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CENTRAL EUROPEAN REVIEW OF ECONOMICS & FINANCE Vol. 44. No 3 (2023) pp. 5-20 DOI https://doi.org/10.24136/ceref.2023.011

Jacek Białek¹

SCANNER DATA AND THE PROBLEM OF SELECTING A PRICE INDEX FORMULA

Abstract

Scanner data are electronic transaction data most often from retail chains and obtained from electronic retail terminals. The identification of products takes place after scanning their characteristic barcode (e.g. EAN or GTIN), thus in the case of scanner data, we have full product information (price, sales volume, weight, description, etc.) at the most disaggregated level. In the cases of many countries, as well as Poland, this type of data is a valuable alternative source of information when estimating inflation. This paper discusses the main advantages but also the challenges of using scanner data in the CPI measurement. The main purpose of the paper, however, is to discuss the problem of selecting an optimal price index formula that would be appropriate for the highly dynamic (in terms of product rotation) scanner data. The considerations, supported by examples of empirical studies, will be demonstrated using the *PriceIndices* package in the R environment.

Keywords: scanner data, Consumer Price Index, bilateral indices, multilateral indices.

JEL Classification: C43

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Introduction

The following definition of scanner data can be found in the literature: "Scanner data mean transaction data that specify turnover and numbers of items sold by barcodes, e.g. GTIN, formerly known as the EAN code (International Labour Office, 2004)."

These data can be obtained from a wide variety of retailers (supermarkets, home electronics, Internet shops, etc.). Scanner data have numerous advantages compared to traditional survey data collection because such data sets are much bigger and cheaper than traditional ones and they contain complete transaction information at the barcode level, i.e. information about prices and quantities. As a rule, scanner data sets have huge volume and may provide some additional information about products (such as the following attributes: size, grammage, sale unit, colour, package quantity, etc.). These attributes may be useful in aggregating items into the homogeneous groups or when product matching over time (Białek and Beręsewicz, 2021). The use of scanner data in the assessment of inflation leads to the improvement of the data collection process, its costs reduction and a better reflection of changes that occur in consumer behaviour. The form of the sample scanner dataset is presented in Tab.1.

Time	Prices	Quantities	Retid	EAN	COICOP	Label	Grammage	Unit	Prodid
2022-12-31	10.47	8.48	26-617	590674717126	011111	long grain rice	0.4	kg	1
2022-12-31	12.47	5.87	40-772	590674717126	011111	long grain rice	0.4	kg	1
2022-12-31	11.40	15.65	70-001	590674717126	011111	long grain rice	0.4	kg	1
2022-12-31	13.20	16.95	85-791	590674717126	011111	long grain rice	0.4	kg	1
2022-12-31	11.47	85.41	01-460	590674717126	011111	long grain rice	0.4	kg	1
2022-12-31	11.97	7.82	05-820	590674717126	011111	long grain rice	0.4	kg	1

Source: Białek et. al. (2022), p. 71.

This paper, however, focuses not on the advantages but on the challenges that accompany the implementation of scanner data for the CPI measurement. One of the major challenges facing statistical offices in this case is the choice of the price index formula (Chessa, 2015). The purpose of this article is to point out potential problems related to this aspect and also to demonstrate possible differences in measuring the dynamics of scanner prices that may arise when using different price indexes.

1. Challenges when using scanner data

Using scanner data in the context of CPI measurement poses a number of challenges, both technological and methodological. First, the processing of scanner data generates an IT challenge, as it is a huge volume of data that needs to be automatically cleaned, classified into appropriate product segment groups (COICOP) and then matched over time (Białek and Beręsewicz, 2021). From a methodological point of view, the challenge in turn is the appropriate filtering of the data. This stage requires selection of the type of data filter and its thresholds, e.g. *extreme price filter* or *low sales filter* can be applied – see van Loon and Roels (2018). Sometimes the statistical office is forced to build a completely new IT environment to handle the processes mentioned earlier. However, some statistical offices choose to implement functioning packages or programs dedicated to scanner data and price indexes. The R packages such as the *IndexNumR* or *PriceIndices* package (Białek, 2022a) should be mentioned here, the latter of which has been implemented at Statistics Poland (Białek, et, al. 2022).

From a methodological perspective, scanner data also provides many opportunities but also challenges. Due to the highly detailed nature of this data, opportunities open up for statisticians to accurately model probability distributions of product prices (Białek and Sulewski, 2022) and thus study the stochastic properties of price indices (Silver and Heravi, 2007; Białek, 2020, 2022b). Nevertheless, the high turnover of scanner products (so-called *product churn*) makes the choice of index formula not at all an obvious choice. The choice of a price index for estimating inflation on the basis of the scanner data should take into account the *weak* and *strong seasonality* of products (CPI Manual, 2004), and should eliminate the measurement bias resulting from the *substitution effect* of goods and *chain drift*. This thread will be developed in the next Section, which is devoted to the selection of the price index formula.

2. Scanner data and price index selection

In the case of traditional data collection, where interviewers collect information about prices from the field and the consumption level is evaluated via household budget surveys, statistical agencies use bilateral index numbers (von der Lippe, 2007; Białek and Roszko-Wójtowicz, 2021). In practice, at the lowest level of data aggregation, where only prices are available, the unweighted Jevons (1865) price index formula is used to calculate price indexes, which is due to the good axiomatic properties of this formula and also to the fact that it is anchored within the so-called *stochastic approach* (von der Lippe, 2007). At higher levels of data aggregation, where the statistical office has knowledge of the level of consumption of specific product groups, the Laspeyres-type formula (1871) is most often used. For a set of prices and quantities of goods observed in the base (0) and current (t) period, the Jevons formula can be expressed as:

$$P_J^{0,t} = \prod_{i=1}^{N_{0,t}} \left(\frac{p_i^t}{p_i^0}\right)^{\frac{1}{N_{0,t}}}$$

and the Laspeyres price index can be written as

$$P_{La}^{0,t} = \frac{\sum_{i=1}^{N_{0,t}} q_i^0 p_i^t}{\sum_{i=1}^{N_{0,t}} q_i^0 p_i^0},$$

where $N_{0,t}$ denotes number of products available in the periods 0 and t, p_i^{τ} means a price of the i-th product observed at the time τ , q_i^{τ} means a quantity of the i-th product observed at the time $\tau \in \{0,t\}$. The use of the Laspeyres index at higher levels of data aggregation and ultimately at the COICOP 2 level is dictated by the lag with the household budget survey providing information on the level of consumption of goods and services.

However, in the case of scanner data, there is no contraindication to using weighted price indexes that also use current period consumption data. Scanner data are complete already at the lowest levels of aggregation and we have information on both prices and quantities of products for the selected moment of transaction. Thus, the "ideal" Fisher (1922) index seems to be the best choice from the perspective of the axiomatic and economic approach in the index theory. The Fisher index is a geometric mean of the Laspeyres and Paasche (1874) indices, i.e.:

$$P_F^{0,t} = \sqrt{P_{La}^{0,t} P_{Pa}^{0,t}}$$
,

where the Paasche price index is as follows:

$$P_{Pa}^{0,t} = rac{\displaystyle\sum_{i=1}^{N_{0,t}} q_i^t p_i^t}{\displaystyle\sum_{i=1}^{N_{0,t}} q_i^t p_i^0} \, .$$

However, some problems arise with the use of the bilateral indexes. The Jevons index does not take full advantage of the information because it does not take into account knowledge of product consumption. On the other hand, the use of weighted bilateral indexes does not take into account intermediate periods between the base period and the current period, i.e. it can generate measurement bias due to the high turnover of scanner products. Unfortunately, even the use of chain weighted indexes (such as the chain Fisher index) does not guarantee an unbiased measurement. It can be shown (Chessa, 2015) that frequently chained weighted indices lead to the *chain drift* bias. The *chain drift* can be formalised in terms of the violation of the *multi period identity test* (Białek, 2022c). The above-mentioned test states, that when all prices and quantities in the current period return to their values from the base period, then the index should equal one.

