including the ownership unbundling in order to separate the generation and sale operations from their transmission networks. Failing a mutually agreed solution, the DSB had decided to establish the panel in July 2015 and to compose it in March 2016. The panel report released in August 2018 was more in favor of the EU. However, both parties had decided to appeal the report in September. The Appellate Body had extended the deadline for this appeal, considering the size of the panel report, the complexity of the case and the shortage of the staff (WTO, 2023e).

On the other hand, the only trade dispute on energy sector in which the EU appears as complainant is the case DS612 against the United Kingdom. Following the Brexit, this trade dispute had started in March 2022 when the EU had complained about the allocation process of 'Contracts for Difference' in low carbon energy generation. The case is still in consultation stage since there (WTO, 2023a).

Conclusions

Despite its systematic and legitimacy problems regarding the panel competence, transparency, cases reported unsolved, the compliance with deadlines and their extended, and consistency between domestic and WTO legislations, the WTO dispute settlement system is still an effective tool for achieving reconciliation between WTO members. Although the dispute settlement involves several stages, the main purpose is to help the member states for achieving a mutually agreed solution, regardless the phase of trade dispute. In practice, some cases are complex, calling for a more active involvement of the investigative bodies, more time and going through all the steps, even the unpleasant ones, regarding the application of retaliatory measures.

One of the paper findings is that most of the EU trade disputes are finished, either by mutually agreed solution, either by successful implementation through adopted reports. At the same time, the United States are the main complainant and the main respondent in most of the cases involving the European Union or a member state.

Another finding is that cases involving the EU can be found at all stages of the trade dispute settlement, fewer at the retaliation phase. Although most of them are concluded, most often through mutually agreed solutions, there are a large number of cases in the consultation stage. Some cases are at the panel stage, whereas the panel is either established, composed or one of the parties has requested the creation of a panel. On the other hand, there are cases in which the panel had suspended its work for more than 12 months, leading to the lapse of the panel's authority for establishment.

As regards the energy sector, the European Union is involved in ten trade disputes so far, most of them as a respondent and still in the consultation phase. Argentina, Indonesia, Russia, China and Malaysia are the complainants in these cases, while the sectors involved are related to biodiesel, renewable energy generation and oil palm-based biofuels. Although most of these cases are still pending, there are two cases where the rulings and recommendations have been fully and successfully implemented, which can be considered as examples of good practice for other cases.

These findings are important and necessary to create further directions of study and new approaches regarding the EU's trade disputes and the dispute settlement process. As regarding the WTO trade dispute settlement, it is necessary to understand and to be aware by the vulnerabilities of this process as well as the need for openness in terms of new and more efficient tools to improve it. The WTO bodies should consider these vulnerabilities as new opportunities and ways to update and improve the quality of the trade dispute settlement. As regarding the EU, European bodies need to anticipate the increased risk of trade disputes escalating, particularly in key areas such as the energy sector. In addition, the European institutions should also try to prevent the risk of loss of control in

major trade disputes and try to resolve disputes at the consultation stage, especially in cases with higher economic and political stakes. To this end, the EU institutions need to look ahead and design their decisions according to their expectations of how their opponents will behave. At the same time, complex trade barriers for sensitive economic sectors should be avoided as there is a greater risk that the opposing side will demonstrate the illegitimacy of these measures, although the EU institutions might hope that these are difficult to prove. These aspects might be useful for understanding the implications for the EU member states, policymakers and public in terms of trade.

References

Altemoller, F. (2021), WTO Appellate Body without legitimacy? The criticism of the Dispute Settlement System and the response of the WTO member states, *Global Trade and Customs Journal,* 16(4), pp. 139-148. https://doi.org/10.54648/gtcj2021015.

Bown, C. and Keynes, S. (2020), Why Trump shot the sheriffs: the end of WTO dispute settlement 1.0, *Journal of Policy Modeling,* 42(4), pp. 799-819. https://doi.org/10.1016/j.jpolmod.2020.03.006.

Dolle, T. and Medina, L. (2021), The EU's request for arbitration under the EU-Ukraine Association Agreement, *Global Trade and Customs Journal,* 15(2), pp. 104-110. https://doi.org/10.54648/gtcj2020013.

Elsig, M., Pauwelyn, J., Bernauer, T. (2012), 22 dispute settlement mechanism: analysis and problems, in: Daunton M., Narlikar, A., Stern, R. (eds.), *The Oxford handbook on the World Trade Organization*, Oxford: Oxford University Press, pp. 485-506. https://doi.org/10.1093/oxfordhb/9780199586103.013.0023.

Gallardo-Salazar, N. and Tijmes-Ihl, J. (2021), The Pacific Alliance and the CPTPP as alternatives to WTO dispute settlement, *Derecho Pucp,* 86, pp. 39-72. https://doi.org/10.18800/derechopucp.202101.002.

Gao, H. (2021), Finding a rule-based solution to the Appellate Body crisis: looking beyond the Multiparty Interim Appeal Arbitration Arrangement, *Journal of International Economic Law,* 24(3), pp. 534-550. https://doi.org/10.1093/jiel/jgab031.

Gil-Pareja, S., Llorca-Vivero, R., and Martinez-Serrano, J.A. (2016), A Re-examination of the Effect of GATT/WTO on Trade, *Open Economies Review,* 27, pp. 561-584. https://doi.org/ 10.1007/s11079-015-9385-5.

Kastner, L. and Pawsey, R. (2002), Harmonising sanitary measures and resolving trade disputes through the WTO-SPS framework. Part I: a case study of the US-EU hormone-treated beef dispute, *Food Control*, 13(1), pp. 49-55. https://doi.org/10.1016/S0956-7135(01)00023-8

Lo, C., Nakagawa, J., Chen, T. (2020), *The Appellate Body of the WTO and its reform*, Springer.

Madhumitha, D.S. (2020), WTO-Analysis of issues with the dispute settlement mechanism, *Beijing Law Review*, 11, pp. 879-888. https://doi.org/10.4236/blr.2020.114052.

Mayr, S., Hollaus, B., Madner, V. (2021), Palm oil, the RED II and WTO law: EU sustainable biofuel policy tangled up in green? *RECIEL,* 30(2), pp. 233-248. https://doi.org/10.1111/reel.12386

Michalopoulos, S. (2018), EU Parliament ends palm oil and caps crop-based biofuels at 2017 levels, *Euractiv,* 17 January (retrieved from https://www.euractiv.com/section/agriculture-food/news/eu-parliament-ends-palm-oil-and-caps-crop-based-biofuels-at-2017-levels/).

Miranda, J. and Miranda, M. (2023), Chronicle of a crisis foretold: how the WTO Appellate Body drove itself into a corner, *Journal of International Economic Law,* https://doi.org/ 10.1093/jiel/jgad023.

Papaconstantinou, G. and Pedreschi, L. (2022), Alternative dispute settlement and the jurisprudential legacy of the World Trade Organization's Appellate Body, *Journal of World Trade,* 56(2), pp. 261-282. https://doi.org/10.54648/trad2022011.

Raj, V. and Mohan, M. (2021), Appellate Body crisis at the World Trade Organization: view from India, *Journal of World Trade,* 55(5), pp. 829-852. https://doi.org/10.54648/trad2021035

Raju, K. (2019), World Trade Organization disputes, *Yearbook of International Environmental Law,* 30(1), pp. 478-483. https://doi.org/10.1093/yiel/yvaa028.

Reynolds, K. (2009), Why are so many WTO disputes abandoned?, in: Hartigan, J. (eds.), *Trade disputes and the dispute settlement understanding of the WTO: an interdisciplinary assessment,* Bingley: Emerald Group, pp. 191-211. https://doi.org/10.1108/S1574-8715(2009)0000006011.

Rovnov, Y. (2021), EU-Ukraine arbitration: will WTO law become more deferential outside the WTO?, *Journal of World Trade,* 55(6), pp. 969-990. https://doi.org/10.54648/trad2021041.

Shin, W. and Ahn, D. (2019), Trade gains from legal rulings in the WTO dispute settlement system, *World Trade Review,* 18(1), pp. 1-31. https://doi.org/10.1017/S1474745617000544.

Singh, S. (2022), Dispute settlement in Indian FTAs: shaping the future with lessons from the past, *Global Trade and Customs Journal,* 17, pp. 304-309. https://doi.org/10.54648/gtcj2022042.

Singh, A. and Tara, P. (2019), A critical analysis of the developing countries participation in the WTO dispute settlement mechanism, *Journal of the Indian Law Institute,* 61(3), pp. 323-349. https://www.jstor.org/stable/27097371.

WTO (2021), *WTO dispute settlement: one-page case summaries 1995-2020,* Geneva: WTO Publications.

WTO (2023a), *WTO dispute settlement. Disputes by members* (retrieved from https://www.wto.org/english/tratop_e/dispu_e/dispu_by_country_e.htm).

WTO (2023b), *WTO dispute settlement. DS443: European Union and a member state - certain measures concerning the importation of biodiesels* (retrieved from https://www.wto.org/ english/tratop_e/dispu_e/cases_e/ds443_e.htm).

WTO (2023c), *WTO dispute settlement. DS459: European Union and certain member states -certain measures on the importation and marketing of biodiesel and measures supporting the biodiesel industry* (retrieved from https://www.wto.org/english/tratop_e/dispu_e/cases_e /ds459_e.htm).

WTO (2023d), *WTO dispute settlement. DS473: European Union anti-dumping measures on biodiesel from Argentina* (retrieved from https://www.wto.org/english/tratop_e/dispu_e /cases_e/ds473_e.htm).

WTO (2023e), *WTO dispute settlement. DS476: European Union and its member states – certain measures relating to the energy sector* (retrieved from https://www.wto.org/english/tratop_e /dispu_e/cases_e/ds476_e.htm).

WTO (2023f), *WTO dispute settlement. DS480: European Union anti-dumping measures on biodiesel from Indonesia* (retrieved from https://www.wto.org/english/tratop_e/ dispu_e/cases_e/ds480_e.htm).

WTO (2023g), *WTO dispute settlement. DS600: European Union and certain member states – certain measures concerning palm oil and oil palm crop-based biofuels* (retrieved from https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds600_e.htm).

WTO Secretariat (2012), Understanding on Rules and Procedures Governing the Settlement of Disputes (DSU), in: *The WTO Dispute Settlement Procedures: A Collection of the Relevant*

Legal Texts, Cambridge: Cambridge University Press, pp. 1-31. https://doi.org/10.1017 /CBO9781139235563.

WTO Secretariat (2017), *A Handbook on the WTO Dispute Settlement System,* Second Edition, Cambridge: Cambridge University Press. https://doi.org/10.1017/9781108265423.

Yildrim, A. (2018), Domestic political implications of global value chains: explaining EU responses to litigation at the World Trade Organization, *Comparative European Politics,* 16, pp. 549-580. https://doi.org/10.1057/s41295-016-0085-3.

Employment in public sector - empirical evidence from Georgia

Egnate SHAMUGIA[*]

Abstract

This paper aims to assess employment in Georgia's public sector and study job creation factors. During the last decade, employment in the public sector has increased, and its share in total employment is, on average, 22.5%. This figure is high considering the real expenditures of the government, and the amount of delivered goods and services since some countries like Georgia ensure the provision of public services with relatively fewer human resources. On the other hand, the paper demonstrates job creation factors in the sector through regression analysis. Such a factor is politicians' rent-seeking - creating jobs for influential groups and ensuring political stability. This is more characteristic of those countries that lack democracy and the rule of law.

Keywords: employment, public sector, rent seeking, public finance

Introduction

Unemployment is a long-term problem, and the government can reduce it in two ways: create an appropriate economic environment that will promote economic growth; or become an employer itself. As a rent seeker, the politicians choose the latter (Tullock, 1967; Krueger, 1974; Laband and Sophocleus, 2018) because governments are not social welfare maximizers but providers of political favours to influential groups (Olson, 1968; Becker, 1983; Hillman and Ursprung, 2016). In the labour market, rent seeking takes different forms. Among them is creating more profitable jobs for political power holders (Gelb *et al.*, 1991; Robinson and Verdier, 2013; Jaimovich and Rud, 2014; Melo and Miller, 2022). While job seekers hardly ever form unions to lobby for creating public sector jobs, officials still create them. Widely expressed concerns in the public drive this behaviour, and the politicians' goal is to achieve political stability. Thus, the government tends to create more jobs in the public sector.

Although an increase in public employment reduces the unemployment rate in the short term, it crowds out the private sector (Holmlund and Lindén, 1993; Malley and Moutos, 1998; Demekas and Kontolemis, 2000; Behar and Mok, 2013). Based on OECD member countries' data from 1960-2000, Algan *et al.* (2002) demonstrated that creating one hundred jobs in the public sector can

---

[*] Egnate SHAMUGIA is research fellow at Gnomon Wise, The University of Georgia, Tbilisi, e-mail: e.shamugia@ug.edu.ge. ORCID: 0000-0003-0085-8018.

eliminate one hundred and fifty jobs in the private sector. Besides, increased employment in the public sector can reduce the economy's productivity, as rent-seeking and rent-creating behaviour can lead to a wasteful allocation of resources (Gelb *et al.*, 1991). In this case, resources are redistributed from the private sector to the public sector, from the highly productive sector - to the less productive sector.

This article aims to evaluate and explain Georgia's public-sector employment. This country is interesting for some reasons. Since the re-establishment of independence, there have been several different approaches for three decades. Back in 2006-07, the sectoral distribution of employment changed due to large-scale privatisation[1]. Since 2014, a limit was set on the number of employees in municipal bodies, and later, the government program for 2018-2020 referred to the Small Government concept, including public sector employment[2]. Also, in 2017, the definition of the public servant and the salary policy were changed again by law. With this, the approach of the previous decade was rejected. However, the new arrangement partially affected the General Government and did not involve public corporations[3].

To do so, first of all, we defined the sector's scope and analyzed the level of employment from a comparative perspective. First, we examined the Georgian labour force distribution dynamics in 2007-2021. Then we compared the relative indicators of the former socialist countries (FSC) and the Organization for Economic Cooperation and Development (OECD). Finally, we studied employment factors in the public sector through the Ordinary Least Square estimator based on FCS's cross-sectional data.

The Scope of the Public Sector

Before analyzing employment in the public sector, it is crucial to discuss its scope and structure. The public sector, as a whole, can be divided into two broad categories – general government units and public corporations, which ensure the provision of goods and services to society and individual households, and the distribution of wealth and income (IMF, 2014). The activities of such entities are mainly based on non-market principles, and in the case of public corporations – it is on the contrary. In terms of management and control, all public sector institutional units are directly or indirectly managed by the general government (see Figure 1).

---

[1] Media outlets on the privatisation that started after the Rose Revolution in Georgia: https://civil.ge/archives/106111; https://eurasianet.org/privatization-in-georgia-solving-the-sensitive-issues
[2] Organic Law of Georgia - Local Self-government Code, Article 156 https://matsne.gov.ge/ka/document/view/2244429?impose=translateEn&publication=65
[3] Government of Georgia program 2018-2020: Freedom, Rapid Development, Prosperity - https://www.gov.ge/files/333_67106_165784_68_67099_111823_2018-2020.pdf

Units of state administration include central and subnational governments. Namely, these are all central, autonomous and municipal units and all non-profit organisations operating under their control. The central apparatus of the state - ministries, sub-departmental institutions included in the system of the ministry, legal entities of public law operating under the ministry's control, and other budgetary organisations implementing public administration belong to the general government. The sub-national government includes the bodies of autonomous republics and municipalities, the legal entities of public and private law established by them, and other budgetary organisations. Apart from the units implementing specifically public administration-related issues, it also covers organisations included in the legislative (Parliament) and judiciary. The latter serves the purpose of public sector statistics production and analysis.

Figure 1. The structure of the public sector
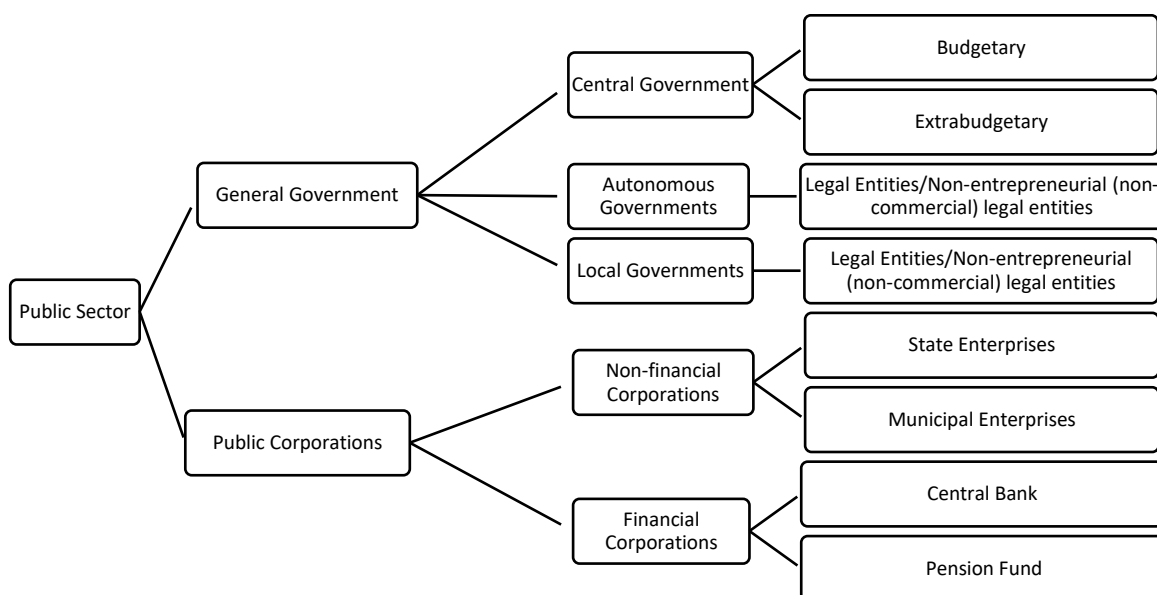
Source: International Monetary Fund; Finance Ministry of Georgia

As for public corporations, they are divided into financial and non-financial. Financial corporations include entities involved in financial and pension fund services. These entities are Central Bank, Pension Agency and other institutions providing financial services. As for the public sector's non-financial corporations, they consist of state and municipal enterprises.