The most promising group of indexes in the context of scanner data appear to be multilateral indexes. The multilateral price index is calculated for a given time window consisting of T + 1 consecutive months, which we number 0,1,2,...,T (typically T = 12). Multilateral indices use all prices and quantities of individual products which are available in a set time window. Multilateral indices are *transitive* (Australian Bureau of Statistics, 2016), which eliminates the chain drift problem. The known and popular multilateral methods are the GEKS method (Gini, 1931; Eltetö and Köves, 1964), the Geary-Khamis (GK) method (Geary, 1958; Khamis, 1972), the CCDI method (Caves et al., 1982) or the Time Product Dummy Methods (de Haan and Krsinich, 2018). For instance, the popular GEKS formula which is based on the Fisher price index, can be expressed as follows:

$$P_{GEKS}^{0,t} = \prod_{\tau=0}^{T} \left(P_F^{0,\tau} P_F^{\tau,t} \right)^{\frac{1}{T+1}}$$

3. Potential differences between price indices while using scanner data

The first aim of our empirical study is indicating potential differences between bilateral indices and full-time window multilateral indices. In the study, scanner data from one retail chain in Poland were used, i.e. monthly data on *ground coffee* (subgroup of COICOP 5 group: 012111) and *white sugar* (subgroup of COICOP 5 group: 011811) sold in 212 outlets during the period from December 2019 to December 2020. Before price index calculations, the database was carefully prepared. First, after deleting missing and duplicated data, the sold products were classified first into the relevant elementary groups and their subgroups (COICOP 6 level). Product classification was done via *data_selecting()* and *data_classification()* functions from the *PriceIndices* R package (Białek, 2022a). The first function required manual preparation of dictionaries of phrases and keywords which are able to identify individual product groups. The *data_classification()* function, which is based on *machine learning* techniques, was used for problematic, previously unclassified products and required manual

preparation of learning data sets. This step of classification was based on random trees and the XGBoost algorithm (Tiangi and Carlo, 2016). Next, the product matching was carried out on the basis on the available GTIN bar codes, internal retailer codes, and product labels. To match products over time we run the data matching() function from the PriceIndices package. All products with two identical codes or one of the codes identical and an identical label were automatically matched. Products were also matched if they had identical one of the codes and the Jaro-Winkler (1989) distance of their labels (descriptions) was smaller than the fixed precision value: 0.02. In the last step before calculating indices, two data filters were applied to remove unrepresentative products from the data set, i.e. the data filtering() function from the PriceIndices package was applied. The extreme price filter (Białek and Beresewicz, 2021) was used to eliminate items with more than three-fold price increase or more than double price drop from period to period. The low sale filter (van Loon and Roels, 2018) was run to roll out products with relatively low sales (almost 35% of products were removed).

Fig. 1 presents a comparison of bilateral indices (unweighted and weighted) prepared for these two above-mentioned scanner data sets. Fig. 2 presents a comparison of the selected multilateral index methods (GEKS, Geary-Khamis and TPD indices) with the chain Jevons and chain Fisher indices. As one can see, the bilateral Jevons index clearly lags behind bilateral weighted price indexes, whereby it can overestimate or underestimate the "ideal" Fisher index by as much as more than 10 percentage points (see Fig. 1). The chain Jevons index also differs substantially from the chain Fisher index and multilateral indexes (the difference is as extreme as 23 percentage points for August 2020 for *white sugar*). As it was above-mentioned, the Fisher chain index is subject to the chain drift effect, and it can be seen that its values differ somewhat from those of the multilateral indexes, which are free of the chain drift problem.



Figure 1. Comparison of bilateral indices for data on ground coffee and white sugar Source: Own calculations in the *PriceIndices* R package



Figure 2. Comparison of the multilateral index methods with the chain Jevons and chain Fisher indices

Source: Own calculations in the PriceIndices R package

4. Comparison of price indices due to their time-consuming

As previous work has shown (Bialek and Beręsewicz, 2021), price indexes vary widely due to the timing of the calculations. Thus, the cited work proposes the *time-consuming criterion* for evaluating multilateral indexes applied to the case of scanner data. The choice of an index whose calculation time is relatively small is of practical importance, since scanner data are generally very large data sets and the final calculation time is proportional to the number of outlets of the retail chain (provided the retail chain has a regional pricing policy). Figure 3 presents a comparison of the calculation times of the considered price indexes for the two product groups analysed.



Figure 3. Comparison of the calculation times of selected price indices Source: Own calculations in the *PriceIndices* R package

As can be seen, the computation of chain indices is relatively faster than the computation of multilateral indices due to the greater complexity of the latter. Among multilateral indexes, the calculation time of the TPD index is relatively attractive as long as the dataset is small (white sugar). For larger datasets (ground coffee), the GEKS index can be calculated the fastest. The Geary-Khamis index, due to its iterative procedure (usually 4-6 iterations are needed), is relatively time-consuming. A similar time-consuming comparison of multilateral indexes which includes additional price indexes, can be found in the paper of Białek (2022d).

5. Problem of aggregation of partial indices over outlets

As it was above-mentioned, the time-consumption of the price index is proportional to the number of outlets of a given retail chain. In other words, if the retail chain has a regional pricing policy, it is necessary to calculate price indices for each outlet separately and then aggregate the partial results into one resultant price index. This arises the natural question of whether the possible aggregation of the results relative to the outlets makes practical sense, i.e. whether there is any substantial difference between the price index calculated without this aggregation and the index that takes this aggregation into account. For a traditional data collection, the only aggregation formula is the Laspeyres formula, since knowledge of consumption of goods and services is unavailable for the current period. In the case of scanner data, any aggregation formula can be considered. Figures 4, 5 and 6 show the effect of aggregation on the value of the price index while considering different aggregation methods, i.e. the aggregation by using the Laspeyres, Paasche and Fisher formulas. For example, when aggregating over outlets by using the Fisher's formula, the impact of results from an outlet will be proportional to the relative shares of sales revenue from that outlet in the base and current periods. Based on Figures 4-6, it can be concluded that the Jevons chain index is particularly sensitive to the decision to perform sub-score aggregation over outlets. The Fisher chain index and the multilateral GEKS index are marginally sensitive to the choice of aggregation formula and also to the abandonment of aggregation (see Fig. 5 and 6). However, this conclusion requires further research, as it may be due to the very similar pricing policies of the given retail chain across all outlets.

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Figure 4. Impact of an aggregation method on the chain Jevons index Source: Own calculations in the *PriceIndices* R package



formula ---- no aggregation ---- Laspeyres ---- Fisher --- Paasche

Figure 5. Impact of an aggregation method on the chain Fisher index Source: Own calculations in the *PriceIndices* R package



Figure 6. Impact of an aggregation method on the GEKS index Source: Own calculations in the *PriceIndices* R package

Conclusions

It seems that from a methodological point of view, the problem of selecting the price index for scanner data case is one of the key problems. This is due to the fact that, firstly, the value of measuring the dynamics of scanner prices strongly depends on the choice of the index itself, and secondly, there are many criteria on the basis of which the choice of an optimal price index can be made (for example, the axiomatic criterion, the economic criterion, the stochastic criterion or the time-consuming criterion). However, it seems that the main conclusion from the study is that there is no recommendation for the chain Jevons index, which, as an unweighted formula, completely fails to reflect the differentiation of products by scale of their sales.

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ARTICLES

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Małgorzata Czermińska¹

SWITZERLAND-EU RELATIONS – BETWEEN ECONOMIC INTEGRATION AND BILATERALISM

Abstract

Switzerland's foreign policy priorities include, among other things, relations not only with neighbouring countries, but also with the EU. Being a country which is located in the heart of Europe, Switzerland considers the relations with the European Union (EU) and its Member States to be of special importance. The paper aims to present mutual relations between Switzerland and the European Union over the past years, demonstrate benefits and threats arising from Switzerland's decision to choose, as the only one of all third countries, a path of "bilateral agreements", as well as describe possible scenarios for mutual relations following the rejection of an institutional agreement, which was expected to put that relationship on a new path. The strategy of bilateralism brings many bene fits to Switzerland. However, due to the firm position of the EU, it will be necessary to look for new scenarios for the development of mutual cooperation. Perhaps such a solution would be to renegotiate the free trade agreement with Switzerland and turn it into a next-generation trade agreement.