Dynamics of employment in the public sector in Georgia

The units discussed above create demand from the public sector to the labour market. However, their contribution to the latter is much smaller than that of the private sector. During the last decade,

the public sector employed an average of 17.6% of the workforce and 22.5% of total employment in Georgia. As of 2021, 316.2 thousand able-bodied people were employed in the public sector, which is an increased rate compared to previous years. For example, in 2020, the public sector employed 281.9 thousand people, which was 5.0 thousand more than in 2019 (see Figure 2). Throughout this time, employment in the public sector has increased not only in absolute terms but also in relative terms. In 2021, the public sector's share in total employment was 24.8%. This indicator amounted to 23.1% in 2018-19. During the last decade, the index was at its lowest in 2014 - at 20.6%. Therefore, the private sector's role has decreased along with an increased share of the public sector. The latter's decline was expressed not only in relative terms but also in absolute terms. In 2021, the private sector employed 916.0 thousand of able-bodied persons. The same indicator consisted of 947.1 thousand people in 2020. It was in 2016 when the largest number of people,1,022.6 thousand people, were employed in the private sector during the last 10 years.

Figure 2. Distribution of employees in Georgia by the institution (thousands)
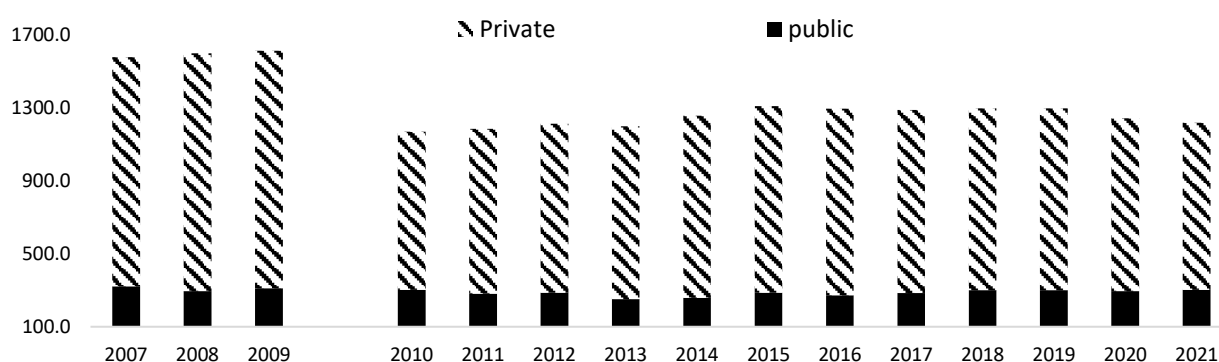
Source: National Statistics Office of Georgia

For a broader picture of public sector employment, it is necessary to analyses the real government spending per employee. This reflects the average supply of goods and services provided by one bureaucrat. Real government spending per employee is calculated using equation (1):

$$PerGW = ((e^g + nA^g + fA^g) / CPI)) / pEm$$

(1)

The distribution of real government expenditure per employee in the public sector ($PerGW$) is equal to the the sum of current expenditure (e^g), non-financial assets (nA^g) and the growth of financial assets (fA^g), all indexed by consumer prices (CPI), to the number of employees in the public sector with (pEm).

Figure 3. Real government spending per public sector employee in Georgia (CPI 2010 =100)
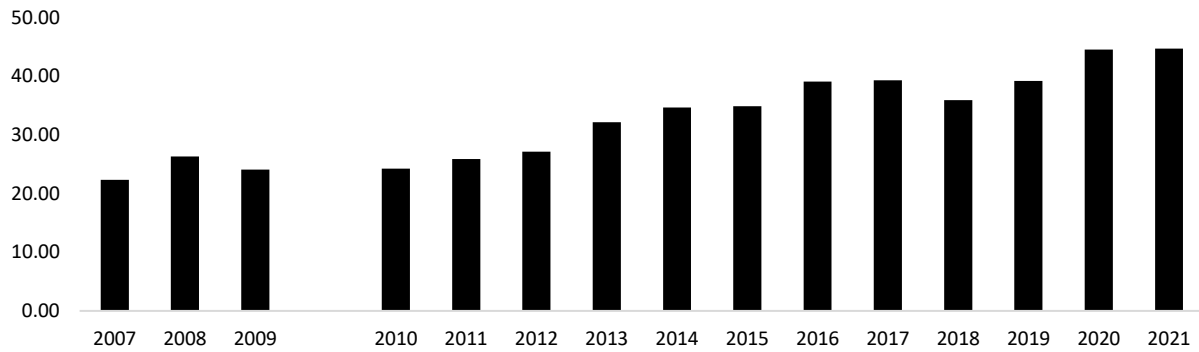
Source: Author's calculations using data from the National Statistics Office of Georgia, Ministry of Finance

In the last decade, the amount of real expenditure per employee in the public sector has increased (see Figure 3). In 2012-2021, the increase was 64.8%. This means that relatively fewer resources are used to provide goods and services by the private sector. However, to assess the scale of employment in the public sector, it is necessary to analyse it from a comparative perspective. In particular, the size of human resources used in goods and services provided by the public sector is defined as follows:

$$PerGW_j = ((e_j^g + nA_j^g) / PPP_j^c)) / pEm_j$$

(2)

where $PerGW_j$, the distribution of real government expenditures per employee of the public sector of country j is defined as the ratio of total real government expenditures to the number of employees in the public sector, pEm_j. Total government expenditures are the sum of current expenditures, e_j^g and growth of non-financial assets, nA_j^g. In order to make the data comparable, government expenditures are weighted by the purchasing power parity conversion index, PPP_j^c.

Scandinavian countries are distinguished by a high share of the public sector in the labour market. For example, as of 2019, 30.7% of Norway's total employment is in the public sector. This indicator is 28.7% and 27.6% in Sweden and Denmark, respectively. Japan stands out with a low share rate in the public sector - 5.9%. In South Korea, this figure is 8.1% (OECD, 2021). Although the public sector's share in the Nordic countries' labour market is high, the government is very active in providing goods and services here. As a result, government spending exceeds 50.0% concerning the entire economy. As for South Korea and Japan, government spending is relatively small but exceeds the level of Georgia or the countries in the region. In South Korea, government spending is

38.1% of the total economy. In Japan, this figure is 47.3% (OECD, 2021). Thus, the Japanese public sector produces and delivers goods and services most efficiently, using the least resources.

Figure 4. Real Government Expenditure per Public Sector Employee (constant prices, purchasing power parity, thousand dollar)
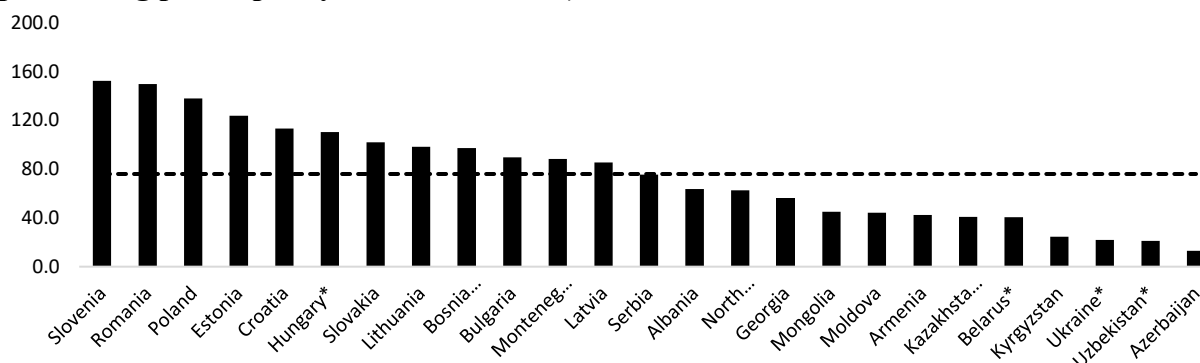
Source: World Bank, International Monetary Fund, International Labour Organization, Author's calculations.
Note: The calculation is based on 2019 data. However, * indicates that for these countries, the data for 2019 is unavailable; therefore, the latest available is used.

As for the human resources used by the public sector in Georgia, it is helpful for a comparative analysis to consider the latter concerning transitional economies. In this direction, Slovenia and Romania occupy good positions (see Figure 4). In these countries, for producing and delivering goods and services, the public sector uses twice as little human resources as the average of former socialist economies. The practice is similar in other EU member states, such as Poland, Estonia, Croatia, Hungary, etc. On the other hand, the Georgian public sector uses more human resources than other countries in transition on average. Compared to Georgia, other former Soviet countries employ more human resources in the public sector. For example, the public sector in Azerbaijan uses six times more human resources than the average to produce and deliver goods and services. And in Uzbekistan - four times more. Ukraine and Kyrgyzstan utilize human resources three times higher than the average among the former Soviet republics. Thus, from a comparative perspective, the public sector in Georgia employs more people than is needed to provide the given public goods and services.

Determinants of public sector employment in FSC

Let us discuss the factors of public sector employment in transitional countries. As a rule, digitization and electronic provision of public services should save resources. Among others, such resources include human capital. However, politicians are not naturally virtuous, focused on maximizing social benefits, but rent seekers. Furthermore, rent-seeking in the labour market manifests itself in creating more profitable jobs for those with political power. Thus, our research interest is the

impact of public services online provision, e-governance and institutional development on public sector employment levels. The rule of law plays a leading role in institutional development. This implies a limited and balanced power of the government. Under such conditions, there is less opportunity for rentiers to create jobs in the public sector and, thus, to maintain power. The strategy for transition economies to study this empirically is based on the following equation:

$$PerGW_j^{-1} = \alpha + \beta_1 X_j + \beta_2 Z_j + \varepsilon$$

(3)

where, equation (3) is a multiple regression estimated by the least squares estimator. The left side, $PerGW_j$, is the distribution of real government expenditures per employee in the public sector of j-the countries. On the right-hand side of equation (3), X is the vector of independent variables of our interest, and Z combines the control variables.

To study the employment level in the transition economies' public sector, we used the inverted index of the real government expenditure per employee of 25 former socialist countries (based on 2019 data). The growth of this indicator means that a country's public sector uses more human resources to provide goods and services. Thus, this indicates that the level of public sector employment is high. In addition, UN indexes are used as variables of e-government and online services (UN, 2020), and the quality of institutions is measured by the five-year average (2017-2021) of governance indicators (Kaufmann *et al.*, 2011). In addition, in the institutions part, we use the democracy index, which combines the electoral process, civil rights, government functioning, political participation and political culture (Economist Intelligence, 2020).

For the selection of transition countries, it is expected that the indicator of the impact of electronic and online services on public sector employment will be negative. However, this dependence is not systematic, as the coefficients estimated by equation (3) are not statistically significant. Therefore, in contrast to the institutional variables, e-government and online services are not statistically significant explanations for the variation in employment in the public sector of transitional countries. The impact of the aggregate indicator of the quality of institutions on employment in the public sector is negative (including the rule of law). Namely, the higher the degree of institutional development - political stability and accountability, limited and balanced government power – the less is the index of the goods and services produced public sector and usage of the human resources for its provision. A similar statistically significant influence is revealed in the case of democracy. There is a positive, statistically significant relationship between the democracy index and real government spending per official in transitional countries. However, such a connection's size is smaller than in the case of institutions (including the rule of law).

Table 1. Descriptive statistics of dependent and independent variables

Variable	Definition	Source/Year	Minimum	Average	Standard Deviation	Maximum	Obs.
Expenditure per public servant	Ratio of total real government expenditures to the number of employees in the public sector	Author's calculations using data from the WB, IMF, ILO; 2019	12.98	76.04	41.3	152.53	25
Public employment	Share of public employment in total employment	ILO; 2019	14.44	25.76	11.98	76.58	25
Institutions	Aggregated institutions	WGI; five-year average (2017-2021)	-0.99	0.07	0.61	1.25	25
Rule of Law	The rule of Law	WGI; five-year average (2017-2021)	-1.09	0	0.67	1.32	25
Democracy	Democraxy Index	Economist Intelligence ; 2020	2.01	5.8	1.56	7.9	25
E-governance	E-Government Development Index	UN E-government knowledgebase ; 2020	0.5	0.73	0.09	0.95	25
Online Services	Online Service Index	UN E-government knowledgebase; 2020	0.27	0.7	0.15	0.99	25
Natural Resources	average rate of natural resource rent over the last ten years	World Bank; 2012-2021	0.25	4.68	7.59	26.02	25
Fractionalisation	The probability that randomly selected individuals belong to different ethnic groups.	Alesina *et al.* (2003)	0.12	0.4	0.17	0.68	25
Decentralisation	share of own revenues in general government revenue	IMF; 2019	0.01	0.1	0.07	0.29	25

Source: Author's calculations

Table 2. OLS estimation of the inverse Real Government Expenditure per Employee, Equation 3

	1	2	3	4	5	6	7	8	9	10	11	12
Natural resources	0.001[b]	0.001[a]	0.001[b]	0.001[b]	0.001[a]	0.001[b]						
Ethnic fractionalization	-0.014	-0.014	-0.012	-0.015	-0.014	-0.012						
E-governance	-0.014	-0.027	-0.052				0.022	0.003	-0.041			
Aggregated institutions	-0.013[c]			-0.014[c]			-0.024[c]			-0.017[c]		
The rule of Law		-0.009[c]			-0.011[c]			-0.018[c]			-0.014[b]	
Democracy index			-0.004[c]			-0.005[c]			-0.008[c]			-0.008[a]
Online serives				-0.009	-0.012	-0.022				-0.028	-0.034	-0.038
Decentralization							-0.068	-0.074	-0.072	-0.109	-0.117[c]	-0.105[c]
R^2	0.66	0.64	0.65	0.66	0.64	0.63	0.50	0.45	0.58	0.53	0.50	0.62
N	25	25	25	25	25	25	16	16	16	16	16	16

Source: Author's calculations. Notes: a – P ≤ 0.01, b – P ≤ 0.05, c – P ≤ 0.1

In addition, we used control variables in the regression analysis, which for our sample, explains most of the variation in the level of employment in the public sector. Such is natural resources. Namely, there is a statistically significant positive relationship between the average rate of natural resource rent over the last ten years (World Bank, 2022) and employment in the public sector concerning the gross domestic product. This is explained by the fact that in the case of transitional countries, natural resources are owned and managed by state companies, and employment in those organisations belongs to the public sector. For example, the highest public sector employment in the sample is in Azerbaijan, the whose leading sector of the economy is the oil and gas industry. State companies represent the latter.

As Brennan and Buchanan claim (1980, p. 216), "in other equal environment, the more decentralized spending and taxation are, the less the government is involved in the economy as a whole." Not only costs and the extent of regulation but also public employment is considered here. Thus, the indicator of income decentralization is used as a control variable, the source of which is the International Monetary Fund (IMF, 2022). In this case, the expected coefficient is negative but not always statistically significant. Another control variable is ethnic fractionalization (Alesina *et al*., 2003). Alesina *et al*. (2000) demonstrated that cities with high levels of ethnic fragmentation also have high levels of public-sector employment. However, such a correlation was not found in our analysis.

We used the approach of changing a dependent variable to test the power of the above results. Namely, in equation (3), we used the inverse indicator of the real size of the government per employee as a measure of public sector employment. In this case, the dependent variable is the share of the public sector in total employment, and the analysis is based on the following equation:

$$Y_j = \alpha + \beta_1 X_j + \beta_2 Z_j + \varepsilon$$

(4)

Only the left side is changed in equation (4). Namely, Y_j, is the share of the public sector in the total employment of j-th countries.

Table 3. The share of the public sector in total employment as a dependent variable, Equation 4

	1	2	3	4	5	6	7	8	9	10	11	12
Natural resources	0.664[b]	0.772[a]	0.499[b]	0.764[b]	0.830[a]	0.554[b]						
Ethnic fractionalization	-16.463	-16.021	-16.211	-19.489	-18.832	-20.717						
E-governmance	15.577	-4.809	20.778				114.978	69.810	75.211			
Aggregated institutions	-1.440[c]			2.695[c]			-20.597[c]			-7.246[c]		
The rule of law		2.515[c]			4.207[c]			-10.948[c]			-2.992[b]	
Democracy index			-1.780[c]			-0.804[c]			-8.926[c]			-7.009[a]
Online services				-16.000	-19.045	-10.199				9.816	0.169	19.998
Decentralization							18.270	8.730	19.485	-2.533	-9.825[c]	13.027[c]
R^2	0.23	0.24	0.26	0.26	0.28	0.26	0.22	0.08	0.49	0.07	0.02	0.36
N	25	25	25	25	25	25	16	16	16	16	16	16

Source: Author's calculations Notes: a – $P \leq 0.01$, b – $P \leq 0.05$, c – $P \leq 0.1$

The left side of Equation (4) is the same as in Equation (3). And the share of the public sector in total employment, as a dependent variable, mostly recurs under the conditions. In this case, e-government and online services do not have a statistically significant impact, while the results mostly recurred in the case of institutions. As for democracy, according to Equation (3), it fully shares the obtained results. The case is the same for natural resources and ethnic fractionalization. The impact of natural resources on public sector employment is statistically significant and positive. As for the ethnic fragmentation, the coefficients have the expected negative signs but are statistically non-significant. Concerning decentralization, the estimates obtained by equation (4) are relatively vague and unambiguous influence is not revealed.

Conclusion

Politicians are expected to choose a path where the government is the employer rather than the private sector while fighting unemployment. This is because of the fact that they are not involved in the maximization of social welfare but in the search for rent. In this case, rent is non-monetized, political power, and the mean for influential groups to achieve job creation and ensure political stability. This kind of thing also manifests in Georgia's public sector and reflects the latter's employment rate. Considering total government spending, we conclude that public sector employment is high because more resources are used to provide goods and services than in transitional economies like Georgia on average. On the other hand, employment growth in the public sector has a detrimental effect on the labour market and the economy as a whole.

Thus, the public sector employment growth is a rent-seeking phenomenon by politicians. It is more characteristic of countries with low institutional development and democracy. In such conditions, political power is less limited, and the principle of balancing and restraining the government is disrupted. The latter is a favorable condition for the rent-seeking politician. This is revealed in our analysis of the determinants of public sector employment in transitional countries, as well.

References

Alesina, A., Baqir, R., and Easterly, W. (2000), Redistributive Public Employment, *Journal of Urban Economics*, 48(2), pp. 219–241. https://doi.org/10.1006/juec.1999.2164.

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., and Wacziarg, R. (2003), Fractionalization, *Journal of Economic Growth*, 8, pp. 155–194. https://doi.org/10.1023/A:1024471506938.

Algan, Y., Cahuc, P., and Zylberberg, A. (2002), Public employment and labour market performance, *Economic Policy*, 17(34), pp. 7–66. https://doi.org/10.1111/1468-0327.00083.

Becker, G. S. (1983), A Theory of Competition Among Pressure Groups for Political Influence, *The Quarterly Journal of Economics*, 98(3), 371. https://doi.org/10.2307/1886017.

Behar, A., and Mok, J. (2013), Does Public-Sector Employment Fully Crowd Out Private-Sector Employment? *IMF Working Papers*, 13(146), i. https://doi.org/10.5089/9781484329412.001.

Brennan, G., and Buchanan, J. M. (1980), *The power to tax: Analytic foundations of a fiscal constitution*, Cambridge University Press.

Demekas, D. G., and Kontolemis, Z. G. (2000), Government Employment and Wages and Labour Market Performance, *Oxford Bulletin of Economics and Statistics*, 62(3), pp. 391–415. https://doi.org/10.1111/1468-0084.00177.

Economist Intelligence (2020), *Democracy Index*. Economist Intelligence Unit. (retrieved from https://www.eiu.com/n/campaigns/democracy-index-2021/).

Gelb, A., Knight, J. B., and Sabot, R. H. (1991), Public Sector Employment, Rent Seeking and Economic Growth, *The Economic Journal*, 101(408), 1186. https://doi.org/10.2307/2234435

Hillman, A. L., and Ursprung, H. W. (2016), Where are the rent seekers? *Constitutional Political Economy*, *27*(2), pp. 124–141. https://doi.org/10.1007/s10602-016-9211-0.

Holmlund, B., and Lindén, J. (1993), Job matching, temporary public employment, and equilibrium unemployment, *Journal of Public Economics*, 51(3), pp. 329–343. https://doi.org/10.1016/0047-2727(93)90069-6.

IMF (2014), Government finance statistics manual 2014. in *www.imf.org* (No. 978-1-49837-916–8). International Monetary Fund, Publication Services.

IMF (2022), *Fiscal Decentralization* [Dataset].

Jaimovich, E., and Rud, J. P. (2014), Excessive public employment and rent-seeking traps. *Journal of Development Economics*, 106, pp. 144–155. https://doi.org/10.1016/j.jdeveco.2013.09.007

Jim Malley, and Thomas Moutos. (1998), Government Employment and Unemployment: With One Hand Giveth, The Other Taketh, *Research Papers in Economics*.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2011), The Worldwide Governance Indicators: Methodology and Analytical Issues, *Hague Journal on the Rule of Law*, 3(2), pp. 220–246. https://doi.org/10.1017/s1876404511200046.

Krueger, A. O. (1974), The Political Economy of the Rent-Seeking Society, *The American Economic Review*, 64(3), pp. 291–303.

Laband, D. N., and Sophocleus, J. P. (2018), Measuring rent-seeking, *Public Choice*, 181(1–2), pp. 49–69. https://doi.org/10.1007/s11127-018-0566-9.

Melo, V., and Miller, S. M. (2022), Estimating the Effect of Rent-Seeking on income distribution: an analysis of U.S. States and Counties. *Public Choice*, 192(1–2), pp. 99–114. https://doi.org/10.1007/s11127-022-00973-7

OECD (2021), *Government at a Glance 2021*, OECD Publishing, Paris. https://doi.org/10.1787/1c258f55-en.

Olson, M., Jr. (1968), *The Logic of Collective Action* (1st THUS), Schocken Books.

Robinson, J. A., and Verdier, T. (2013), The political economy of clientelism. *The Scandinavian Journal of Economics*, 115(2), pp. 260–291. https://doi.org/10.1111/sjoe.12010.

Tullock, G. (1967), The welfare costs of tariffs, monopolies, and theft, *Economic Inquiry*, *5*(3), 224–232. https://doi.org/10.1111/j.1465-7295.1967.tb01923.x.

UN (2020), *UN E-Government Survey 2020: Digital Government in the Decade of Action for Sustainable Development* (eISBN: 978-92-1-005145-3), United Nations.

World Bank (2022), *World Development Indicators* [Dataset].

Companies' market adaptation strategies in the academic literature

Maria-Magdalena MAFTEI[*], Gina-Ionela BUTNARU[**]

Abstract

Adapting to market changes is the lifeblood of any business. In the context of an increasingly dynamic environment, the need for a company to survive, adapt, and perform in the marketplace requires innovative strategies supported by digitalization. Developing the entrepreneurial behavior of human capital and maximizing the company's financial performance requires continuous learning, time management, and building strong and constructive relationships. In this study, an up-to-date review of the specialized literature sets the stage for classifying companies' market adaptation strategies into internal and external strategies. Thus, the results obtained are in line with the company's objectives to identify strategies for market adaptation in a dynamic and challenging environment. Among them, innovative strategies to adapt the company to the market, based on education and experience, have long-term positive effects on economic growth and development in the field.

Keywords: business administration, strategic adaptation, strategies, companies market

Introduction

In the context of globalization, current studies examine the adaptability that generates economic performance to identify the best strategies for entrepreneurs and managers. Studying companies' adaptability Harries (2021, p. 1) believes that a dynamic small business sector contributes to increased competitiveness and innovation, prevents economic stagnation, and supports the growth of developing economies. Thus, due to the ever-changing economic context, the adaptive strategies of companies in the service sector require the constant attention of academic researchers.

Strategic entrepreneurship involves the efficient use of resources to adapt to the market by exploiting market opportunities to sustain the firm's performance. The resource orchestration theory analyzed by Baert *et al*. (2016, p. 346) emphasized the role of entrepreneurs and managers in managing firm resources to achieve strategic objectives.

---

[*]Maria-Magdalena MAFTEI is PhD student at IOSUD - Business Administration, "Ștefan cel Mare" University of Suceava, Romania, e-mail: mariamagdalenamaftei@gmail.com.
[**]Gina-Ionela BUTNARU is Professor Dr. Habil. at Faculty of Economics and Business Administration, "Alexandru Ioan Cuza" University of Iasi, Romania, e-mail: gina.butnaru@uaic.ro.

Considering the complexity of this research topic based on the evolution of entrepreneurial activities over time and previous research, the objective of this study is to identify the innovative adaptation strategies of companies in the market. Such a study can be an important contribution to the specialized literature.

The study will be structured in 4 sections: the first section presents a review of specialized literature regarding the company's market adaptation phenomenon and the most important firms' adaptation strategies to the market in general; the second part presents the methodology applied in this study; the third section presents the results and discussions on the main strategies adopted by managers and owners of companies in the last decade, taking into account the difficulties and crises that characterized this period. The last part presents the main conclusions, theoretical and practical implications, limitations of the study, and new directions for future research.

1. Literature review

In business management, the internal and external conditions of organizations determine their better maturation, by adapting to an ever-changing environment and increasing financial performance. The organization manages its ability to adapt to new market changes by learning from past experiences (Araújo *et al.*, 2021, pp. 1252-1246). "Adaptive organizational behavior involves learning and action, based on adaptation and renewal to cope with environmental changes" (Martin-Rios and Pasamar, 2018, p. 5). Thus, studies in psychology show that learning "is a systematic activity, guided by an organized framework, whose objective is the accumulation of knowledge and the formation of character and personality", while internal and external conditions generate the achievement of the desired results (Sălăvăstru, 2004, p.14).

According to Moi and Cabiddu (2021, p. 1148) adapting to market changes and anticipating industry trends can be considered as "the ability to proactively perceive and respond to market signals, continuously learn from market experiences, and integrate and coordinate resources across networks." Thus, Barcik (2018, p. 128) considers competition as an important factor in economic development, and thus an important factor in the process of adapting companies to the market. Gomes *et al.* (2018, p. 1) define adaptation strategy as "a company's decision to change the elements of its internal marketing mix to attract specific foreign markets" in the context of globalization.

The success of the company depends on the internal capabilities to respond quickly and efficiently and adapt to the influence of external factors, to ensure strategic stability in a turbulent business environment (Zaitseva, 2017, p. 158). Therefore, adaptation involves the interaction between

two entities: the individual/organization/system and its external or internal environment. The result is a re(self) organization through different strategies starting from the need to survive, to compensate, to innovate, to educate mediated by a vital decision-making process (Simonet, 2010, p. 6) with the aim of the organization's thriving. In this sense, Grant (2021, p. 9) concludes that adaptation implies the coherence of a company's strategy with the external environment and with its internal environment.

In an unpredictable and constantly changing environment, the ability to meet the demands of the market is an important factor in the activity of companies and their development. The ability to adapt to the new reality allows companies to survive and aspire to a leadership position.

Sánchez *et al*. (2011, p. 15) stated that strategic adaptation can be considered a process consisting of a series of external and internal responses. According to them, the company's adaptation strategies to the market are realized through internal reactions such as: (1) redefining the company's architecture, (2) updating the organizational chart, (3) incorporating new knowledge, (4) updating processes, (5) introducing new incentive systems for employees, (6) changing the company's culture. External responses are embodied in market adaptation strategies focused on the outside of the company such as (1) new and differentiated products/services, (2) relationships with new suppliers and customers, (3) vertical integration or disintegration, (4) expansion or contraction of internal markets etc.

At the same time, strategic adaptation can be seen as a dynamic process of adjusting to environmental change and uncertainty, to maintain effective adaptation to them while internal interdependencies can be addressed, through internal market adaptation strategies, such as (1) process development, (2) product development, (3) research or (4) creating a new organization (Borowski and Kupczyk, 2015, pp. 7-25).

Knowledge strategies should be created taking into account the internal and external business environment, and decision-makers should reconsider the strengths and weaknesses of the company to identify new opportunities and threats, especially in times of crisis (Bratianu and Bejinaru, 2020, p.13). Marketing agility feeds into this planning (Moi and Cabiddu, 2020, p. 2) to commit resources that enable companies to adapt their strategies to the ever-changing global market demands (Gomes *et al*., 2020, p. 1). Sinha and Sinha (2020, p. 20) concluded that sustainable business growth is the merit of an "innovation process through agile strategies and responsible leadership" in a "volatile, uncertain, complex and ambiguous" environment (U.S. Army Heritage and Education Center, 2022).

Hossain *et al*. (2022, p. 10) divide firms' market adaptation strategies into *short-term strategies* and *long-term strategies*.

Short-term strategies describe the threats that the company faces in the market related to financial liquidity and supply chain disruptions. Kahveci (2022, p. 5) mentions short-term strategies such as cutting costs, postponing or canceling current investments, professional training programs, using consulting services, seeking new sources of financing, reducing rents or closing jobs, freezing wages, reducing employees' working hours, reducing wages. These strategies are used by all companies, especially in times of crisis. Crises can be classified as follows: environmental crises, socio-political crises, health crises, technology-related crises, and economic-related crises (Mihalciuc, 2022, p. 3).

The health crisis caused by Covid-19 has intensified studies in 2020-2021. For example, Li *et al*. (2021, p. 2) identified 4 response strategies to this health crisis: retreat strategy, persistence strategy, innovation strategy, and market exit strategy. Adaptation strategies, as observed by Ratten and Jones (2021, p. 7) are classified considering the time of onset of the crisis, as follows: strategies before the crisis, strategies during the crisis, and strategies after the crisis. According to the authors, these crises are considered as an opportunity to rethink the strategies of the company by completely reorienting the original strategies and focusing on new initiatives, which include introducing new business models, rapidly changing the global supply chain, and strengthening the team. Strategies used during the crisis include creating local communities and supporting them, digital technology, networking, global strategies, entrepreneurial education for economic growth, maintaining the environmental balance, and social justice. In addition, Mazorodze and Buckley (2020, p. 6) recommend creating communities of practice, implementing mentoring, and storytelling, creating succession plans, coaching, and finally developing domain-specific knowledge.

Long-term strategies represent the company's capabilities and target long- and medium-term results, as follows: (1) creation of new products/services, (2) identification of new markets, (3) focus on the local market and new customer niches, (4) creation of loyalty programs, (5) implementation of technological and digital innovations, (6) innovative marketing plans. The results obtained by Luamba *et al*. (2021, p. 430) led to the identification of 3 growth strategies for companies: adaptation to change, marketing planning, and technological innovation. In this context, business strategies (OECD and Eurostat, 2018, p. 106) express the ability of a company to innovate.

Therefore, market adaptation strategies are developed starting from the following components (Eurostat, 2018, p. 3) described in Table 1: (1) price, (2) quality, (3) market leadership, risk approach (engagement in high-risk, high-reward activities versus favoring low-risk activities), (4) degree of openness (seeking new collaborative partners versus building close and stable relationships with key partners), (5) transformation (seeking new business models versus continuous improvements of the

existing business model), (6) focusing on a single product market versus (7) simultaneously serving multiple markets.

Table 1. Components describing the market adaptation strategies of an innovative company

No.	Innovative company market adaptation strategies
1.	Focus on improving existing goods or services
2.	Focus on introducing new goods or services
3.	Focus on low prices (price leader)
4.	Focus on high quality (quality leader)
5.	Focus on a wide range of goods or services
6.	Focus on one or a few important goods/services
7.	Focus on standardized goods or services
8.	Focus on customized solutions
9.	Focus on satisfying established customer groups
10.	Focus on reaching new customer groups
11.	Focus on improving existing organizational processes
12.	Focus on introducing new organizational processes
13.	Focus on new business models
14.	Focus on building close and stable relationships with partners
15.	Focus on finding new collaboration partners

Source: author's elaboration based on Eurostat (2010, 2018)

According to Havlovska *et al*. (2020, p. 1053), the strategic approach to adaptation is key to achieving positive long-term results and can become a factor of competitive advantage (Borowski, 2013, p. 1).

The adaptation process can be observed and analyzed in companies that are at least seven to ten years old, and the results obtained can be tested for this appropriate time frame in which performance can be measured (Sánchez *et al*., 2011, p. 20). Thus, the results and performance achieved by the company are visible in the long term through the profit balance and the salary level of the employees (Galloway and Brown, 2002, p. 403). At the same time, they enable the calculation of performance indicators in companies and the evaluation of the success of strategies implemented in the long term (Irimiaș, 2021, p. 160). In addition, business performance, according to Cho and Lee (2018, p. 128) can be divided into two categories, financial performance and non-financial performance, performances measured by different indicators of economic profitability. In this sense, strategy is defined by how the company uses its resources and capabilities to achieve its objectives (Conti and

Pencarelli, 2017, p. 141), through a set of internal activities determined by shareholders and managers, in a specific industry as an external environment (Nonaka and Takeuchi, 2021, p. 5).