JEL classification: F13, F15, F53

Keywords: Common Commercial Policy, the European Union, trade agreements, Switzerland-EU relations, economic integration, bilateralism.

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Introduction

Switzerland's foreign policy priorities include, among other things, relations not only with neighbouring countries and their border regions, but also with the EU. Being a country which is located in the heart of Europe, Switzerland considers the relations with the European Union (EU) and its Member States to be of special importance. The country has very strong economic, political and social ties with the bloc. One of the goals of Switzerland's European policy is to create the best possible framework for long-lasting and mutual relations with the most important economic and political partner, while bringing benefits to all parties.

Switzerland is one the EU's major trading partners (in 2021, it was the fourth largest player, in terms of trade volumes (exports + imports), following China, the USA and the United Kingdom, having a share of 6.5%). Trade dealings with the European Union account for almost a half of Switzerland's trade (45% in 2021). The export of Swiss goods to the EU is concentrated on several sectors, specifically, the chemical/pharmaceutical and medical industry (EUR 54.4 billion, 44%), machinery and equipment (EUR 15.6 billion, 12.6%), pearls and precious stones (EUR 13.8 billion, 11.2%) and optical and photographic instruments (EUR 11.3 billion, 9.2%) (Table 1). Switzerland is a very relevant partner of the EU as regards trade in services, in particular, services amounted to EUR 162.7 billion, accounting for 9.1% of the aggregate trade in services in the EU (Eurostat data).

		- I	MPORT	S		EXPORTS				
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Value	99.1	101.9	109.9	108.9	123.7	132.0	134.6	146.5	142.3	156.5
Share in										
Extra-EU, in	5.6	5.3	5.7	6.3	5.8	6.6	6.5	6.9	7.4	7.2
%										
Main Goods (% of the total) (HS section)	Productindustri and ap or or or se and Optica and ac	cts of t ries (4 ppliance cultured emi-prec articles I, phot al i ccessorie	he che 44,1)(VI s (12,6 pea ious n therec ographi instrume es therec	mical o); Ma 6)(XVI); rls, p netals, of (11,2 c, mea ents, of (9,2)()	r allied chinery Natural recious stones 2)(XIV); asuring, parts XVIII)	Products of the chemical or allied industries (23,3)(VI); Machinery and appliances (15,5)(XVI);Vehicles, aircraft, vessels and transport equipment (9,2)(XVII); Natural or cultured pearls, precious or semi-precious metals, stones and articles thereof (7,0)(XIV)				
Switzerland's	IMPO	RTS				EXPOR	RTS			
Major Trading										
Partners	EU27	(49.1);	the U	nited K	ingdom	n EU27 (41.7); the USA (16.6); China				China
(% of the total, 2021)	(11.3);	the US	A (7.4), (China (6	.2)	(8.7); Ir	ndia (8.3)		

 Table 1. EU-Switzerland Trade in EUR billion and %

Source: Own elaboration based on: (European Commission Trade Statistics, 2022)

The European integration has been a political and economic challenge to Switzerland throughout the past 60 years, the Swiss could not be, nor are they now, indifferent to the progressing integration of Europe. Most referenda on the European integration was held in Switzerland, where citizens voted at least 17 times, directly or indirectly, on the issue concerning their relations with the EU (Schwok, 2020, p. 60).

The paper aims to present mutual relations between Switzerland and the European Union over the past years, demonstrate benefits and threats arising from Switzerland's decision to choose, as the only one of all third countries, a path of "bilateral agreements", as well as describe possible scenarios for mutual relations following the rejection of an institutional agreement, which was expected to put that relationship on a new path. One scenario is to renegotiate the free trade agreement of the 1970s and turn it into a new- generation trade agreement. Possible scenarios for the development of mutual relations, indicating the real possibilities of their implementation are the added value of this study.

1. Stages of Switzerland's European Policy – Genesis and Main Provisions of Bilaterals I

Given the relations between Switzerland and EEC/EU, four main stages can be distinguished (Kozłowski, 2015, p. 59):

- Stage 1 (1951-1972), covering the period from establishing European Communities to signing the 1972 Free Trade Agreement between Switzerland and the EEC;
- Stage 2 (1973-1987), the beginning of which was marked by the entry into force of the Free Trade Agreement with the EEC, and the end – by the creation of the single European market;
- Stage 3 (1987-1992), which was characterised by a policy for strengthening Switzerland-EU relations, as well as the European Economic Area (EEA) Agreement signed in Porto in 1992;
- Stage 4, after 1992, the beginning of which can be seen as a substantial change in the course of action for Switzerland's integration policy, following a referendum held in December 1992, when Switzerland refused to be a member of the EEA.

The free trade agreement covering trade in industrial articles (goods included in sections 25-99 of the Brussels Nomenclature) was concluded on 19 December 1972, entered into force on 1 January 1973, and as a consequence of the said instrument, customs duties imposed on industrial products in trade between the European Community and Switzerland were abolished on 1 July 1977. This is one of the oldest trade agreements signed by the EU. It does not contain any provisions on services, investments, intellectual property rights, government procurements, nor social and environmental issues (Regulation (EEC) No 2840/72 of the Council of 19 December 1972).

On 26 May 1992, the Federal Council filed an official application for the commencement of accession negotiations. However, Switzerland did not conduct a referendum on its membership of the European Union (Kux, Swerdrup, 2000, p. 252).

Three of EFTA countries, namely Iceland, Lichtenstein and Norway, are currently bound by the 1992 European Economic Area (EEA) Agreement. Switzerland signed the Agreement, but eventually, did not join the EEA on account of the unfavourable result of a referendum conducted on that issue (6 December 1992)². The 1992 vote divided the country (Seitz, 2014, p. 149; Mueller, Heidelberger, 2019, p. 188). The idea behind the EEA is to create for Member States a common market in industrial goods (without agricultural and fishery products), persons, services and capital. EFTA countries being the members of the EEA have not adopted the Union customs tariff and are not involved in the common commercial policy, nor in the common agricultural or fisheries policy.

As the vote on the EEA was "no", there were no grounds for entering into accession negotiations, hence in January 1993, the Bundesrat declared that the commencement of accession negotiations would be suspended for some time. After the negative result of the December 1992 referendum, the Swiss government had to hastily reframe its concept of integration policy with the European Union. At that time, a new strategy of Switzerland's integration policy was implemented, and its main instrument was bilateral agreements, also known as sectoral agreements – a strategy of bilateralism (bilateralism)³. The EU accepted bilateralism as an interim solution, expecting that it would result in Switzerland's full membership over time⁴. Key importance must be attached to two basic elements of the strategy of bilateralism, both of which are correlated with each other (Kozłowski, 2015, p. 62):

- Entering into sectoral bilateral agreements, which cover important areas of co-operation;
- Adapting or incorporating the EU acquis into the Swiss legal system.

² In Switzerland, all important international treaties must be put to a mandatory referendum.

³ The strategy of bilateralism was referred to in the literature also as virtual membership, integration without membership or quasi-membership (Popławski, Starzyk-Sulejewska, 2012, p. 73; Kozłowski, 2015, p. 59).

⁴ However, that never happened, and, conversely, in 2006, Switzerland announced that EU Membership was no longer a strategic goal of the integration policy (Europabericht, 2006, p. 6825).

That strategy has been pursued so far under two packages of bilateral agreements – *Bilaterals* I (BAI) and *Bilaterals* II (BAII). This two-way method of regulating mutual relations can be divided into three periods. The first period began in 1993, when negotiations on the first series of bilateral agreements, BAI, were opened. The first agreement package is comprised of seven co-operation agreements between Switzerland and the EU, which were signed on 21 June 1999, but entered into force on 1 June 2002. These agreements concerned:

- Freedom of movement;
- Land transport;
- Air transport;
- Scientific and technological cooperation;
- Public procurement;
- Trade in agricultural products;
- Technical barriers to trade (the mutual recognition of standards and conformity assessments).

All bilateral agreements, except for the Agreement on Scientific Research, take the form of arrangements providing Switzerland with access to a specific segment of the European market⁵. These seven agreements are legally related to each other by a so-called "guillotine clause", which stipulates that where one agreement is terminated, the other instruments will cease to have effect six months later.