2. Methodology research

According to Zaiţ and Spalanzani (2006, p. 140) the methodology used in the study, involves a methodological approach through an explanatory content analysis. The results obtained will describe the important concepts identified in the literature related to the company's adaptation strategies to the market. The review of the literature used electronic primary information sources such as scientific articles on the company's adaptation strategies to the market. This information validates the collected information due to the credibility of the selected research, through the possibility of mentioning and recognizing the sources used and also due to the systematic control of the information presented by the professionals (Irimiaș, 2021, p. 171).

In the first phase of the study, a review of academic literature was elaborated (Hossain *et al.*, 2022, p. 1). The study used a protocol that involved establishing selection criteria (Rosalina *et al.*, 2021, p. 135) for a qualitative content analysis of articles returned from academic databases. Recent publications or scholarly articles from 2008-2021, were selected to demonstrate the timeliness of a topic. The following selection criteria were established: level of organizational analysis, focus on the adaptation phenomenon, the role of knowledge and experience in the adaptation process, and the goals and achievements of the companies.

In the second phase, a detailed qualitative analysis of the scientific articles was carried out, the processing of which was done using the Microsoft Office package (Excel and Word). The workflow included: the identification of keywords, the identification of the strategies used by the companies, the identification of the actors involved, and the synthesis of the results obtained.

In the third phase, the technique of data extraction (Bar-Ilan, 2008, p. 10) enabled the regular review of the targeted literature (2021-2022) and its improvement through the acquisition of additional relevant information, including the identification of new sources of information and the study of trends.

3. Results and discussion

Companies' market adaptation strategies, especially under the direct influence of external factors and internal factors of the company, were extracted from scientific articles published online

during the period 2008-2021. These strategies consider education, innovation, sustainability, behavior, entrepreneurship, local development, communication, service quality, and transformative experiences (Table 2).

Table 2. Synthesis of the market adaptation strategies for the companies

Adaptation strategies regarding:	Author	Year
The quality of service activities	Vena-Oya *et al.*	2021
Increasing volume of hikers and shorter stays	Kristiana *et al.*	2021
Creativity and innovation	Mínguez *et al.*	2021
Increase spending, increase in direct, indirect, or induced income	Beata *et al.*	2021
Education, research, development	Maftei and Kicsi	2021
Creativity and innovation, co-creation and knowledge	Haller *et al.*	2020
Innovation (technological, digital, social)	Arrobas *et al.*	2020
Entrepreneurship and sustainability	Wilson	2020
Communication	Pung and Del Chiappa	2020
Transformative service	Ramazanova *et al.*	2018
Sustainable development of the region	Butnaru *et al.*	2018
Institutional measures at the national and international levels	Li and Chuan	2012
Lasting development	Li and Chuan	2012
Education	Lyons	2008

Source: author's elaboration

The qualitative analysis of the selected articles allowed the identification of difficulties and challenges faced by firms in general. The analysis of the specialized literature regarding the difficulties and challenges faced by companies on the market allows the classification of the firms' adaptation strategies into two categories: internal and external (Table 3).

Table 3. Companies' market adaptation strategies in the last decade. Summary of the academic literature

Level of analysis	Market adaptation strategies by areas of analysis	Author
Internal Level	Education	Li and Chuan, 2012; Cleland *et al.*, 2015; Beata *et al.*, 2021; Harries, 2021; Vodă *et al.*, 2020; Sarta *et al.*, 2020; Bratianu and Bejinaru, 2020; Mínguez *et al.*, 2021; Beata *et al.*, 2021; Quansah and Hartz, 2021

	Innovation	Sánchez *et al*., 2011; Badulescu *et al*., 2018; Gismera Tierno *et al*., 2020; Badea *et al*., 2020; Vodă *et al*., 2020; Kristiana *et al*., 2021; Mínguez *et al*., 2021; Maftei and Kicsi, 2021; Araújo *et al*., 2021
	Education and entrepreneurial experience	Sánchez, 2011; Özarallı and Rivenburgh, 2016; Vodă *et al*., 2020; Sarta *et al*., 2020; Gismera Tierno *et al*., 2020; Harries, 2021
	Entrepreneurship	Lafuente-Ruiz-de-Sabando *et al*., 2018; Fernandes *et al*., 2018; Gismera Tierno *et al*., 2020; Badea *et al*., 2020; Vodă *et al*., 2020; Sarta *et al*., 2020
	Financial resources	Haller, 2012; Sarta *et al*., 2020
	Human Resources (HR)	Ulman *et al*., 2021
	Economic performance	Haller *et al*., 2020
External Level	The political and economic environment	Sarta *et al*., 2020
	Competition	Barcik, 2018; Vodă *et al*., 2020
	Sustainable Development	Li and Chuan, 2012; Ramazanova *et al*., 2018; Badulescu *et al*., 2018; Ulman *et al*., 2021; Arrobas *et al*., 2020
	The institutional environment	Butnaru *et al*., 2018; Sarta *et al*., 2020; Harries, 2021
	Market	Pung and Del Chiappa, 2020; Vodă *et al*., 2020; Sarta *et al*., 2020;
	Networking	Vodă *et al*., 2020; Badea *et al*., 2020

Source: author's elaboration

The companies' market adaptation strategies are the key to achieving competitive advantages and long-term performance. Organizations in an ever-evolving context adapt, according to Kristiana *et al*. (2021, p. 213) through continuous creativity and innovation. Innovation and entrepreneurship have been considered since the beginning of the 20th century as generators of economic growth, (Schumpeter, 1972). Innovation, technical or social, represents a factor of progress in the evolution of humanity and is determined by the creativity of the individual, according to Burciu (2008, p. 76). Innovation strategies are developed through internal and external factors of the organization (Araújo *et al*., 2021, p. 1246) determining the adaptation of the company to the market and obtaining results. Also, active involvement in partnerships and relationships with a wide range of stakeholders, creating

strong links with business incubators, technology parks, and other external initiatives are considered necessary educational components for innovative companies (Badulescu *et al.*, 2018, p. 102). Technological and digital innovation in the educational environment (Lafuente-Ruiz-de-Sabando *et al.*, 2018, p. 8) aims to offer academic programs and practical programs regarding the training of the future workforce, the human capital that will make a difference in economic growth and development. Innovation thus becomes a key endogenous process that enables companies to respond quickly and with better market performance. High-performing companies have above-average innovation management practices and develop innovative behavior (Sánchez *et al.*, 2011, p. 34).

Various strategies have been proposed in the literature to prevent, manage, and mitigate the negative effects that some companies face due to different types of crises. In the studies conducted by Bratianu and Bejinaru (2020, p. 14), strategies based on emotions and human values and strategies based on rational knowledge and economic data were identified. The comparative analysis of the two types of strategies was done starting from the analysis of criteria such as time perception and future dynamics, systemic thinking, prevailing logic, mental models, and the prevailing type of knowledge processes that help managers better adapt to the crises facing humanity. The response strategies to the different types of crises are crucial for the reputation of companies in the market and for the retention of customers.

Sarta *et al.* 2020 (pp. 43-67) consider adaptation as a "process of intentional decision-making by organizational members, leading to observable actions aimed at reducing the distance between the organization's environment and the economic and institutional environment in which it operates." Subsequently, Harries (2021, p. 1) analyzed the adaptation of companies in the context of natural crises. It identified the following statistically significant predictors regarding the adaptation of companies to the market, such as owner's education, gender (sex), age of the business, and business sector. Also, the determination of appropriate management strategies is attributed to the continuous education of leaders in the company, who are also agile and flexible. "In addition, they leverage time management processes, build strong and productive relationship networks, and create a positive, family-oriented workplace culture to increase the chances of survival" (Quansah and Hartz, 2021). According to Vodă *et al.* (2020, p. 24), self-reliance and networking have an important impact on entrepreneurial activity in both developed and less developed countries.

Currently, the adaptation process of companies is related to sustainable development and the flexibility of companies to adapt to a constantly changing environment through innovative strategies. A case study by Barcik (2018, p. 132) identified that a company's strategies can be built on three values: "sustainable development, quality, and leadership", which are found in the responsibility of the corporation "by providing a safe, healthy, and friendly working environment for employees,

producing products that promote a sustainable lifestyle and create sustainable infrastructures, efficient use of natural resources and high recycling rates, responsible use of the environment and limiting the impact on water, soil, and air quality, commitment, and active participation in the life of local communities". A sustainable society is prosperous if it is economically, socially, and environmentally prosperous (Ulman *et al*., 2021, p. 3).

The last decades have seen the educational environment as a promoter of the social mission of stimulating the local economy through the transfer of technology to local businesses (Tomasi *et al*., 2020, p. 1). Human capital development strategies are considered to be the most important for building the future alongside and with the help of digital technology (Nonaka and Takeuchi, 2021, p. 1). Education is considered to be one of the most important factors in economic growth (Li and Chuan, 2012, p. 509) and social growth (Beata *et al*., 2021, p. 806).

The creation of companies is essential to the development of a country, as it contributes to the dissemination of innovation, job creation, improved competitiveness, greater social cohesion, and well-being (Fernandes *et al*., 2018, p. 139).

Formal university education is necessary to stimulate entrepreneurship (Gismera Tierno *et al*., 2020, p. 1), and the educational environment is currently facing an important challenge to prepare the new generation for entrepreneurship (Özaralli and Rivenburgh, 2016, p. 26). Sánchez (2011, p. 239) considers important from a practical point of view for those developing entrepreneurial training programs, the development of entrepreneurial skills in addition to the knowledge and resources needed to start a business, as traditionally considered. As it emerges from the analysis of specialized literature, continuous education, and experience generate innovation, which is the key to the performance of economic agents and constitutes one of the basic strategies in the process of adapting the company to the market.

The education and experience of the company's employees can help increase the efficiency of the decision-making process through the company's market adaptation strategies. Experts can make better use of resources and express accurate insights to a much greater degree than non-experts (Righini, 2012, p. 74). However, the situations are so complex that they are considered new and unpredictable, and therefore the mixture of firms' market adaptation strategies can be considered a necessary option.

The context generated by the Covid-19 pandemic forced everyone's adaptation at the global level, especially companies in the service sector whose mission is the provision of satisfaction through human interaction (Mishra, 2021, pp. 175-198). Therefore, companies have applied "creative strategies" and "technological and digitization strategies" to adapt to market changes. Creative

strategies aim to survive by minimally changing business models, gaining social legitimacy, creating communities of social connection among customers, and educating these communities online. In the current context, companies have adopted a set of mixed strategies. For companies that chose to continue, persistence enabled (re)building trust with clients and, in some cases, generated higher performance. Many entrepreneurs considered the crisis an opportunity for growth and development.

Haller (2012, p. 71) presents one of the contradictions of development and progress in any economy. This contradiction describes the discrepancy between "limited resources (raw materials, power, production capacity, labor force, financial means) and productive and individual consumption needs, increasingly diversified and growing". Therefore, internal factors generate internal adaptation strategies that mainly relate to human capital and financial resources. External factors determine external adaptation strategies that take into account the network of actors (networking) that contribute to the creation of the product, the institutional environment, the market, competition, sustainability objectives, social responsibility, and interculturality.

The reconfiguration of the business environment to the new global reality can only be achieved if we have leaders oriented toward the adoption of innovative strategies aligned with the objectives of sustainable development (Maftei and Kicsi, 2021).

Conclusions, theoretical and practical implications, limitations, and future research

The strategic adaptation of the organization starts from the desire to create a better future, morally, with value for the company and shareholders on the one hand, and on the other hand, it is concerned with its customers and the community (Nonaka and Takeuchi, 2021, p. 1), citizens (Kaplan and Norton, 2004, p. 10).

The benefit of this research is to provide accurate, scientifically validated information on how companies adapt to market demands. We can acknowledge that this work contributes to the general business management literature and provides an understanding of how entrepreneurs and managers can adapt to the constant challenges of value creation and performance in a difficult business environment. The analysis of the strategies used by companies in each case provides additional details and information from the post-crisis reality and can be a source of recommended actions.

The limitations of the study relate to the intensive use of articles available online. It should be emphasized that most publications currently provide this access option, and therefore this option does not have a significant impact on the research results. However, the data presented contributes to the general understanding of the concepts described in the study and forms the basis for future research on firms' market adaptation strategies using specific bibliometric methods. Another important

research direction is to correlate the performance of market adaptation strategies with captured organizational outcomes (Martin-Rios and Pasamar, 2018, p. 3). The mix of these strategies in organizational activity targets performance, economic growth, wealth, and welfare and is reflected in business outcomes.

References

Araújo, M., Reis, L., and Morais, I. (2021), *Innovation Strategies for Adaptation of Organizations in a VUCA World*, Proceedings of the European Conference on Innovation and Entrepreneurship, 2, pp. 1245–1253. https://doi.org/10.34190/eie.21.162.

Arrobas, F., Ferreira, J., Brito-Henriques, E., and Fernandes, A. (2020), Measuring tourism and environmental sciences students' attitudes towards sustainable tourism, *Journal of Hospitality, Leisure, Sport & Tourism Education*, 27, 100273. https://doi.org/10.1016/j.jhlste.2020.100273.

Badea, L., Șerban-Oprescu, G. L., Dedu, S., and Piroșcă, G. I. (2020), The Impact of Education for Sustainable Development on Romanian Economics and Business Students' Behavior, *Sustainability*, 12(19), 8169. https://doi.org/10.3390/su12198169.

Badulescu, D., Perticas, D., Hatos, R., and Csintalan, C. (2018), Students' Entrepreneurial Skills and European HEI's Performance, in Entrepreneurship and Innovation: A Case Study, in: Staníčková, M., L. Melecký, E. Kovářová and K. Dvoroková (eds.), *Proceedings of the 4th International Conference on European Integration 2018*, Ostrava: VŠB - Technical University of Ostrava, 2018, 98-106.

Baert, C., Meuleman, M., Debruyne, M., and Wright, M. (2016), Portfolio Entrepreneurship and Resource Orchestration, *Strategic Entrepreneurship Journal*, 10(4), pp. 346–370. https://doi.org/10.1002/sej.1227.

Barcik, A. (2018), The Antitrust Compliance in Management Strategies of Enterprises – the European Perspective, in: Staníčková, M., L. Melecký, E. Kovářová and K. Dvoroková (eds.), *Proceedings of the 4th International Conference on European Integration 2018*, Ostrava: VŠB - Technical University of Ostrava, pp. 128-135 (retrieved from https://is.muni.cz/publication/1459476/ ICEI-2018_Proceedings.pdf).

Bar-Ilan, J. (2008), Informetrics at the beginning of the 21st century—A review, *Journal of Informetrics*, 2(1), pp. 1–52. https://doi.org/10.1016/j.joi.2007.11.001.

Beata, G., Jaroslav, B., Katarina, Z., Martin, R., and Ivankova, V. (2021), The Effect of Education

and R D on Tourism Spending in OECD Countries: An Empirical Study, *Amfiteatru economic*, 23(58), 806. https://doi.org/10.24818/ea/2021/58/806.

Borowski, P. (2013), *The strategy of adaptation as a mode of development in the contemporary companies on energy sector examples*, 2nd International Conference on Energy Systems and Technologies, Egypt, pp.1-8.

Borowski, P., and Kupczyk, A. (2015), Adaptation Strategy as a Direction of Firm Development in an Uncertain (Variable) Environment, *Journal of Emerging Markets*, 20(1-2), pp. 24-36.

Bratianu, C., and Bejinaru, R. (2020), COVID-19 induced emergent knowledge strategies, *Knowledge and Process Management*, 28(1), pp. 11-17. https://doi.org/10.1002/kpm.1656.

Burciu, A., Prelipcean, G., Bostan, I., Chasovschi, C., Hapenciuc, V., Roman, C., Popescu, M., and Vancea, R. (2008), *Introducere în management*, Ed. Economică.

Butnaru, G. I., Mironiuc, M., Huian, C., and Haller, A. P. (2018), Analysis of Economic Growth in Tourism Under the Impact of Terrorism and of the Waves of Refugees, *Amfiteatrul Economic*, 20(S12), 885. https://doi.org/10.24818/ea/2018/s12/885.

Cho, Y. H., and Lee, J.-H. (2018), *Entrepreneurial orientation, entrepreneurial education, and performance*, *Asia Pacific Journal of Innovation and Entrepreneurship*, 12(2), pp.124–134. https://doi.org/10.1108/apjie-05-2018-0028.

Cleland, V., Hughes, C., Thornton, L., Venn, A., Squibb, K., and Ball, K. (2015), A Qualitative Study of Environmental Factors Important for Physical Activity in Rural Adults, *Plos One*, 10(11), e0140659, pp.1-14. https://doi.org/10.1371/journal.pone.0140659.