The Agreement on the Free Movement of Persons is considered the most important of all agreements included in the BAI package (Abkommen zwischen der Schweizerischen Eidgenossenschaft einerseits und der Europäischen Gemeinschaft und ihren Mitgliedstaaten andererseits über die Freizügigkeit). That agreement enables Swiss citizens to enjoy the freedom of choice as regards a workplace or a place of residence within the EU, the same right is applicable in Switzerland to EU nationals. The condition which Swiss and EU citizens must fulfil in order to be allowed to settle in another country is having health and accident insurance, and if they are employed, they need to have a valid contract of employment or, where they conduct an activity as self-employed persons or are not employed, must have enough funds to meet the cost of living. The agreement also governs the mutual recognition of professional qualifications and the coordination of national social security systems. And finally, the agreement enables the cross-border provision of services on a short-term basis (not longer than 90 days in a year) (Agreement between the European Community and the Swiss Confederation on trade in agricultural products).

⁵ For more information about *Bilaterale I* see: (Kozlowski, 2010; Oesch, 2020b).

The free movement of persons is supplemented in Switzerland with so-called accompanying measures (*Begleitendemassnamen*), in order to prevent wage and social dumping. It refers, among other things, to the rule under which own citizens are given the priority to be employed, and as part of so-called accompanying protection measures, inspections were carried out to check wages and work conditions (Abkommen vom 21. Juni 1999 zwischen der Schweizerischen Eidgenossenschaft einerseits und der Europäischen Gemeinschaft und ihren Mitgliedstaaten andererseits über die Freizügigkeit).

In 2020, about 1.4 million EU citizens lived in Switzerland, compared to about 400,000 Swiss citizens residing in the EU. Another 343,809 EU nationals cross the border every day to work in Switzerland. Given the total workforce of 5.1 million people, around 25% – that is to say, more than 1.28 million people – are EU citizens (of which 343,809 are cross-border workers (European Commission, 2021).

The Agreement on Land Transport opens the road and rail transport market for the carriage of persons and goods between Switzerland and the EU. The purpose of the agreement is to create comparable conditions for market access and competition for transport companies from Switzerland and the EU. At the same time, it forms a contractual basis for introducing and gradually raising a charge on heavy vehicles (trucks) (Leistungsabhängige Schwerverkehrsabgabe, LSVA), in transit via Switzerland, which is aimed at reducing road transport in favour of carriage by rail. In exchange, Switzerland accepted a gradual increase in weight limit for trucks from 28 to 40 tonnes (since 2005). Under the agreement, Swiss carriers are allowed, e.g., to transport goods from one EU country to another ("large-scale cabotage"). The only exception to opening the market is so-called "small-scale cabotage" (domestic transport by foreign companies). Other restrictions in Switzerland, such as a ban on night and Sunday truck traffic, remain in force.

In the area of carriage of goods, railway companies have better mutual access to rail networks. In particular, this has a beneficial effect on transport companies which are engaged in international combined transport (trucks or containers loaded onto a train). Both parties have also committed themselves to improve railway infrastructure.

The air traffic agreement provides Swiss airlines with equal access to the deregulated EU market on a reciprocal basis. Unlike the other agreements included in the Bilaterale I package, the air agreement meant the incorporation of the whole EU acquis regarding air law by Switzerland, that is to say, it is updated on a continuous basis in accordance with new EU regulations. As a consequence of being admitted to air traffic on the liberalised EU market, Swiss airline companies have attained the position equal to that of European competitors (Integrationsbüro EDA/EVD, 2008, p. 39). The fact that the European prohibition of discrimination on grounds of nationality applies to them and that they have the right to acquire majority shareholdings of EU airline companies reflects the foregoing view. Further, important solutions were introduced, e.g. the freedom to choose flight routes, transport rates and the size of aeroplanes. As regards airline passengers, the agreement ensures lower prices and the greater availability of air connections.

The Agreement on Scientific and Technological Cooperation, made as part of the Bilaterals I package, is a considerable improvement of the 1985 Agreement, making Switzerland one of the five "associated countries" (the others include the remaining EFTA countries and Israel) taking part in five EU framework programmes for research.

The EU-Switzerland Public Procurement Agreement is based on the WTO agreement on public procurement markets. This multilateral agreement laid down rules for calls for tenders made by national, regional and district authorities in the area of the water, public transport, power and construction sectors (with certain restrictions) based on the equal treatment (non-discrimination) principles, transparent procedures and law, legal appeal against the outcome of a tendering procedure and contract awards (of a specific value) (Abkommen zwischen der Schweizerischen Eidgenossenschaft und der Europäischen Gemeinschaft über bestimmte Aspekte des öffentlichen Beschaffungswesens). The bilateral agreement on public procurement goes beyond the APM scope and covers also the telecommunications industry and railway companies, the power sector (i.e. gas, oil and coal, except for electricity), as well as contracts awarded by local governments and private companies (Vahl, Grolimund, 2006, p. 28-29).

The whole idea behind the agreement on trade in agricultural products is to reduce tariff and non-tariff barriers, covering those market segments which are of particular importance to Switzerland and the EU. As regards tariff concessions aimed at reducing customs duties, full liberalisation – taking place from 1 June 2007 – of trade in cheeses, fruits, vegetables and wine was of the greatest relevance to Switzerland.

Another agreement provides for the mutual recognition of conformity assessments relating to standards (certificates, tests. marketing authorisations, etc.) for several groups of industrial products (which in the EU are governed by so-called new approach directives): such as construction products, machinery, medicinal the control of the production of pharmaceuticals (although this does not apply to permissions for sale of medicines), toys, motor vehicles, tractors, telecommunications systems, measurement instruments; boilers and gas heating equipment, electric and electromagnetic compatibility equipment, equipment for potentially explosive atmospheres, personal protective equipment, pressure vessels. Under the agreement, the Swiss law is regarded as equivalent with EU legislation, which simplifies procedures and reduces exporters' costs for exporters and importers from the EU/EEA and Switzerland. In respect of the areas which are not covered by the agreements, where Swiss and EU requirements do not converge, for instance, in the case of some chemicals, plant-health products, biocides and construction products, still two conformity tests will be necessary, even though both of them may be carried out by Swiss authorities (Vahl, Grolimund, 2006, p. 26). In other words, the agreement reduces bureaucratic impediments to and administrative costs for exporters and importers from the EU/EEA and Switzerland. It must be updated on a regular basis to incorporate relevant new EU legal acts into the agreement (i.e. relating to product standards). This is usually a routine procedure, however, in view of a lack of progress in negotiations of the framework agreement, which will be discussed below, the EU announced that it would refuse to incorporate new EU legal acts into the agreement on mutual recognition or had already taken such measures. The Medical Devices Regulation 2017/745 has been effective in the entire EU since May 2021 - however, it has not been incorporated into the agreement so far (Swiss Medtech, 2021), which hinders free access to the market and has already resulted in administrative impediments and extra costs (SQS, 2021). Similar consequences are expected soon in relation to the failure to incorporate the In-Vitro Diagnostics Regulation 2017/746 into the agreement (Meier, 2021). As far as the value is concerned, the agreement covers two-thirds of trade in industrial products between Switzerland and the EU (SECO, 2021).

A report prepared by the federal government one year after the entry into force of Bilaterals I contained an assessment which was "cautiously positive" (Bilaterale Abkommen I Schweiz-EU: Erste Erfahrungen ein Jahr nach Inkrafttreten). It was based on a survey conducted in private and public institutions. Concerns over "the flood of immigrants" and "an avalanche of trucks", which were voiced by many opponents, have never proved to be true. Relatively small migration from the EU and reducing truck transit traffic through the Alps were considered the greatest achievements. In 2002, the number of trucks at four transit points declined by 9%. The number of trucks decreased, despite a 2% rise in the volume of goods transported by road through the Alps. This means that greater transport volume was handled by fewer trucks, whereas average vehicle load capacity rose considerably.

2. Second Period of Bilateralism – Bilaterals II

The second period of bilateralism was marked by the consolidation and expansion of the bilateral way. It began in 2002 with the effective implementation of a set of BAI agreements and the signature of a series of new BAII bilateral agreements. After entering into BAI, the European Commission was essentially sceptical about new negotiations with Switzerland. The reason why the second round of bilateral talks took place, despite that scepticism, was the fact that the following two issues became relevant to the EU: firstly, Switzerland should be included in a cross-border savings taxation system planned by the EU. Secondly, closer co-operation with Switzerland on the fight against indirect tax frauds (especially cigarette smuggling) was desired.