Consiglio Nazionale delle Ricerche, & Istituto di Ricerca su Innovazione e Servizi per lo Sviluppo. (2018), *XXII Edizione 2017/2018 Rapporto sul Turismo Italiano*, Rogiosi Editore (retrieved from https://www.rogiosi.it/product/xxii-edizione-2017-2018-rapporto-sul-turismo-italiano/).

Conti, E., and Pencarelli, T. (2017), La valutazione della performance strategica si una piccola impresa: Il caso Bartolucci Francesco S.R.L., pp.139-161.

European Parliament. (2022), *Fact Sheets on the European Union*. pp. 1-7 (retrieved from https://www.europarl.europa.eu/ftu/pdf/en/FTU_3.4.12.pdf).

Eurostat. (2010), *European Commission Community Innovation Survey 2010 Synthesis Quality Report* (retrieved from https://ec.europa.eu/eurostat/cache/metadata/Annexes/inn_cis2_esms_an5.pdf).

Eurostat. (2018), *Community Innovation Survey – Eurostat*, Europa. eu (retrieved from https://ec.europa.eu/eurostat/web/microdata/community-innovation-survey).

Fernandes, C., Ferreira, J. J., Raposo, M., Sánchez, J. C., and Hernandez–Sanchez, B. (2018). Determinants of entrepreneurial intentions: an international cross-border study, *International*

Journal of Innovation Science, 10(2), pp.129-142. https://doi.org/10.1108/ IJIS-02-2017-0017.

Galloway, L., and Brown, W. (2002), Entrepreneurship education at university: a driver in the creation of high growth firms? *Education + Training*, 44(8/9), pp. 398–405. https://doi.org/10.1108/00400910210449231.

Gismera Tierno, L., Pérez-Macías, N., and Medina-Molina, C. (2020), Visual Thinking Boosting Spanish Higher Education Students' Entrepreneurial Intentions, *Journal of the Knowledge Economy*, 12(8/9), pp.1–17. https://doi.org/10.1007/s13132-020-00700-x.

Gomes, E., Sousa, C. M. P., and Vendrell-Herrero, F. (2018), International Marketing Agility, Special Issue Call for Papers from *International Marketing Review*, Emerald Publishing (retrieved from https://www.emeraldgrouppublishing.com/archived/products/journals/call_for_papers.htm%3 Fid%3D7071).

Gomes, E., Sousa, C. M. P., and Vendrell-Herrero, F. (2020), International marketing agility: conceptualization and research agenda, *International Marketing Review*, 37(2), pp. 261–272. https://doi.org/10.1108/imr-07-2019-0171.

Grant, R. M. (2021), *Contemporary strategy analysis*, Hoboken NJ: Wiley.

Haller, A.-P. (2012), Concepts of Economic Growth and Development. Challenges of Crisis and Knowledge, *Economy Transdisciplinarity Cognition*, 15(9), pp. 66-71. (retrieved from https://www.ugb.ro/etc/etc2012no1/09fa.pdf).

Haller, A.-P., Butnaru, G. I., Hârșan, G.-D. T., and Ştefănică, M. (2020), The relationship between tourism and economic growth in the EU-28. Is there a tendency towards convergence? *Economic Research - Ekonomska Istraživanja*, pp. 1–25. https://doi.org/10.1080/1331677x.2020.1819852.

Harries, T. (2021), Understanding small business adaptation to natural hazards: A critical review, *International Journal of Disaster Risk Reduction*, 63, 102403. https://doi.org/10.1016/j.ijdrr.2021.102403.

Havlovska, N., Illiashenko, O., Konoplina, O., Shevchuk, I., Hlynska, A., and Prytys, V. (2020), Strategic adaptation as a way of managing organizational changes in the context of implementing a safety oriented enterprise management approach, *TEM Journal*, 9(3), pp.1053–1061. https://doi.org/10.18421/TEM93-29.

Hossain, M. R., Akhter, F., and Sultana, M. M. (2022), SMEs in Covid-19 Crisis and Combating strategies: A Systematic Literature Review (SLR) and A Case from Emerging Economy, *Operations Research Perspectives*, 100222. https://doi.org/10.1016/j.orp.2022.100222.

Irimiaș, T. (2021), Measuring and monitoring change in a strategic business context. Considerations

on the role of organizations' composition elements, *CES Working Papers*, XIII(2), pp.159-180.

Kahveci, E. (2022), Business strategies for small- and medium-sized tourism enterprises during COVID-19: a developing country case, *Journal of Hospitality and Tourism Insights*, Emerald Insight, pp. 1-25 (retrieved from https://www.emerald.com/insight/2514-9792.htm).

Kaplan, R. S., and Norton, D. P. (2004), The strategy map: guide to aligning intangible assets, *Strategy & Leadership*, 32(5), pp. 10–17. https://doi.org/10.1108/10878570410699825.

Kristiana, Y., Pramono, R., and Brian, R. (2021), Adaptation Strategy of Tourism Industry Stakeholders During the COVID-19 Pandemic: A Case Study in Indonesia, *The Journal of Asian Finance, Economics, and Business*, 8(4), pp. 0213–0223. https://doi.org/10.13106/jafeb.2021.

Lafuente-Ruiz-de-Sabando, A., Zorrilla, P., and Forcada, J. (2018), A review of higher education image and reputation literature: Knowledge gaps and a research agenda, *European Research on Management and Business Economics*, 24(1), pp. 8–16. https://doi.org/10.1016/j.iedeen.2017.06.005.

Li, C. C. and Chuan, O. S. (2012), Tourism Receipts, Health and Economic Growth: Johansen Cointegration and Granger Causality Approach, *Proceedings of USM-AUT International Conference 2012 Sustainable Economic Development: Policies and Strategies*, School of Social Sciences, Universiti Sains Malaysia, 67, pp. 671-677.

Li, C. C., and Chuan, O. S. (2012), Tourism receipts, education and economic growth in Malaysia, in: Zainal, A. Radzi, S.M. Hashim, R. Chik C.T. and Abu R. (eds.), *Current Issues in Hospitality and Tourism Research and Innovations. London: Taylor and Francis,* pp. 509-514.

Li, S., Wang, Y., Filieri, R., and Zhu, Y. (2021), Eliciting positive emotion through strategic responses to COVID-19 crisis: Evidence from the tourism sector, *Tourism Management*, 90, 104485. https://doi.org/10.1016/j.tourman.2021.104485.

Luamba, Dr. D. S., Blye, Dr. M. L. J., Mwema, Dr. Ir. E. M., Williams, Dr. I. A., James, Dr. K., and Chagadama, Dr. J. (2021), The Benefits of Innovation for Small Businesses*, International Journal of Business and Management Research*, 9(4), pp. 425–432. https://doi.org/10.37391/ijbmr.090405.

Maftei, M. M., and Kicsi, R. (2021), *Reconfigurări ale mediului de afaceri în industria turismului la nivel global și adaptarea educației în turism la noile realități*, Internaționalizarea organizațiilor de afaceri, Universitatea „Ștefan cel Mare", Suceava, pp. 1-24.

Martin-Rios, C., and Pasamar, S. (2018), Service innovation in times of economic crisis: the strategic adaptation activities of the top E.U. service firms, *R&D Management*, 48(2), pp. 195–209. https://doi.org/10.1111/radm.12276.

Mazorodze, A. H., and Buckley, S. (2020), A review of knowledge transfer tools in knowledge-intensive organisations, *SA Journal of Information Management*, 22(1), pp.1-6. https://doi.org/10.4102/sajim.v22i1.1135.

Mihalciuc, C. (2022), Analysis of the main financial indicators for the entities in the tourist sector of the North - East Region from Romania in a pandemic context, *Revista de turism - studii si cercetari in turism*, 34, pp. 1-9 (retrieved from http://www.revistadeturism.ro/rdt/article/view/584/349).

Mínguez, C., Martínez-Hernández, C., and Yubero, C. (2021), Higher education and the sustainable tourism pedagogy: Are tourism students ready to lead change in the post pandemic era? *Journal of Hospitality, Leisure, Sport & Tourism Education*, 29, 100329. https://doi.org/10.1016/j.jhlste.2021.100329.

Mishra, D. P. (2021), COVID-19 Disruption and Service Firms' Adaptation Strategies: Institutional Theory Perspectives, *The ICT and Evolution of Work,* pp.175–203. https://doi.org/10.1007/978-981-33-4134-0_8.

Moi, L., and Cabiddu, F. (2020), Leading digital transformation through an Agile Marketing Capability: the case of Spotahome, *Journal of Management and Governance*. https://doi.org/10.1007/s10997-020-09534-w.

Nonaka, I., and Takeuchi, H. (2021), Humanizing Strategy, *Long Range Planning*, 102070. https://doi.org/10.1016/j.lrp.2021.102070.

OECD and Eurostat. (2018), *Oslo Manual 2018*, *The Measurement of Scientific, Technological and Innovation Activities*, OECD. https://doi.org/10.1787/9789264304604-en.

Özaralli, N., and Rivenburgh, N. K. (2016), Entrepreneurial intention: antecedents to entrepreneurial behavior in the U.S.A. and Turkey, *Journal of Global Entrepreneurship Research*, 6(1), pp. 1-32. https://doi.org/10.1186/s40497-016-0047-x.

Pung, J., and Del Chiappa, G. (2020), An exploratory and qualitative study on the meaning of transformative tourism and its facilitators and inhibitors, *European Journal of Tourism Research*, 24, pp. 2404–2404. https://doi.org/10.54055/ejtr.v24i.406.

Quansah, E., and Hartz, D. E. (2021), Strategic adaptation: leadership lessons for small business survival and success, *American Journal of Business*, 36(3/4), pp. 190-207. https://doi.org/10.1108/ajb-07-2020-0096.

Ramazanova, M., Deyá Tortella, B., Kakabayev, A., and Bulai, M. (2018), Ecotourism as a tool for local sustainable development: The case of Burren, Ireland, *Lucrările Seminarului Geografic "Dimitrie Cantemir"*, 46(2), pp. 109–118. https://doi.org/10.15551/lsgdc.v46i2.08.

Ratten, V., and Jones, P. (2020), Covid-19 and entrepreneurship education: Implications for advancing research and practice, *The International Journal of Management Education*, 19(1), 100432. https://doi.org/10.1016/j.ijme.2020.100432.

Righini, E. (2012), *Behavioural law and economics: problemi di policy, assetti normativi e di vigilanza*, FrancoAngeli s.r.l., Milano, Italy, pp.1-164.

Rosalina, P. D., Dupre, K., and Wang, Y. (2021), Rural tourism: A systematic literature review on definitions and challenges, *Journal of Hospitality and Tourism Management*, 47, pp. 134–149. https://doi.org/10.1016/j.jhtm.2021.03.001.

Sălăvăstru, D. (2004), *Psihologia educației*, Iași: Polirom.

Sánchez, A., Lago, A., Ferràs, X., and Ribera, J. (2011), Innovation Management Practices, Strategic Adaptation, and Business Results: Evidence from the Electronics Industry, *Journal of Technology Management & Innovation*, 6(2), pp.14–39. https://doi.org/10.4067/s0718-27242011000200002.

Sarta, A., Durand, R., and Vergne, J.-P. (2020), Organizational Adaptation, *Journal of Management*, 47(1), 014920632092908. https://doi.org/10.1177/0149206320929088.

Schumpeter, J. A. (1972), *Storia dell'analisi economica*, Limited edition cleaned by Claudio Napoleoni, Boringhieri, Italia.

Simonet, G. (2010), *The concept of adaptation: interdisciplinary scope and involvement in climate change*, S.A.P.I.EN.S. Surveys and Perspectives Integrating Environment and Society, 3(1), (retrieved from http://journals.openedition.org/sapiens/997).

Sinha, D., and Sinha, S. (2020), Managing in a VUCA World: Possibilities and Pitfalls, *Journal of Technology Management for Growing Economies*, 11(1), pp. 17–21. https://doi.org/10.15415/jtmge.2020.111003.

Tomasi, S., Paviotti, G., and Cavicchi, A. (2020), Educational Tourism and Local Development: The Role of Universities, *Sustainability*, 12(17), 6766. https://doi.org/10.3390/su12176766.

U.S. Army Heritage, and Education Center. (2022), *Who first originated the term VUCA (Volatility, Uncertainty, Complexity and Ambiguity)?* (retrieved from https://Usawc.libanswers.com /Faq/84869).

Ulman, S.-R., Mihai, C., Cautisanu, C., Brumă, I.-S., Coca, O., and Stefan, G. (2021), Environmental Performance in EU Countries from the Perspective of Its Relation to Human and Economic Wellbeing, *International Journal of Environmental Research and Public Health*, 18(23), 12733. https://doi.org/10.3390/ijerph182312733.

Vodă, A. I., Butnaru, G. I., and Butnaru, R. C. (2020), Enablers of Entrepreneurial Activity across the European Union - An Analysis Using GEM Individual Data, *Sustainability*, 12(3), 1022.

https://doi.org/10.3390/su12031022.

Zaiţ, D., and Spalanzani, A. (2006), *Cercetarea în economie şi management. Repere epistemologice şi metodologice*, Ed. Economică, Bucureşti.

Zaitseva, O. I., and Betina, V. O. (2017), Scientific and Methodological Approaches to the Incorporation Adaptation Potential in Enterprise Management System Strategic, *Scientific Bulletin of Polissia*, 1(9), pp. 158-16.

The relationship between economic performance and energy consumption at EU level

Andrei Teofil POSTOLACHI[*]

Abstract

Starting from the premise that an increase in the use of energy determines a corresponding economic growth, this article aims to determine if at the community level of the European Union there is a causality between energy consumption and economic performance. Thus, using the multiple regression analysis, we sought to determine if, at the level of all 28 member states of the EU, the economic performance, measured through GDP, can be explained by the simultaneous variation in the consumption of the 5 types of primary energy: solid fuels, electricity, natural gas, oil and renewable energy. The results, of particular importance in the development of measures through the European energy policy, show a significant impact of the use of electricity, oil and renewable energy on the European GDP, while the influence of coal and natural gas consumption has a low intensity.

Keywords: EU energy policy, economic performance, energy consumption, solid fuels, oil, natural gas, electricity, renewable energy

Introduction

In the economic sciences, researchers are always looking for answers to questions that arise from the desire to understand, as comprehensively as possible, the phenomena that occur both at the level of individuals, at the microeconomic level, and the determinants of macroeconomic manifestations. This approach, therefore, seeks to identify a possible causal link between the macroeconomic development of the European Union (EU) over the last 25 years, which we will quantify using the aggregate indicator Gross Domestic Product (GDP), and the usage of various energy products (solid fuels, oil, natural gas, renewable energy).

Given the emphasis in European energy policy on reducing the use of polluting fossil fuels and replacing them with renewable sources, establishing a meaningful link between energy consumption and economic growth becomes essential in developing and implementing strategies and guidelines by the European authorities, at least in the short and medium term. To underpin any debate on energy

---

[*]Andrei Teofil POSTOLACHI is researcher at Alexandru Ioan Cuza University of Iasi, Romania, e-mail: andrei_postolachi@yahoo.com.

policy it is essential to understand that there is a strong correlation between economic growth and energy consumption. This link is recognised and validated in studies by Kraft and Kraft (1978), Masih A. and Masih (1996), Glasure and Lee (1997), Asafu-Adjaye (2000), Stern (1993 and 2000), Soytas and Sari (2003), Jumbe (2004), Lee C. (2005).

Measuring and testing the links between the two indicators has been the subject of numerous other studies, with the literature providing various attempts by researchers to capture possible connections that can be made between macroeconomic outcomes and the energy required to achieve them (Ozturk, 2010). However, most of the analyses consider countries, groups of countries or regions outside Europe (the United States, South-East Asian countries, Turkey, North-African countries, and others). Soava et al. (2018) is one of the recent research study that analysed at data from all 28 EU member countries and, although he reached results that statistically assessed a low impact, the study confirms the link between GDP and renewable energy consumption. At the same time, Nasreen and Anwaar (2014) conducted a similar analysis for 15 Asian countries, and the empirical results confirmed a co-integration of the variables, with a significant dependence between energy consumption and economic growth at the level of the countries analysed.

The context of the analysis is characterised by the current situation at Community level, where the effects of the measures taken during the Covid19 pandemic and the complex consequences of the war in Ukraine are strongly affecting the EU's economic performance. In these circumstances, the study aims to identify whether and to what extent the energy consumption influences economic growth process, since energy is a key element in the dynamics of any type of economic activity and one of the significant inputs. For this purpose, this analysis considers two major variables, GDP and energy consumption, the last being divided into five primary category of energy resources: solid fuels (coal), oil, natural gas, electricity, and renewable energy. Therefore, this paper proposes to study whether the consumption of these five types of energy influence the economic performance of the EU as a whole, using data from 1995 to 2021.

1. Literature overview

In the previous research efforts reviewed, numerous studies examine the potential links between energy and economic growth. Stern (2004) considers that the choice to study this connection, and moreover choosing between theories regarding the determinants of economic growth among energetic resources must be based on both scientific opinions as well as empirical evidence.