In mid-2002, Switzerland and the EU resumed negotiations on ten areas, of which seven were leftovers (LOs) (omitted in the package I). In autumn 2004, Switzerland and the EU signed Bilaterals II, which, unlike Bilaterals I, do not have any legal relationship. The agreements are not linked by a guillotine clause. The link exists only for the Schengen and Dublin Association Agreements (a "mini guillotine"). In Switzerland, these two agreements – the only ones which were disputable – were approved in a referendum, receiving 54% of the vote (Oesch, 2020a, p. 23). They were introduced gradually in the period from 2005 to 2009. Another package of sectoral agreements includes:

- Switzerland's participation in the Schengen and Dublin agreements (co-operation between the police and judicial authorities, the coordination of an asylum and migration policy (LO));
- Processed agricultural products;
- Statistical collaboration (access to Europe-wide data and the conformity of Swiss data with Eurostat's standards);
- Education (participation in EU educational programmes): Socrates, Erasmus, Leonardo da Vinci, Youth);
- Fight against tax frauds (LO);
- Pensions;
- Participation in the EU Media programme (promoting the production and distribution of European films). Under the media agreement, the EU provides now financing for Swiss-EU co-productions through Media Plus, whereas film-makers from Switzerland qualify for MEDIA training programmes); Joining the European Environment Agency;
- Tax on proceeds from bank deposits (savings) (LO);
- Switzerland's financial contribution to economic and social cohesion in new Member States of the EU.

The Schengen and Dublin Association Agreements, which – on account of the link connecting them (the "mini guillotine") and their similar nature, but not only, are perceived by Swiss people as "appertaining to each other" – can be considered the most important arrangements of all bilateral agreements included in the BAII package. The Schengen/Dublin Agreement promotes close co-operation among EU Member States and associated countries on borders, a judicial system, the police, visas and asylum. As a result of the Schengen co-operation, participating countries lifted essentially all identity checks on internal borders and made the decision about compensatory measures to strengthen internal security. The Dublin co-operation ensures that every application for asylum is considered only by one country. In 2004, Switzerland and the EU entered into the Schengen Association Agreement as part of BAII to facilitate travelling. The agreement covers also further measures ensuring the internal and external security of Europe. With regard to Switzerland, this means, among other things, financial and staff support for the European Border and Coast Guard Agency – FRONTEX (Oesch, 2020a, p. 151-154).

Another agreement provides the liberalisation of trade in the processed agricultural goods which were only to a certain extent included in the 1972 Agreement. In some areas, Switzerland eliminated customs duties and export subsidies completely, with respect to such products as coffee, cocoa, jams, mineral water, alcohol-free beverages, beer and spirit drinks. Whereas as regards other areas, customs duties and export subsidies were reduced by Switzerland. This applies to such products as flour, powdered milk, butter and vegetable fat and has implications for a wide variety of products, such as chocolate, pasta, biscuits, bread, ice cream and other processed food. Furthermore, the scope of application of the agreement was extended include additional products, for example, dietary supplements to and phytopharmaceuticals. At the same time, trade in meat, some processed agricultural products, fisheries products, food and tobacco is subject to customs duties, including 10% on tobacco and 13% on beef (European Commission, Market Access Database). What deserves attention is the fact that customs duties on agricultural goods in Switzerland are significantly higher than in the EU, both in the case of an average MFN rate and an import-weighted average rate. Moreover, as regards agricultural products, more than 86% of the value of imports from the EU comprises duty-free import (almost 34% of tariff lines), while in the EU, it is only 41% (32% of tariff lines) (Table 2). Switzerland does also not participate in a customs union, nor in a VAT system in the EU, hence for export purposes, customs declarations, tax authorities' inspections and certificates of origin are required before goods can be exported to the EU.

Table	2.	Rates	of	Customs	Duties	in	European	Union's	and	Switzerland's
		Custo	ms	Tariff in 2	020 (%)		-			

Specification	Total	Ag	Non-Ag						
European Union									
Simple average MFN applied	5.2	11.7	4.1						
Trade weighted average	3.2	8.4	2.8						
Duty-free tariff lines (% of all tariff lines) (MFN applied)	27.0*	31.7	28.6						
Simple average of MFN duties based only on tariff lines in relation to imports from Switzerland	-	34.5	1.3						
Trade-weighted average MFN duty in relation to imports from Switzerland	-	20.9	1.0						
Duty-free imports from Switzerland (% TL)		32.1	99.0						
Duty-free imports from Switzerland (Value in %)		41.2	99.9						
S	witzerland								
Simple average MFN applied	5.6	32.4	1.3						
Trade weighted average	1.7	22.1	0.7						
Duty-free tariff lines (% of all tariff lines) (MFN applied)	26.9**	29.7	31.6						
Simple average of MFN duties based only on tariff lines in relation to imports from EU	-	15.7	4.3						
Trade-weighted average MFN duty in relation to imports from EU	_	11.5	1.9						
Duty-free imports from EU (% TL)	_	33.8	98.9						
Duty-free imports from EU (Value in %)	-	86.2	100.0						

*data relating to the European Union for 2019

**data relating to Switzerland for 2021

Source: (WTO, 2019, p. 63; WTO, 2022, p. 61)

Switzerland and the EU negotiated a bilateral agreement relating to participation in long-term framework research programmes. This strengthened the position of national research institutions in European networks.

Under Bilaterals II, Switzerland and the EU made an agreement on the taxation of savings income. Swiss banks charge tax on interest accrued on deposits of EU Member States' citizens in the amount of 35% (since 2011) and pay back three-thirds of that sum to the countries of origin of account holders. The remaining 25% is held in Switzerland. The federal budget receives 90% of that sum, while cantons 10%. This means that savings income earned by EU nationals may be effectively taxed in Switzerland, while maintaining the Swiss legal system and banking secrecy. In February 2006, the EU signed the Memorandum of Understanding (MoU) with Switzerland, which concerned its financial contribution of CHF 1 billion over a five-year period to cohesion in the EU. In December 2014, the Parliament approved the CHF 45 million contribution for Croatia, which is the only country where projects will be implemented until 2024. (Basic Facts on the Framework of EU-Switzerland Relations, 2021).

In order to avoid double taxation of pensions received by former EU officials residing in Switzerland, the agreement on pensions was concluded. In accordance with the agreement, Switzerland grants income tax exemption on revenue from pensions of retired EU officials residing in Switzerland, on condition that such revenue is taxed at source (i.e. in the EU). The EU imposes a so-called withholding tax, namely, which is levied by an entity paying up a benefit, whereas Switzerland charged federal, cantonal and communal tax on such pensioner's net income, i.e. from which a withholding tax has been deducted. Originally, that agreement referred to around 50 Swiss citizens, but due to a growing number of people who, on reaching the retirement age, decide to settle in Switzerland, these figures may continue to rise (Vahl, Grolimund, 2006, p. 31).

Compared to the 1972 EU-Switzerland Free Trade Agreement, the anti-fraud agreement updates the protocol on co-operation on combating frauds. The scope of legal assistance was extended to include tax frauds, fiscal offences relating to indirect taxes in the EU, totalling above EUR 25,000. In such cases, representatives of EU law enforcement authorities are permitted to participate in investigative activities and inspect bank accounts (Kozłowski, 2011, p. 29).

On 27 May 2015, the EU and Switzerland signed a historic new agreement on tax transparency (replacing the 2005 Agreement on taxation of savings income), which will considerably contribute to strengthening fight against tax evasion (Europa, 2015). Under the agreement, both parties have been automatically sharing information on financial accounts of their residents (since 2018). This means the end of the Swiss banking secrecy for EU citizens and precludes tax fraudsters from hiding untaxed income in Swiss accounts.