The pioneers of the energy consumption - economic growth relationship are the researchers Kraft and Kraft (1978). In their view, their results provide evidence in support of unidirectional causality between economic growth (analysed through the Gross National Product indicator) and energy consumption in the case of the United States between 1947 and 1974. However, Akarca and Long (1980) failed to obtain a causal relationship between energy consumption and economic growth, given the shorter period of analysis. They argued that the results of the study by Kraft J. and Kraft A. are unstable in terms of temporality. On the other hand, using the Granger causality test, Abosedra and Baghestani (1991) confirmed the causal relationship between the American GNP and energy consumption for the period 1947 to 1987.

Over time, numerous researchers have continued to contradict or confirm the results of the Kraft and Kraft study. Yu and Jin (1992) tested the co-integration between energy consumption, economic growth and unemployment. They found that there was no well-determined relationship between these variables. However, the authors conclude by stating that the lack of a long-run equilibrium relationship between energy consumption and economic growth does not reject the hypothesis that there is no causal relationship between these variables.

There are studies in the literature that find a unidirectional causality between energy consumption and economic growth, including Glasure and Lee (1997) and Bowden and Payne (2009). On the other hand, there are studies that illustrate the existence of a unidirectional causal relationship between economic growth and energy consumption (Yu and Choi, 1985; Soyta and Sari, 2003) or studies that find causality running in both directions (Yang, 2000; Glasure 2002). In other words, Oztuk (2010) identifies four scenarios from this point of view, which he divides into four distinct working hypotheses. The first is the neutrality hypothesis, which assumes that there is no correlation between GDP/GNP and energy consumption. Feedback hypothesis is the second, which confirms a two-way causality; economic growth and energy consumption are mutually determined and influenced at the same time. On the other hand, the other two hypotheses indicate a unidirectional influence. The conservation hypothesis assumes that improved economic performance will lead to an increase in energy consumption, thus leaving the possibility for policy-makers to implement measures to reduce energy consumption without significantly affecting future economic performance. Finally, the growth hypothesis considers energy as complementary to labour and capital and as a significant contributor to economic growth. The growth hypothesis stresses that any policy decision leading to lower energy consumption will determine a deterioration in overall economic performance. For these considerations, this paper takes into account the growth hypothesis.

Regarding the neutrality hypothesis, which indicates the absence of a significant link between the variables, several analyses and papers have led to its confirmation (Akarca and Long, 1980; Yu

and Hwang, 1984). Fatai et al. (2002) applied several statistical tests (Granger causality, ARDL - autoregressive distributed lag, Toda and Yamamoto test) in the case of the New Zealand economy. At the same time, Altinay and Karagol (2004) used Granger causality, while Soytas and Sari (2009) applied Toda-Yamamoto causality test for Turkey. All these papers obtain results infirming a significant influence of energy consumption on economic performance.

Mutual dependence has however been established for some countries in relatively recent analyses. For Taiwan, Hwang and Gum (1991) using co-integration and error correction models and later Glasure (2002) adding the variance decomposition of the two models in the case of South Korea confirm the feedback hypothesis. Ghali and El-Sakka (2004) for Canada, Paul and Bhattacharya (2004) for India, Erdal et al. (2008) for Turkey or Belloumi (2009) for Tunisia (in the long run), through application of co-integration and Granger causality methods confirm that an economic growth or decrease implies an increase or decrease in energy consumption. At the same time, a change in the structure of consumption in the energy sector determined proportional changes in the same direction of macroeconomic performance.

Unidirectional dependence scenarios assume that the two variables influence each other in one direction, while the mutual dependence relationship is not valid at the same time. Thus, Aqeel and Butt (2001) testing data for Pakistan, Ang (2008) for Malaysia, Karanfil (2008) for Turkey, Zhang and Cheng (2009) for China, used different methods of statistical analysis (the Granger causality test or Johansen co-integration test). The results led to the approval of the conservation hypothesis for the analysed countries, a fact that enables policy-makers to implement energy policies that can constrain energy consumption, without it subsequently affecting economic outcomes.

The dependence relationship from energy consumption to economic performance is one of the most tested hypotheses in the literature. This is validated by a multitude of studies, applied for vast periods, for an increased number of states and which assumed a diversity of applied statistical methods. Stern (1993) analysed data from the period 1947-1990 in the United States, applying multivariate VAR (vector autoregressive) model, and later (Stern, 2000) obtained the same dependence relationship within the American economy using Co-integration and Granger causality tests. Later, Bowden and Payne (2009) confirmed these results by applying the Toda-Yamamoto causality test to data for the United States from 1949 to 2006. Using the same methods, authors found similar results for Asian countries, such as South Korea (Oh and Lee, 2004), Taiwan (Lee and Chang, 2005) and Indonesia (Sriyana, 2019). In addition, Wolde-Rufael (2004) used the same methods for Shanghai and Soytas et al. (2001) in the case of Turkey, obtaining the same outcomes. Belloumi

(2009) applied the same methods for Tunisia and, in this case, the dependence is valid in the short term.

Streimikiene and Kasperowicz (2016) proposed a similar analysis, looking for statistical results confirming the link between the same indicators at EU level. Thus, using data for 14 countries within the European Union, for the period 1995-2012, and panel unit root tests, panel co-integration test, fully modified ordinary least squares (FMOLS) estimator and dynamic ordinary least squares (DOLS) estimator, they confirmed the existence of a positive relationship between energy consumption and economic growth process.

Testing data for two countries, Romania and Spain, Pirlogea and Cicea (2012) identified a positive long-run (1990-2010) link between energy consumption from oil sources and economic growth, measured by GDP per capita in constant prices. The authors also found that in the short term, for example in the case of Romania, renewable energy consumption influences economic performance, but the relationship is not valid in the reverse direction. In other words, economic growth will not lead to an increase in renewable energy consumption. The same conclusions are valid for Spain, taking into account natural gas consumption. Tang et al. (2016) established a similar level of co-integration between variables for Vietnam's economy.

The different results obtained by the authors can easily be attributed to methodological factors: different time intervals for which the analyses were done and the introduction of additional variables in the test (foreign investment, foreign trade operations, unemployment, and inflation). Elements related to the economic structure can certainly influence the results, as it is evident that national economies have different productivity structures: industrialised economies are more energy intensive, developing economies have lower energy consumption, or tertiary-oriented economies have rather low energy consumption relative to the value of final goods and services obtained.

2. Data and methods

Starting from the premise that an increase in living standards cannot be achieved without a corresponding increase in energy consumption, the aim of this empirical study is to assess the impact of energy consumption in the five main energy markets (solid fuels, electricity, natural gas, oil, and renewable energy market) on economic growth in the European Union. Therefore, using a multiple regression model, it will be analysed whether the simultaneous variation in the consumption of solid fuels, electricity, natural gas, oil, and renewable energy explains changes of the Gross Domestic Product.

Therefore, in the present study we decided to restrict the analysis to one of the four working hypotheses mentioned above, namely the growth hypothesis, in order to assess the effects that changes in the structure of energy consumption have on final macroeconomic outcomes.

The period of analysis is from 1995 to 2021 and the sample used is taken from the Eurostat database. The dependent variable included in the analysis is Gross Domestic Product (GDP), expressed in millions of euro, while the independent variables used are solid fuels consumption, electricity consumption, natural gas consumption, oil consumption and renewable energy consumption, expressed in terajoules. The methodology involves a logarithmic process for all series and the SPSS statistical software in order to process the collected data. In addition, the methodology implies the using of the X12 procedure implemented by the US Census Bureau for all series in order to remove seasonal factors.

As can be seen from Figure 1, the evolution of economic performance at the EU level, measured in this case by the GDP indicator, shows increases in most of the years analysed, with the exception of 2009 and 2020.

Figure 1. The EU Gross Domestic Product between 1995- 2021 at market prices (Millions of Euro)
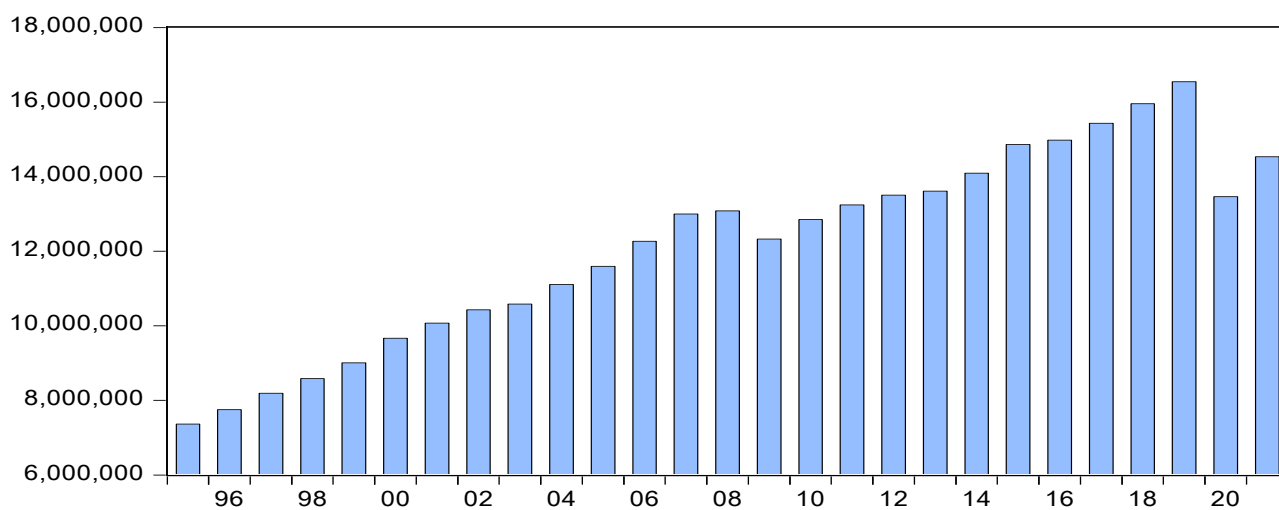
Source: own representation based on Eurostat data

On the one hand, the effects of the economic crisis of 2008-2010 on economic performance at the global level lead to the decrease recorded in 2009, from this point of view the European economy being, like most world economies, affected by this negative period. On the other hand, the results for 2020 are significantly lower than for 2019. The measures taken by the authorities in the initial period of the Covid-19 pandemic are causing this drop in GDP. These measures involved, especially in the first part of the year, the restriction of entire sectors of economic activity, which led to a deterioration

in the results for the initial year of the pandemic, compared to the previous year. At the same time, the GDP level for 2021 is lower than in 2019, a sign that the pandemic has produced much larger impact that could not be fully covered in the following year.

Oil is one of the primary energy resources that is very important in the energy mix of any economy. This is mainly due to its use as a fuel for the means of transport that ensure national and international distribution of all categories of products, and it is an essential input in the transport industry. In addition to transport, other industries such as chemicals, petrochemicals, steel, and so on use consistently this resource. The consumption of oil resources in the European Community shows two distinct periods, according to Figure 2. The first from 1995 to 2008 shows a relatively constant rate of consumption, with low volatility from one year to the next. The second is from 2010 onwards, when the trend becomes downward, with oil use declining and reaching its lowest value in 2020.

Figure 2. The EU Oil Consumption in 1995-2021 (Thousands of Terajoules)
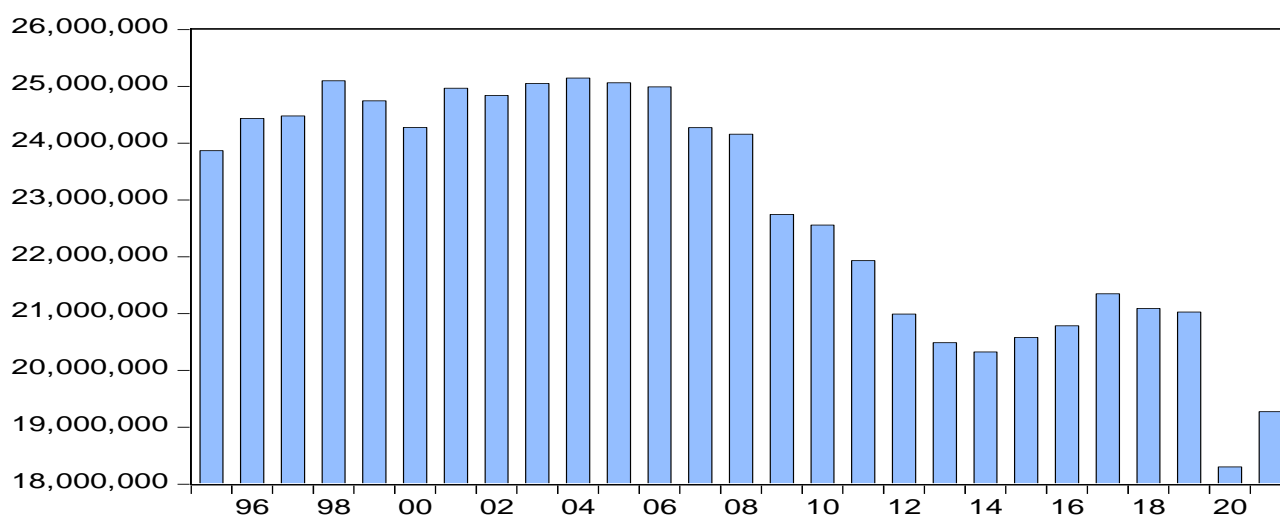
Source: own representation based on Eurostat data

Figure 3 reveals numerous fluctuations in natural gas consumption at EU level. The period 1995-2021 has 3 phases. The first phase is one of growth, in which natural gas consumption increases from 1997 to 2010, exceeding 15 billion of terajoules and having two episodes of decreases in 2007 and 2009, as an effect of the economic crisis of that period. The second phase shows a downward trend from 2011 until 2014, when the level of natural gas consumption returns to the 1997 level. The growth in the next phase, starting in 2015, had two interruptions in 2018 and 2020, so that the upward trend was not strong enough to match the peak levels of 2005-2010.
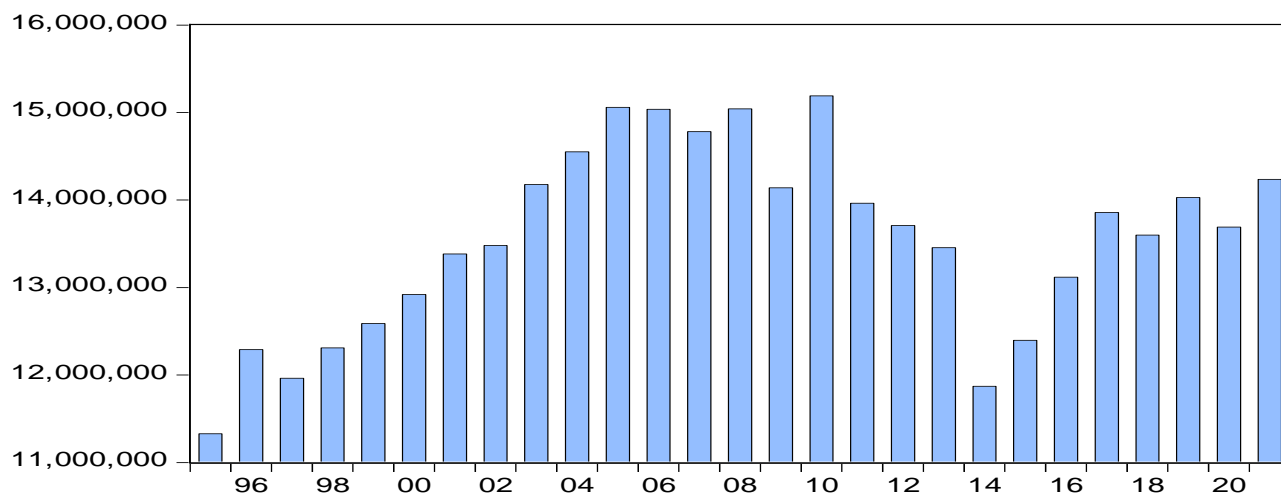
Figure 3. EU Natural Gas Consumption in 1995-2021 (Thousands of Terajoules)

Source: own representation based on Eurostat data

European measures from energy policy are part of the global approach to reducing greenhouse gases, focusing on replacing the use of polluting fossil fuels with less polluting renewable sources. In this respect, the trend in the consumption of solid fuels, especially solid fuels, shows the positive results of these measures. According to Figure 4, the consumption of solid fuels is steadily decreasing over the period analysed, with values in 2021 approximately half those of 1995. This trend suggests that consumption of this type of resource is steadily decreasing in the European Union, with Member States gradually replacing increasing amounts of solid fuels with renewable energy resources.