3. Third Period of Bilateralism – Institutional Agreement

The third period is characterised by uncertainty. It began in 2014 with the success of a social initiative against "mass immigration", which was a threat to the entire package of bilateral agreements. The referendum committee (9 February 2014) put forward a proposal to stifle the process of mass immigration to Switzerland. This could be achieved by setting annual immigration quotas applicable also to seasonal workers, asylum seekers and people coming to the country to join their families. The committee's initiative was supported in the referendum by a slight majority of votes –

50.3% (Porębski, 2021, p. 278). Another referendum of 30 November 2014: "Stop overpopulation – protect the natural basis for life" also deserves mentioning. The initiators of the proposal requested that the upper limit for the number of immigrants be set. The committee's proposal was rejected in the referendum by a majority of 59.2% votes (Porębski, 2021, p. 279).

Although bilateral agreements strengthened economic relations, they also built a complex and partially incoherent network of obligations. Apart from that, almost all bilateral agreements must be updated regularly. Furthermore, they do not contain any arrangements relating to supervision or effective dispute resolution mechanisms. To remedy these deficiencies, on 22 May 2014, the EU and Switzerland entered into negotiations on the Institutional Agreement (IFA). The negotiations were aimed at solving several difficult issues, from conditions for EU service providers in Switzerland, to the role of the Court of Justice in resolving disputes. The EU expressed the hope that the new agreement would modernise the existing bilateral agreements (Overton, 2021).

The framework agreement would set an overriding framework for Swiss-EU relations that could provide the basis for the protection and extension of Switzerland's access to the single market and would replace the mosaic of bilateral agreements. The new framework agreement would be tantamount to Switzerland joining the dispute resolution system and accepting the jurisdiction of the European Court of Justice (ETS) in all matters concerning the interpretation of the EU law. The IFA negotiations ended on a political level on 23 November 2018.

The contents of the framework agreement were questioned in the Swiss political circles from the very beginning of the negotiations, however, they became more politicised in 2019, when the Swiss government commenced internal consultations on the text of the framework agreement, which had been, as a matter of fact, already negotiated with the EU. Talks on the IFA were resumed in January 2021, when circumstances relating to Covid-19 permitted. Eventually, on 26 May 2021, the Swiss Federal Council notified the European Commission of its decision to end the negotiations of the framework agreement once and for all, stating that the document could not be signed (Walter, 2021). The Swiss Federal Council referred to the following three major contentious issues: state aid rules, wage protection and EU citizens' access to social security benefits in Switzerland. Swiss cantons were concerned that their system of providing unlimited state guarantees to banks would be no longer permitted under the EU state aid regulations. As regards wage protection, Swiss trade unions and companies voiced the fear that the framework agreement would lead to "wage dumping". Switzerland endeavours to protect its higher wages and working conditions by employing "social accompanying measures", however, the EU wanted to remove them to create conditions ensuring a level playing field for competition.

Since the withdrawal from the framework agreement, the matter of mutual relations, possible political scenarios for the development of relations, has been still open.

4. Bilateralism vs EU Membership

In aggregate, 20 sectoral bilateral and about 120 accompanying agreements were concluded (Fedlex, 2022). Many of these agreements need to be updated on a regular basis, in particular those which are based on the harmonisation or equivalence of relevant Swiss and EU regulations. The majority of Switzerland-EU bilateral agreements are classic co-operation agreements. The parties to the agreement are, in principle, independent and each of them is individually responsible for implementing and applying the agreements within their respective territories. Switzerland does not grant any legislative rights, nor other decision-making powers to a higher, supranational authority - except for air traffic. Simultaneously, it must be mentioned that there is no mechanism for Switzerland's implementation of the EU acquis with regard to the internal market, designed to update bilateral agreements. In particular, Switzerland is not required to dynamically transpose EU legal acts into its own acquis (Oesch, 2020a, p. 100), nor is it bound by any arrangements between two contracting parties on the legal interpretation of and supervision over agreements or on dispute resolution. Bilateral agreements provide Switzerland and EU Member States with mutual sectoral access to the market. Hence, compared to other third countries, Switzerland has a privileged status (Sonderfall) in trade with the EU. A bilateral approach thus allows for pursuing a policy of openness and co-operating closely with European neighbours. Simultaneously, the institutional independence of Switzerland is maintained. On the other hand, as a non-EU member, Switzerland is not allowed to participate in a co-decision process on the EU level.

Apart from being a party to the Convention establishing the European Free Trade Association and the Free Trade Agreement (FTA) with the European Union, Switzerland has now a network of 33 free trade agreements with 43 partners. The majority of trade agreements with Switzerland was signed under the EFTA; however, Switzerland can conclude free trade agreements with non-EFTA countries, as was the case with the United Kingdom, Japan and China. The Free Trade Agreement between the EFTA and Mercosur countries in South America was negotiated, but it has not been signed yet (Swiss Secretariat for Economic Affairs'webside, 2022).

Aspect	Bilateral agreements/Comments	Accession to EU/Comments					
Trade	↑A growth, but it concerns only certain goods for which customs duties and other trade barriers were eliminated (hence it does not apply to some agricultural goods or those which are covered in the EU by anti-dumping duties)	↑The complete removal of trade barriers should contribute to an increase in mutual trade					
Border formalities	→In spite of facilitations, customs formalities and checks are still in place	↑No customs clearance and customs formalities					
Commercial policy	↑Decisions regarding trade agreements with third countries can be made independently	↓↑A commercial policy can no longer be shaped independently, the Union customs tariff must be applied to trade with third countries, an average level of MFN duties on agricultural goods drops, revenue from customs duties also declines At the same time, benefits could be derived from joining the treaty-based commercial policy and a vast network of trade agreements made by the EU worldwide					
Certificates, market surveillance, rules for admission to trading	↑Due to the BAI on mutual recognition, but this does not apply to all goods	↑Due to the implementation of the Union rules for the elimination of technical barriers to trade					
Budget revenue	↓Switzerland will bear the costs of approx. CHF 80 million arising out of reduced revenue from customs duties on processed agricultural products, contributions to MEDIA programs and the European Environment Agency, as well as compliance with statistics and the implementation of the Schengen/Dublin Agreements.	↓A further decline in revenue from customs duties, obligatory allocation of 75% of revenue from import duties to the EU budget, transfers to the EU budget, the possible adoption of the Union customs tariff would result in a drop in an average level of MFN duties					
Land and air transport	↑Due to the signature of the BAI relating to transport, the collection of charges for transit through Switzerland	\rightarrow Major issues were settled in the BAI					
Movement of persons	\uparrow Due to the signature of the BAI	↓The EU's migration policy must be adopted, which is a matter of concern to the Swiss					

Table 3. Juxtaposition between Bilateralism and Switzerland's Accession to EU

Continuca tubi		
Tax system	\rightarrow	JAdopting taxation rules for VAT in the EU would mean that the base VAT rate is to be raised from 7.7% to the minimum level required in the EU, i.e. 15%. This would be also tantamount to higher contributions to the EU budget (on account of VAT). A positive effect could be seen if an increase in a VAT rate was accompanied by a decline in direct taxes.
Real wages	\rightarrow	Ļ
Employment	↑	∱Bigger rise
Direct democracy, federalism	\rightarrow	↓
Migration and asylum policy	↑	\rightarrow
Environmental policy	\rightarrow	\rightarrow
↑ Better		

Continued table 3

Source: Own elaboration.

As the summary presented in Table 3 shows, compared to the bilateralism strategy pursued so far, the full EU membership of Switzerland would not bring too many benefits to it. The key issues associated with market access, movement of persons, transport policy were, as a matter of fact, dealt with in sectoral agreements. Bilateralism introduced also liberalisation and requisite structural adjustments in sensitive areas. It is also the guarantee that Switzerland will preserve the fundamental principles of the state's functioning, i.e. direct democracy and federalism (including, but not limited to, the high level of autonomy that communes and cantons have), which, in the case of EU membership, would have to be limited considerably, if not excluded at all. Further, it must be mentioned that the matter of Switzerland's accession to the EU was no longer considered after the withdrawal of the application for EU membership in 2016. It seems that in the case of Switzerland the economic theory of integration has been proved. It points to the economic balance of membership. And as far as economic balance is concerned, for relatively small economies, such as Switzerland, indeed, considerable importance is attached to access to a huge single European market, however, the decision on whether membership is to be applied for or not is influenced by political factors, which in the case of Switzerland play an essential role.

 $[\]uparrow$ Better \rightarrow Neutral

[↓] Worse
Weaknesses Strengths				
 Agreements form a complex 	- Switzerland's access to the specific segment			
and partially incoherent network	of the European market:			
of obligations:	- A broad range of issues to be regulated			
– Almost all bilateral agreements must	(in aggregate, 20 sectoral bilateral and about 120			
be updated regularly	accompanying agreements were concluded -			
and are not dynamic in nature.	Euro-compatible legislation of Switzerland).			
- There are no arrangements relating	- Liberalisation and requisite structural adjustments			
to supervision or effective dispute	in sensitive areas (trade in agricultural goods			
resolution mechanisms;	air transport);			
- The guillotine clause in the BAI	- Special quality of mutual relations, which provides			
and a threat to the effectiveness	the basis for considering them a form of privileged			
of the whole agreement package;	partnership* or integration without membership;			
- Liberalisation through the	- The right to pursue own monetary and foreign			
negotiation	exchange policy:			
of sectoral agreements is not	- Lower fiscal costs than in the case of full members.			
possible in every area	under bilateral agreements. Switzerland does			
(e.g. services);	not make any contributions to the general budget			
 No possibility of co-deciding about 	of the EU; furthermore, it controls the manner			
shaping the EU law and EU policies,	of spending the funds designated for new Member			
as well as further dynamic	States;			
development of the EU law;	- Participation in long-term framework research			
	programmes, strengthening the position of national			
	research institutions;			
	- Switzerland's ability to influence the form and contents			
	of agreements, negotiate favourable solutions;			
	- Safeguarding own interests in a selective			
	and pragmatic manner;			
	 Union authorities are not superior in a decision-making 			
	process;			
	- Preserving neutrality, federal structures and direct			
	democracy - three main and fundamental pillars			
	of Switzerland;			
	- Financial sector: the interests of the Swiss financial			
	sector are safeguarded (taxation of savings, fight			
	against frauds) and banking confidentiality			
	is maintained in relation to direct taxes			
	(Schengen/Dublin);			
	- Food industry: Reduced customs duties improve			
	export opportunities for the food industry. This also			
	brings benefits to the Swiss agriculture (processed			
	agricultural products);			
	- Tourism: A Schengen visa encourages tourists			
	to come to Switzerland (the Schengen/Dublin			
	Agreement);			
	 Security policy: Cross-border crime can be effectively 			
	combated only through international co-operation			
	involving the police and courts. Schengen provides			
	tools necessary to achieve that goal.			

Table 4. SWOT Analysis of Switzerland's Bilateral Strategy

Continued table 4.	
	 Asylum policy: The Dublin co-operation counteracts "asylum tourism", and consequently, reduces the pressure on the national asylum system. Environment: The European Environment Agency is an important tool of international co-operation on environmental protection. As a member of the Environment Agency, Switzerland can contribute to such co-operation. Statistics: The agreement on statistics ensures the harmonisation and optimisation of the exchange of comparable statistical data between Switzerland and the EU. Culture: Participation in Union film promotion programs (MEDIA) strengthens the role of a film as an important part of Swiss cultural heritage. Education: Co-operation as part of Union educational programs provides Swiss citizens with access to a wide range of trainings. This creates better opportunities on the labour market. Except for the Schengen and air transport agreements to adopt changes to the "EU acquis" applicable to these bilateral agreements. Bilateral agreements do not grant any supranational institution, such as the European Commission, control powers to check whether Switzerland complies with the European law correctly; Switzerland is not obliged to abide by decisions issued
Thursda	by the Court of Justice of the European Onion (CJEO).
 Threats The EU is of the opinion that bilateral agreements are insufficient because they give Switzerland too many opportunities to deviate from the European law and challenge the uniformity of the common market; Opposition to any changes concerning a more supranational solution, which would grant European institutions greater powers. The conclusion of negotiations of the institutional agreement; The EU has now a much bigger network of bilateral agreements and is able to promote its interests on third countries' markets more effectively; The EU, due to the size of its market, has much greater negotiating power. 	 Opportunities The volume of mutual trade and significance of bilateral trade to both parties; The replacement of the 1972 Free Trade Agreement with a new-generation trade agreement and the renegotiation of its provisions or, optionally, considering the negotiation of an interim agreement regulating major contentious matters in mutual relations; Switzerland's capacity to independently conclude agreements at the WTO and EFTA preferential agreements.

Continued table 4

*(Calliess, 2008). Source: Own elaboration

The SWOT matrix for the strategy of bilateralism demonstrates that it is advantageous for Switzerland to continue the two-way path. What deserves particular attention is the fact that when deciding to opt for this solution, Switzerland chooses the solution which is not only the most viable, but also has the most desirable beneficial effects (Table 4). Nevertheless, an emphasis must be put on the main threat to bilateralism, namely, the EU's clear position that bilateral agreements are insufficient and give Switzerland too many opportunities to deviate from the European law. On the other hand, an opportunity created by the volume of mutual trade and the significance of partners in that trade, not to mention the geographical proximity and the fact that Switzerland shares many of its values with Europe and builds the area of security and peace, gives grounds for the partners'efforts to strengthen mutual relations.

Conclusions

The strategy of bilateralism aimed at entering into sectoral agreements, which has been being pursued since the late 1990s, brings many benefits to Switzerland and is, at it appears, a more favourable solution (to Switzerland) than full EU membership. However, the European Union has been pushing Switzerland for years to transform more than 120 separate agreements into a framework agreement covering everything, from access to the labour market to energy supply and scientific research. This was manifested through the negotiations of the institutional agreement. Nevertheless, in May 2021, as everybody knows, the Swiss government decided to withdraw from the negotiations of the so-called "framework arrangement", assuming that voters would disapprove of such an agreement in a referendum.

In this situation, the question arises as to what happens next, which solutions would be beneficial in the future? Full EU membership is rather unlikely for the reasons given in the research. Hence which options are available? It seems that the solution which would be the most advantageous for both parties includes the renegotiation of the 1972 Free Trade Area Agreement and its transformation into a new-generation trade agreement. As regards their contents, new free trade agreements have a comprehensive scope and mean the greatest possible liberalisation of trade, including well advanced liberalisation of services and investments, as well as the elimination of non-tariff barriers or quantitative restrictions. New free trade agreements contain also provisions on trade facilitations, specifically, with respect to customs matters. These are thus issues that were covered by sectoral agreements (as part of Bilaterals), although they could be contained in a new-generation trade agreement with Switzerland. One must not forget that, as a matter of fact, it is an older-generation agreement made with Switzerland in 1972 that constitutes a framework agreement governing mutual trade relations. The EU concluded new-generation trade agreements with South Korea, Canada, Japan, Singapore and Vietnam, hence mainly with developed countries. In addition, the EU is currently renegotiating older-generation agreements with Turkey (a customs union), with selected Mediterranean countries, why not with Switzerland? Such an agreement would regulate mutual relations in the future, negotiations could enable, apart from the liberalisation of mutual trade, the partners to set the conditions for a dispute resolution system and the possible superiority of the European Court of Justice in certain areas. That agreement would be also not tantamount to Switzerland joining a customs union, which would be problematic due to its political system. In fact, Swiss people dismissed the possibility of joining the European Economic Area (a common market), yet this took place 30 years ago, in other realities. Entering into Bilaterals I and II shows that mutual arrangements and compromises can be made with respect to selected areas, specifically, those related to access to the Union market. It is true that negotiations of an interim (framework) agreement can be considered, after several years, yet this will be difficult, as was proved by the outcome of the negotiations covering the framework agreement in 2018.