Figure 4. EU Solid Fuels Consumption in 1995-2021 (Thousands of Terajoules)

Source: own representation based on Eurostat data

In contrast to the previous data, Figure 5 highlights this trend, while the renewables are increasingly becoming a part of the EU energy mix. The evolution of renewable energy consumption is steadily improving, with the values three times higher in 2021 than at the beginning of the period analysed.
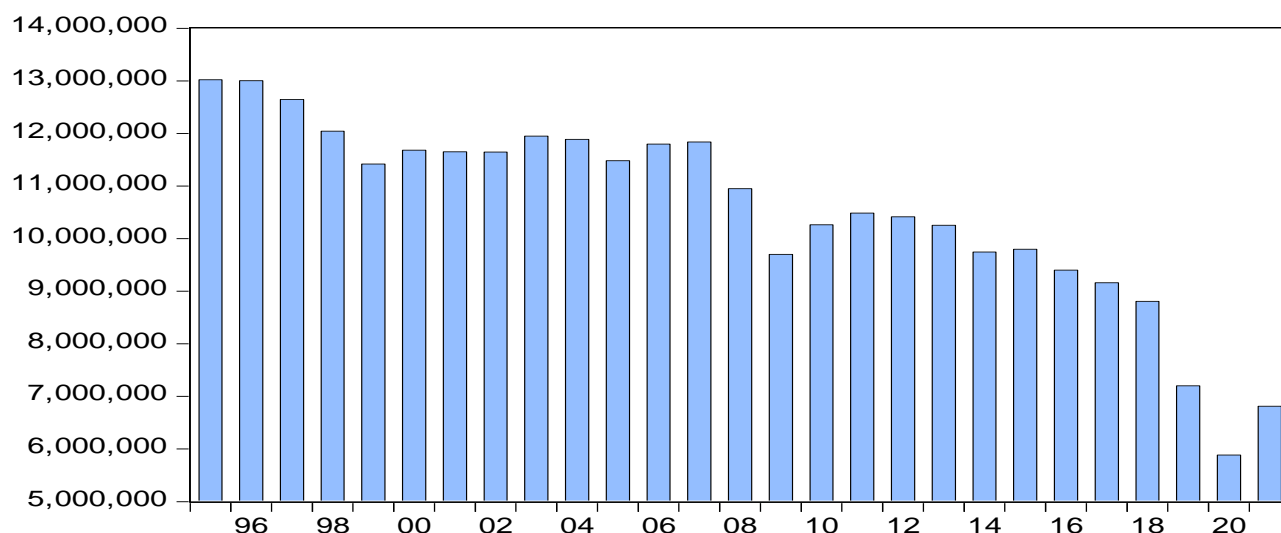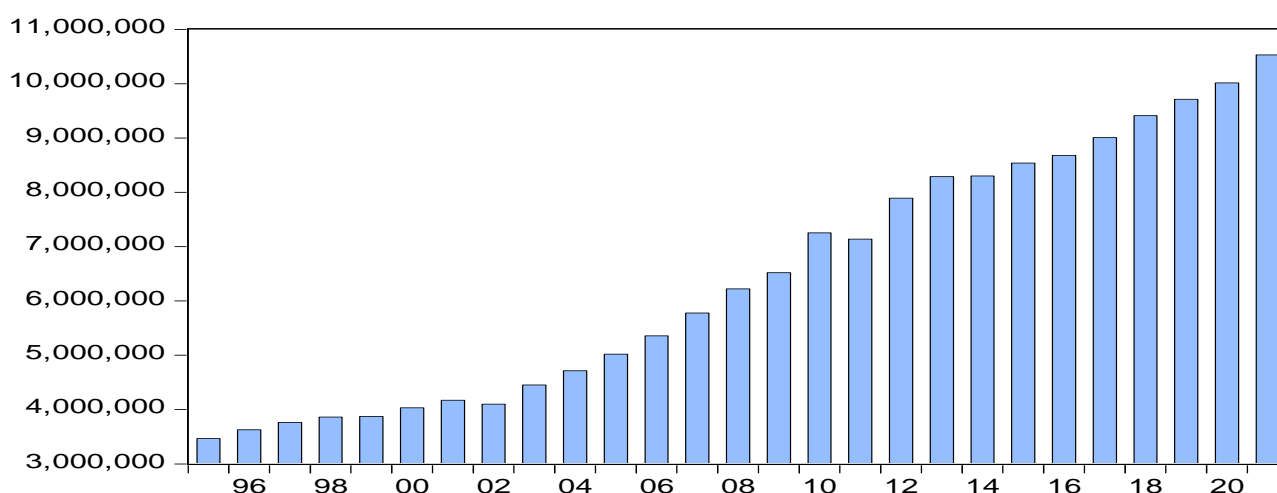
Figure 5. EU Renewable Energy Consumption in 1995-2021 (Thousands of Terajoules)

Source: own representation based on Eurostat data

Comparing data on renewable energy consumption with data on GDP development, a clear similarity appears in the trends of the two indicators, which may underline a strong positive link between these two. However, taking into account that the data are taken at EU level and that Member States have quite different economic performances and energy mixes, a more detailed analysis of the correlation between these two indicators will be the subject of future studies.

Comparing the evolution of coal consumption with that of renewables, the value of renewable energy exceeds that one of solid fuels from 2019 onwards. This highlights once again the results of European energy policy, which seeks to decouple economic activity from the use of polluting energy resources and replace them with renewables.

3. Econometric analysis

In this study, we examined whether simultaneous changes in solid fuels, electricity, natural gas, oil and renewable energy consumption influence the GDP at the EU level, using a multiple regression model.

3.1. Exploratory analysis of variables

Table 1 presents the main indicators of the descriptive statistics for the analysed variables. At the level of the European Union, the average GDP for the period 1995-2021 was 12.152,35 billion euros, with a minimum of 7.363,52 billion euros (in 1995) and a maximum value of 16.545,38 billion euros (in 2019). As regarding solid fuels consumption, the average is 10.553,69 thousand terajoules. The maximum value was recorded in 1995 (13.020,37 thousand terajoules).

Table 2. Descriptive analysis of variables

	Descriptive Statistics							
	N	Minimum	Maximum	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
GDP	27	7.363,52	16.545,38	12.152,3536	-0,280	0,448	-0,895	0,872
Solid fuels	27	5.887,87	13.020,37	10.553,6855	-0,999	0,448	0,680	0,872
Electricity	27	-65,05	62,22	5,0854	-0,333	0,448	-0,304	0,872
Natural Gas	27	11.327,64	15.191,48	13.561,8034	-0,305	0,448	-0,716	0,872
Oil	27	18.303,96	25.146,25	22.846,3717	-0,498	0,448	-1,113	0,872
Renewable energy	27	3.467,69	10.528,41	6.434,6654	0,248	0,448	-1,434	0,872
Valid N (listwise)	27							

Source: own processing in SPSS based on data provided by Eurostat

The average electricity consumption was 5,085 thousand terajoules, with a maximum of 62,22 thousand terajoules in 2009. In the case of natural gas consumption, the average at the level of the European Union for the period 1995-2021 was 13.561,80 thousand terajoules, with a minimum recorded value of 11.327,64 thousand terajoules in 1995. As regarding oil and petroleum products, the average consumption at EU level for 1995-2021 is 22.846,37 thousand terajoules, with a minimum value of 18.303,96 thousand terajoules and a maximum value of 25.146,25.

Table 2 shows the major differences between Member States in terms of energy consumption in 2021. Poland is the largest consumer of solid fuels in the European Union, consuming around 42% of the EU total. In the same ranking are Germany, the Czech Republic, France, Romania and Belgium, with consumption levels exceeding 1 billion tonnes for each country. At the opposite pole are Luxembourg, Cyprus, Slovenia, Latvia, Portugal and Estonia, with consumption levels below 100 million tonnes per country, while Malta has no consumption of solid fuels in 2021.

Table 2. Final consumption of energy resources in 2021 for the EU members

EU Member	Solid fuels	Electricity	Natural gas	Oil
	Million tonnes	Gigawatt-hour	Terajoule	Million tonnes
Austria	513.07	66.861,49	245.303,76	11,34
Belgium	1.082,50	83.068,70	518.147,50	20,19
Bulgaria	818.87	32.088,80	68.676,11	4,32
Croatia	171.60	16.854,40	66.398,89	2,92
Cyprus	66.42	4.656,27	0,00	1,07
Czech Rep.	3.528,63	61.303,99	259.788,62	9,51
Denmark	216,36	33.602,44	75.717,89	5,66
Estonia	3,50	8.134,59	12.034,76	1,06
Finland	189,40	83.301,00	37.986,00	7,41
France	1.915,56	442.322,44	1.415.340,38	68,45
Germany	6.760,70	505.174,50	2.777.954,91	95,61
Greece	336,66	50.554,44	68.930,97	8,72
Hungary	273,00	43.387,00	308.281,00	7,93
Ireland	371,50	29.659,30	90.240,33	6,43
Italy	457,73	300.887,06	1.673.234,38	45,65
Latvia	26,99	6.930,29	16.356,58	1,54
Lithuania	261,60	11.953,60	66.874,00	2,52
Luxembourg	72,83	6.392,85	28.307,74	2,69
Malta	0,00	2.583,17	0,00	0,37
Netherlands	273,95	112.348,57	921.162,19	24,81
Poland	15.027,60	157.314,15	592.321,94	30,40
Portugal	13,65	48.116,52	89.364,01	8,57
Romania	1.564,54	49.623,17	320.094,15	9,79
Slovakia	763,00	26.457,00	144.551,00	3,75
Slovenia	42,44	13.550,05	28.956,28	2,27
Spain	603,00	235.025,00	713.125,12	44,07
Sweden	520,00	131.028,00	37.988,30	9,82
EU27	**35.875,07**	**2.563.178,76**	**10.577.136,82**	**436,89**

Source: Eurostat. Supply, transformation and consumption – commodity balances

In terms of electricity consumption, Germany is the largest consumer in the European Union, consuming around 20% of the EU total. France, Italy, Spain, Poland, Sweden and the Netherlands follow in the same list of largest consumers in the EU, with consumption levels exceeding 100.000 gigawatt per hour for each country. On the other hand, Estonia, Latvia, Luxembourg, Cyprus, and Malta are the smallest consumers, each having a consumption level below 10.000 gigawatt per hour. As regarding natural gas, the top list is almost the same. Germany, Italy and France are the largest consumers in the EU, followed by the Netherlands, Spain and Poland. For Germany, the natural gas consumption represents more than 26% of the EU total and three times higher than the Netherlands. However, there are also cases of low consumption, such as Latvia and Estonia, while Cyprus and Malta have no consumptions of natural gas in 2021. Finally, the same countries appear in the top of the largest oil consumers and in the top of the smallest oil consumers. Germany consumes almost 437 million tonnes of oil, representing 22% of the EU level. The top continues with France, Italy, Spain

and Poland, each consuming more than 30 million tonnes of oil. Most of countries have a level consumption lower than 10 million tonnes, while Latvia, Cyprus, Estonia and Malta consume less than 2 million tonnes of oil.

3.2. Estimation of model parameters

The multiple regression model that expresses the link between the dependent variable and the five independent variables is of the form:

$$GDP_t = \beta_0 + \beta_1 \text{solid fuels}_t + \beta_2 \text{electric}_t + \beta_3 \text{ natural\_gas}_t + \beta_4 \text{ oil}_t + \beta_5 \text{renewable}_t + \varepsilon$$

where:

GDP = gross domestic product at market prices;

Solid fuels = solid fuels consumption;

Electric = electricity consumption;

Natural gas = natural gas consumption;

Oil = oil consumption;

Renewable = renewable energy consumption;

$\beta_{j, j = 0....5}$ = the parameters of the proposed model;

ε = the error term;

t = the year for the collected indicator.

Table 3 presents the results obtained after processing the data in SPSS software.

Table 3. Coefficients values of the regression model

	Coefficients(a)						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Bet			Tolerance	VIF
1 (Constant)	-31.822,551	5.411,995		-5,880	0,000		
Solid fuels	0,493	0,170	0,345	2,901	0,009	0,136	7,366
Electricity	9,123	4,842	0,109	1,884	0,073	0,579	1,727
Natural gas	-0,237	0,200	-0,098	-1,184	0,250	0,282	3,540
Oil	1,168	0,244	0,950	4,790	0,000	0,049	20,423
Renewable energy	2,370	0,244	2,108	9,713	0,000	0,041	24,456

a. Dependent Variable: GDP
Source: own processing in SPSS based on data provided by Eurostat

According to the previously results, the estimated model, through which the connection between the considered variables is illustrated, is the following:

$$GDP = -31.822,6 + 0,493 * solid\ fuels + 9,123 * electricity - 0,237 * natural\ gas + 1,168 * oil + 2,370 * renewable\ energy$$

According to Table 3, the variables consumption of solid fuels, oil and renewable energy have influence on GDP (value Sig<0.05 for each factor), while the influence of electricity is statistically significant for a significance threshold of 10%. The regression model parameter estimates have the following meaning:

- Estimate $b_1=0,493$: an increase in solid fuels consumption by one thousand terajoules causes an increase, on average, by 0,493 million euros in GDP, under the conditions in which the other independent variables remain constant;

- Estimate $b_2=9,123$: an increase in electricity consumption by one thousand terajoules causes an increase, on average, by 9,123 billion euros of GDP, under conditions in which the other independent variables remain constant;

- Estimate $b_4=1,168$: an increase in oil consumption by one thousand terajoules causes an increase, on average, by 1,168 billion euros of the GDP, under conditions in which the other independent variables remain constant;

- Estimate $b_5=2,370$: an increase in the consumption of renewable energy by one thousand terajoules causes an increase, on average, by 2,370 billion euros of the GDP, under conditions in which the other independent variables remain constant.

The parameters values obtained are of significant importance in understanding the energy footprint of the European economy. On the one hand, the low value of the parameter for the variable related to coal consumption has the lowest value, which indicates the lowest impact of coal consumption on the EU GDP, closely related to its downward trend. The negative value of the parameter for natural gas is given by the high volatility of gas consumption in the analysed period.

Given the value-added components involved in the renewables industry, we note that the impact of an increase in their consumption is more than double that of oil. At the same time, the parameter with the highest value, which shows us a significant impact, is the one corresponding to the electricity variable, since the sources of its production are on the one hand traditional ones (oil, natural gas, coal) or on the other hand, in significant growth, the renewable ones.

The equation sheds light on a rather interesting situation, on the one hand the European economy can register significant increases with a higher electricity consumption, an amplified effect if their source is renewable. At the same time, a decrease in energy consumption from fossil sources

can be easily covered, without affecting the economic output, by replacing them with renewable sources.

3.3. Testing the model parameters

Testing the model parameters involves several stages. The first stage surprises the formulation of the following hypotheses:

H$_0$: $\beta_0 = 0$ (M(Y) = 0 | X$_1$, X$_2$, X$_3$, X$_4$, X$_5$= 0)

H$_1$: $\beta_0 \neq 0$ (M(Y) $\neq$ 0 | X$_1$, X$_2$, X$_3$, X$_4$, X$_5$= 0)

H$_0$: $\beta_i = 0$, i=$\overline{1,5}$ (the independent variable *i* has no partial linear influence on the dependent variable)

H$_1$: $\beta_i \neq 0$ (the independent variable *i* has a partial linear influence on the dependent variable).

The second stage presents the choosing of the significance threshold (α) and the test statistic. On the one hand, the significance threshold takes the value 0.05. On the other hand, the analysis considers the t-Student statistic. The third stage implies the calculation of the test statistic values. In this regard, Table 3 presents the values of the t-Student statistic, being determined as follows:

- For the β0 parameter: $t_{calc} = \dfrac{b_0}{s_{\widehat{\beta}_0}}$ = -31822,6 / 5411,995 = -5,880

- For the β1 parameter: $t_{calc} = \dfrac{b_1}{s_{\widehat{\beta}_1}}$ = 0,493 / 0,170 = 2,901;

- For the β2 parameter: $t_{calc} = \dfrac{b_2}{s_{\widehat{\beta}_2}}$ = 9,123 / 4,842 = 1,884;

- For the β3 parameter: $t_{calc} = \dfrac{b_3}{s_{\widehat{\beta}_3}}$ = -0,237 / 0,200 = -1,184;

- For the β4 parameter: $t_{calc} = \dfrac{b_4}{s_{\widehat{\beta}_4}}$ = 1,168 / 0,244 = 4,790;

- For the β5 parameter: $t_{calc} = \dfrac{b_5}{s_{\widehat{\beta}_5}}$ = 2,370 / 0,244 = 9,713.

The penultimate stage is to find the theoretical values of the test statistic, which for t$_{\alpha/2;n-5}$ are read from the t-Student table. For a significance threshold of 0.05 and a sample of n = 27, the value t$_{0,025;22}$ = 2.05 is read. The final stage implies the establishing of the decision rule. According to Table 3, the Student test for the parameters solid fuels, oil and renewable energy consumption indicates a value Sig. t < 0.05. This suggests the rejection of the null hypothesis for these parameters, with a probability of 95%.

3.4. Model testing

Testing the model implies the same stages as testing the model parameters. For the first stage, the hypotheses are the following:

H₀: $\beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ (the model is not statistically significant)

H₁: Not all regression coefficients are simultaneously equal to zero (the model is statistically significant)

Table 4 presents the modelling results.

Table 4. ANOVA

	Model	Sum of Squares	df	Mean Square	F	Sig.
		ANOVA(b)				
1	Regression	169.064.908,535	5	33.812.981,707	99,683	0,000
	Residual	7.123.305,339	21	339.205,016		
	Total	176.188.213,874	26			

a. Predictors: (Constant), Renewable energy, Natural gas, Electricity, Solid fuels, Oil
b. Dependent Variable: GDP
Source: own processing in SPSS based on data provided by Eurostat

The second stage implies the choosing of the significance threshold (α) and the test statistic. Again, the significance threshold takes the value 0.05, while the analysis considers the Fisher statistic in order to test the significance of the multiple linear regression model. Then, the calculation of the test statistic value, according to which $F_{calc} = (ESS/RSS)*((n-k) / (k-1)) = 99,683$. After that, the theoretical value $t_{\alpha/2;n-5}$ are read from the t-Student table. For a significance threshold of 0.05 and a sample of n=27, the value $t_{0,025;22} = 2.05$ is read. The theoretical value $F_{\alpha;k-1;n-k}$ is read from the Fisher table and is equal to 2.69.

The final stage implies the establishing of the decision rule, according to which $F_{calc} = 99,683 > F_{\alpha;k-1;n-k} = 2.817$. This result leads to the decision to reject the hypothesis H0. Therefore, the multiple linear regression model is statistically significant, with a level of 95% probability. Table 5 shows the correlation ratio and determination ratio values.

Table 5. Estimation of correlation ratio and determination ratio

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
					Change Statistics					
1	0,980	0,960	0,950	582,41310	0,960	99,683	5	21	0,000	1,181

a. Predictors: (Constant), Renewable energy, Natural gas, Electricity, Solid fuels, Oil
b. Dependent Variable: GDP
Source: own processing in SPSS based on data provided by Eurostat

According to Table 5, the probability Sig. associated with the Fischer test value from the ANOVA table is less than 0.05 (Sig = 0.000), which means that the proposed model is statistically significant in order to explain the dependence between the variables. Therefore, the independent variables explain the variation of the dependent variable, GDP, with a probability of 95%. At the same time, the estimated value of the correlation ratio is R =0.980, which indicates the existence of a very strong link between the dependent variable GDP and the independent variables considered in the analysis. Also, the value of R^2=0.960 indicates that 96.0% of the variation of the dependent variable, GDP, is explained by the simultaneous variation of the independent variables.

3.5. Hypothesis testing of regression model errors

The estimated linear model requires validation by testing the assumptions regarding the modelling errors, namely the average of the errors is zero, normality, homoscedasticity, respectively the non-correlation of the errors. Formally, these assumptions are written as follows:

- $M(\varepsilon_i) = 0$, which means that the mean of errors is zero;

- $\varepsilon_i \to N(0, \sigma^2)$, expresses the normality hypothesis;

- $V(\varepsilon_i) = \sigma^2$, suggests the homoscedasticity hypothesis;

- cov $(\varepsilon_i, \varepsilon_j) = 0$, shows the hypothesis of non-correlation or independence of errors.

Table 6 presents the output resulted after testing the hypothesis regarding the mean of errors, according to which M $(\varepsilon_i) = 0$.

Table 6. One-Sample Test

					95% Confidence Interval of the Difference	
	T	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Unstandardized Residual	0.000	26	1.000	0.00000000	-207.0598644	207.0598644

Source: own processing in SPSS based on data provided by Eurostat

The value associated with the Student statistic (Sig. = 1.000 > $\alpha = 0.05$) supports the decision to accept the null hypothesis (H_0: M $(\varepsilon) = 0$), guaranteed with a confidence level of 95%. Thus, the hypothesis that the mean of the errors does not significantly differ from the zero value is accepted.

Given that the modelling errors do not follow a normal distribution law, the estimators built based on the least squares method do not, in turn, follow a normal distribution law. Table 6 surprises

the non-parametric Kolmogorov-Smirnov test, used for testing of the normality of the regression model errors, according to which $\varepsilon_i \to N(0, \sigma^2)$

Table 7. Kolmogorov-Smirnov test

One-Sample Kolmogorov-Smirnov Test		
		Unstandardized Residual
N		27
Normal Parameters(a,b)	Mean	0.0000000
	Std. Deviation	523.42457172
Most Extreme Differences	Absolute	0.120
	Positive	0.080
	Negative	-0.120
Kolmogorov-Smirnov Z		0.624
Asymp. Sig. (2-tailed)		0.831

a. Test distribution is Normal.
b. Calculated from data.
Source: own processing in SPSS based on data provided by Eurostat

According to Table 7, the probability value associated with the calculated test statistic is lower than the threshold of 0.05 (Sig. = 0.831), a result that leads to the decision to accept the null hypothesis (H_0: $\varepsilon_i \to N(0, \sigma^2)$). Thus, the distribution of the errors of the estimated regression model follows a normal distribution law, guaranteed with a level of 95% confidence.

Next, the analysis reveals the test of homoscedasticity. According to the assumption of homoscedasticity, the error variance must be constant. To test it, the following statistical hypotheses are necessary in order to test the homoscedasticity:

- H_0: hypothesis of homoscedasticity (V (ε_i) = σ^2);

- H_1: hypothesis of heteroscedasticity (V (ε_i) = σ_i^2).

For this step is necessary to test the non-parametric correlation between the estimated modelling errors (expressed in absolute magnitude) and the values of the independent numerical variables. The analysis implies the Spearman test statistic to test the assumption of homoscedasticity. For the considered regression model, Table 8 resumes the results for solid fuels, electricity, oil and renewable energy consumption after data processing in SPSS.

Table 8. Spearman tests

			Unstandardized Residual	Solid fuels	Electricity	Oil	Renewable energy
Spearman's rho	Unstandardized Residual	Correlation Coefficient	1000	-0.162	-0.060	-0.064	0.102
		Sig. (2-tailed)	0.0	0.418	0.767	0.751	0.613
		N	27	27	27	27	27

Source: own processing in SPSS based on data provided by Eurostat

The value of the Spearman correlation coefficients are -0.162 for solid fuels consumption, -0.060 for electricity, -0.064 for oil and 0.102 for renewable energy. At the same time, for solid fuels consumption, the value of Sig. = 0.418 shows that the hypothesis of homoscedasticity is accepted with a probability of 95%. Applying the same approach to the other analysed independent variables, the results show that Sig > 0.05 in all cases. Therefore, the errors of the analysed regression model are homoscedastic, guaranteed with a probability of 0.95.

Finally, the analysis considers the test of hypothesis for autocorrelation of errors, according to which cov (ε_i, ε_j) = 0. Two hypothesis are necessary, such as:

- Null hypothesis (H_0): there is no autocorrelation of errors;

- The alternative hypothesis (H_1): there is autocorrelation between the errors of the estimated model.

Autocorrelation of errors can be tested through several methods, the most used of which are Durbin Watson and Runs test. This paper opts for the Runs test, while Table 9 presents the results of testing the autocorrelation of error.

Table 9. Runs test

	Unstandardized Residual
Test Value(a)	47.69233
Cases < Test Value	13
Cases >= Test Value	14
Total Cases	27
Number of Runs	13
Z	-0.386
Asymp. Sig. (2-tailed)	0.700

a. Median
Source: own processing in SPSS based on data provided by Eurostat

The value of Sig. = 0.700 associated with the calculated test statistic is greater than the significance threshold of 0.05. Thus, the decision is to accept the null hypothesis with a confidence level of 0.95, which means that the model errors do not record the autocorrelation phenomenon.

As conclusion, the analysis is valid, considering the compliance with all assumptions regarding the errors of the regression model.

Conclusions

The paper scope is to identify, based on data recorded at EU level, whether the energy consumption influences economic performance across the EU. The result is one of the essential

prerequisites in addressing the EU energy policy, which together with the approach to all other joint actions, is in a delicate situation given the rather unstable economic outlook.

The consumption of electricity, natural gas, oil and renewable energy have a significant influence on economic development at the level of the European Union, an intuitive result from an economic point of view. Therefore, the correlation between the consumption of electricity, oil, and renewable energy, on the one hand, and economic growth, on the other hand, proves, empirically, to be directly proportional. There is a generally association between the high values of the consumption of electricity, natural gas, oil and renewable energy and positive rates of economic growth. For solid fuels consumption, the results are statistically insignificant. The explanation for the lack of correlation is that the variable represented by solid fuels consumption is the only one that registers a continuous downward trend in the analysed model during the period 1990-2015.

The results obtained through the statistical analysis highlighted the fact that, for the European Union, the level of economic development has profound energy valences. With the exception of solid fuels, the impact of the consumption of the other types of energy analysed is a considerable one on economic growth. That is why ensuring a sufficient supply of energy resources to support any growth will influence the prospects for economic growth that the European Union imposes on itself. However, the previous results explain influences at the Community level, and consequently the energy approach of the European policies must take into account the fact that the pressure of energy consumption may vary from country to country within the EU.

The energy consumption always accompanies directly proportional the evolution of the economic growth, most often related to the increases in the productivity of an economy. This paper suggests that for the period between 1990 and 2015, the consumption of energy from renewable sources registers the most spectacular increases. The increasing trend is amplified after the year 2010, a sign of the awareness that a sustainable economic development is closely related to a continually increasing use of this type of resource. At the same time, the results show that the evolution of the use of renewable energy sources are positive, with a significant increase until 2020.

It should be borne in mind that the analysis followed EU-wide data, and the dependency relationship established is valid at the EU level as a whole, with the typicality of each Member State's economy, both in terms of economic performance and energy resource use, being quite heterogeneous. Therefore, we cannot translate the results for individual Member States. However, the results underline once again that the upward trend in economic performance at European level is dependent on an increasing use of energy resources. In other words, European energy policy must consider this correlation, so that the measures and policies adopted enable the economic environment

to have easier access to these resources, thereby increasing the chances of overcoming the current difficult period as quickly and cheaply as possible.

Based on the results, a decrease in fossil fuel consumption at EU level can lead to a decrease in productivity, so economic growth can indeed be supported by a reduction in the use of coal, oil or natural gas, as long as this is offset by an increase in the use of renewable resources. To these we add their significant impact, as determined by the present statistical analysis, and the fact that renewable industry is constantly evolving, innovative and capable of stimulating sustained regional development. This is closely linked to the common vision on European energy policy for a more connected, less dependent on external supplies and greener energy market.

Future studies should aim to apply similar statistical methods to see whether the correlation we have obtained at EU level is valid at the individual level of all Member States. Certainly, given the significant differences between Member States' economies (area and geographical position, population, macroeconomic structure, availability of domestic energy resources, structure of energy imports) the challenges of an integrated energy policy are significant.

References

Abosedra, S., Baghestani, H. (1989), New evidence on the causal relationship between United States energy consumption and gross national product, *The Journal of Energy and Development*, 14(2), pp. 285-292.

Akarca, A.T., Long, T.V. (1980), On the relationship between energy and GNP: a re-examination, *Journal of Energy and Development*, 5, pp. 326 – 331.

Altinay, G., Karagol, E. (2004), Structural break, unit root, and the causality between energy consumption and GDP in Turkey, *Energy Economics,* 26 (6), pp. 985 – 994.

Ang, J., B., (2008), Economic development, pollutant emissions and energy consumption in Malaysia, *Journal of Policy Modeling*, 30, pp. 271 – 278.

Asafu-Adjaye, J. (2000), The relationship between energy consumption, energy prices and economic growth: time series evidence from Asian developing countries, *Energy Economics*, 22, pp. 615-625.

Aqeel, A., Butt, M.S. (2001), The relationship between energy consumption and economic growth in Pakistan, *Asia Pacific Development Journal*, 8(2), pp. 101-110.

Belloumi, M. (2009), Energy consumption and GDP in Tunisia: cointegration and causality analysis, *Energy Policy*, 37 (7), pp. 2745 – 2753.

Bowden, N., Payne, J.E. (2009), The causal relationship between US energy consumption and real output: a disaggregated analysis, *Journal of Policy Modeling*, 31(2), pp. 180-188.

Erdal, G., Erdal., H., Esengun, K. (2008), The causality between energy consumption and economic growth in Turkey, *EnergyPolicy*, 36(10), pp. 3838-3842.

Fatai, K., Oxley, L., Scrimgeour, F.G. (2004), Modelling the causal relationship between energy consumption and GDP in New Zealand, Australia, India, Indonesia, the Philippines and Thailand, *Mathematics and Computers in Simulation*, 64, pp. 431-445.

Ghali, K.H., El-Sakka, M.I.T. (2004), Energy use and output growth in Canada: a multivariate cointegration analysis, *Energy Economics,* 26, pp. 225-238.

Glasure, Y.U., Lee, A.R. (1997), Cointegration, error-correction, and the relationship between GDP and energy: The case of South Korea and Singapore, *Resource and Energy Economics*, 20, pp. 17-25.

Glasure, Y.U. (2002), Energy and national income in Korea: further evidence on the role of omitted variables, *Energy Economics*, 24, pp. 355-365

Hwang, D., Gum, B. (1991), The causal relationship between energy and GNP: the case of Taiwan, *Journal of Energy Development*, 16, pp. 219-226.

Jumbe, C. (2004), Cointegration and causality between electricity consumption and GDP: empirical evidence from Malawi, *Energy Economics,* 26, pp. 61- 68.

Karanfil, F. (2008), Energy consumption and economic growth revisited: does the size of unrecorded economy matter?, *Energy Policy*, 36(8), pp. 3029-3035.

Kraft, J., Kraft, A. (1978), On the relationship between energy and GNP, *Journal of Energy Development*, 3, pp. 401-403.

Lee, C.C., Chang, C.P. (2005), Structural breaks, energy consumption, and economic growth revisited: evidence from Taiwan, *Energy Economics*, 27, pp. 857 – 872.

Lee, C.C. (2005), Energy consumption and GDP in developing countries: a cointegrated panel analysis, *Energy Economics*, 27, pp. 415-427.

Masih, A.M.M., Masih, R. (1996), Energy consumption, real income and temporal causality: results from a multi-country study based on cointegration and error-correction modelling techniques, *Energy Economics*, 18, pp. 165-183.

Nasreen, S., Anwar, S. (2014), Causal relationship between trade openess, economic growth and energy consumption: a panel data nalysis of Asian countries, *Energy Policy,* 69, pp. 82-91

Oh, W., Lee, K. (2004), Causal relationship between energy consumption and GDP: the case of Korea 1970–1999, *Energy Economics*, 26 (1), pp. 51-59.

Ozturk, I. (2010), A literature survey on energy-growth nexus, *Energy Policy,* 38, pp. 340-349.

Paul, S., Bhattacharya, R.N. (2004), Causality between energy consumption and economic growth in India: a note on conflicting results, *Energy Economics*, 26(6), pp. 977-983.

Pirlogea, C., Cicea, C. (2012), Econometric perspective of the energy consumption and economic growth relation in European Union, *Renewable and sustainable energy reviews*, 16(8), pp. 5718-5726.

Soava, G., Mehedintu, A., Sterpu, M., Raduteanu, M. (2018), Impact of renewable energy consumption on economic growth: evidence from european union countries, *Technological and Economic Development of Economy*, 24(3), 914-932.

Soytas, U., Sari, R. (2003), Energy consumption and GDP: causality relationship in G7 countries and emerging markets, *Energy Economics*, 25, pp. 33-37.

Sriyana, J. (2019), Dynamic effects of energy consumption on economic growth in an emerging economy, *International journal of energy economics and policy,* 9(4), pp. 283-290.

Stern, D.I. (1993), Energy and economic growth in the USA. A multivariate approach, *Energy Economics*, 15, pp. 137-150.

Stern, D.I. (2000), A multivariate cointegration analysis of the role of energy in the US macroeconomy, *Energy Economics*, 22, pp. 267-283.

Stern, D. I. (2004), Economic growth and energy, *Encyclopedia of Energy*, 2, pp. 36-51.

Streimikiene, D., Kasperowicz, R. (2016), Review of economic growth and energy consumption: A panel cointegration analysis for EU countries, *Renewable and sustainable energy reviews*, 59, pp. 1545-1549.

Tang, C.F., Tan, B.W., Ozturk, I. (2016), Energy consumption and economic growth in Vietnam, *Renewable and sustainable energy reviews*, 54, pp.1506-1514.

Wolde-Rufael, Y. (2004), Disaggregated industrial energy consumption and GDP: the case of Shanghai, *Energy Economics*, 26, pp. 69-75.

Yang, H.Y. (2000), A note on the causal relationship between energy and GDP in Taiwan, *Energy Economics*, 22, pp. 309-317.

Yu, E.S.H., Hwang, B.K. (1984), The relationship between energy and GNP: further results, *Energy Economics*, 6, pp. 186-190.

Yu, E.S.H., Jin, J. C. (1992), Cointegration tests of energy consumption, income, and employment, *Resources and Energy*, 14(3), pp. 259-266.

Yu, E.S.H., Choi, J.Y. (1985), The causal relationship between energy and GNP: an international comparison, *Journal of Energy and Development*, 10, pp. 249-272.

Zhang, X.P., Cheng, X-M, (2009), Energy consumption, carbon emissions, and economic growth in China, *Ecological Economics*, 68(10), pp. 2706-2712.