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ARTICLES

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G-7 AND BRICS COUNTRIES IN GLOBAL VALUE CHAINS

Abstract

G-7 and BRICS countries play important roles in the world economy and global politics. The aim of the article is to answer the research question: "How participation of G-7 and BRICS countries in global value chains has been changing since 1995?". To answer this question global value chains participation indexes were calculated. They were derived from Inter-Country Input-Output Tables. The value-added of this study stems from employing Input-Output Tables delivered by two institutions (Organization for Economic Co-operation and Development and Asian Development Bank). Consequently, article presents indexes calculated on the basis of two datasets. Combining two databases enabled to conduct study for quite long period (1995-2022). Analyzing the changes of global value chains participation indexes of G-7 and BRICS countries, we can distinguish following phases of internationalization: period of rapid globalization (1995-2008), global crisis and economic rebound (2009-2011), period of slowbalization somewhat strengthened by coronacrisis (2012-2020), and another recovery (2021-2022). This finding lead us to the conclusion that fast internationalization came to a halt in 2008 and since global financial crisis globalization has been quite slow despite some periods of recovery. Thus, there is an implication for more detailed research on slowbalization its grounds, tendencies and prospects (whether fast internationalization is possible in the future; what is the role of economic policy in stimulating the pace of globalization).

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JEL classification: F12, F14

Keywords: global value chains (GVCs), trade in value-added (TiVA), internationalization, fragmentation.

Introduction

The aim of the article is to answer the research question: "How participation of G-7 and BRICS countries in global value chains has been changing since 1995?". Nowadays, G-7 countries (USA, Germany, France, United Kingdom, Italy, Japan and Canada) account for about 43% of world GDP (2022, US dollars in current prices), 28% of global gross exports (2022, US dollars in current prices) and 19% of global value-added exports (2022, US dollars in current prices). The figures for BRICS countries (Brazil, Russia, India, China and South Africa) are 25%, 21% and 18% respectively³. Thus, the study on G-7 and BRICS countries brings some knowledge how the participation in global value chains has been changing generally since 1995 (the changes in participation of G-7 and BRICS countries in global value chains as a proxy of changes in speed of globalization). Moreover, G-7 appears to be a good representation of developed economies and BRICS representation of developing economies respectively as both groups consist of the countries which play important roles in the world economy and global politics.

The research is based on data delivered by the Organization for Economic Co-operation and Development (OECD) and the Asian Development Bank (ADB). Both institutions deliver Inter-Country Input-Output Tables which are used for calculating trade in value-added (value-added exports and value-added imports) and indicators based on it (for example indices of backward and forward participation in global value chains). As recently the OECD has published statistics for years 1995-2020 and the ADB has published statistics for years 2000 and 2007-2022, the research on G-7 and BRICS countries covers the period 1995-2022.

The value-added of the article stems from employing Inter-Country Input-Output Tables delivered by the OECD and the ADB. Consequently, paper presents indexes calculated on the basis of two datasets. Additionally, combining two databases enabled to conduct study for quite long period (almost 30 years).

1. GVC participation index as a measure of internationalization degree

Nowadays transnational corporations work with and integrate their geographically dispersed partners, suppliers and customers into complex international structures knowns as global value chains (GVCs), global

¹ The shares were calculated based on UNCTAD's and ADB's statistics.

production networks (GPNs), global commodity chains (GCCs) or global factories (for a comprehensive review of the multidisciplinary studies on GVCs/GPNs/GCCs/global factories see Kano et al. (2020)).

Global value chains are a phenomenon in the period of economic research after the New Trade Theory. This principle has indicated how product completion is fragmented in countries, regions, and continents. Companies outsourcing and offshoring product assembly activities subsequently benefit from comparative advantages in countries where they relocated such activity. GVCs depend on the fragmentation of production and trade in intermediates to take advantage of the cost advantages of each site or stage in the chain up to the stage of assembly (Černá et al., 2022, 14).

The best-known measure of a country's position in GVCs was created by Koopman et al. (2010) who introduced the GVC participation index. The index summarizes foreign value-added in domestic exports (backward participation) and the domestic value-added in foreign exports (forward participation).

GVC backward participation index for country *i* is calculated based on the formula (1):

GVC backward participation index_i =
$$\frac{FVA \text{ embodied in the total gross exports_i}}{\text{total gross exports_i}} \cdot 100\%$$
 (1)

where:

- *GVC backward participation index*_i GVC backward participation index of country *i*,
- N number of countries,
- K number of industries,
- *FVA embodied in the total gross exports* foreign value added content of gross exports, so the sum of elements of matrix $(\widehat{\mathbf{V}}\mathbf{B}\mathbf{e}_i)$ corresponding to all industries in all countries apart from country *i* (matrix ($\widehat{\mathbf{V}}\mathbf{B}\mathbf{e}_i$) is of size (*K*·*N*)×1),
- $v a 1 \times (K \cdot N)$ row vector with domestic value added shares of output for each industry in country *i*,
- $\widehat{\mathbf{V}}$ a diagonalised matrix of vector v, i.e. a ($K \cdot N$)×($K \cdot N$) matrix with elements of vector v on the diagonal and 0 elsewhere,
- **B** the global Leontief inverse matrix with $(K \cdot N) \times (K \cdot N)$ dimensions,
- $e_i a (K \cdot N) \times 1$ vector with all entries equal to zero except those corresponding to total (all industries) gross exports of country *i*,

*total gross exports*_{*i*} – total (all industries) gross exports of country *i*.

Thus, GVC participation index is a 'foreign value-added intensity measure' often referred to as 'import content of exports' (OECD, 2022).

GVC forward participation index for country *i* is calculated based on the formula (2):

GVC forward participation index_i = $\frac{DVA \text{ embodied in the total foreign gross exports_i}}{\text{total gross exports_i}} \cdot 100\%$ (2),

where:

*GVC forward participation index*_{*i*} – GVC forward participation index of country *i*,

- DVA embodied in the total foreign gross $exports_c$ the country *i* domestic value added content embodied in the gross exports of all industries in foreign countries (all countries apart from *i*), so the sum of elements of matrix $(\widehat{V}Be_{-i})$ corresponding to all industries in country *i* (matrix $(\widehat{V}Be_{-i})$ is of size (*K*·*N*)×1),
- $\widehat{\mathbf{V}}$ a diagonalised matrix of vector v, i.e. a ($K \cdot N$) ×($K \cdot N$) matrix with elements of vector v on the diagonal and 0 elsewhere,
- **B** the global Leontief inverse matrix with $(K \cdot N) \times (K \cdot N)$ dimensions,
- e_{-i} a (*K*·*N*)×1vector with elements corresponding to the total (all industries) exports of all countries except for country *i* (for country *i* elements equal to zero),

total gross exports_i - total (all industries) gross exports of country *i*.

In other words, GVC forward participation index is estimated as being the value-added contents of exports originated in the source country, and embodied in the exports of the foreign countries, divided by the gross exports of the source country (OECD, 2022).

 $GVC participation index_i = GVC backward participation index_i + GVC forward participation index_i$ (3)

The higher the value of GVC participation index (see equation (3)), the higher the country's participation in GVCs, i.e. trade in intermediaries is more prevalent in total trade and the production process is more internationalized and usually more fragmented. In addition to world trade and FDI, a major role in globalization is played by the processes of production internationalization, related to production fragmentation and the functioning of GVCs. Those processes intensified from the 1990s, as *signum temporis* of the accelerating globalization at the end of 20th century and at the beginning of 21st century. Imports and exports of intermediate goods and services, reflecting international trade in parts, components, semi-finished products, seem to be an appropriate measure for analyzing

the trends in the internationalization of production. Thus, the GVC participation index appears to be a good measure of country's degree of internationalization. It provides an estimation of how much a country is connected to GVCs got its production and foreign trade.

2. G-7 countries

On the basis of Inter-Country Input-Output Tables delivered by the OECD and the ADB, and employing formula proposed by Koopman et al. (2010), the values of GVC participation index were calculated. The lines on the Figures 1-12 illustrate these values – blue lines represent the results of calculations basing on OECD's datasets and orange line represents the results of computations basing on ADB's databases.

According to the OECD's statistics, during 1995-2008, GVC participation index of USA increased from ca. 29% to around 37% (see Figure 1). Year 2009 brought the collapse of index. Period 2010-2011 can be described as a fast recovery and years 2012-2015 as a stagnation (according to the ADB's statistics) or a decline (according to the OECD's statistics). For sure period 2012-2015 cannot be classify as a growth phase. Year 2016 can be named as the beginning of increase (ADB) or the end of decline (OECD). Years 2017-2018 brought a noticeable growth. According to the ADB's statistics a visible fall happened in 2019 (the last year before pandemic) and in 2020 was continued by a slight decline in 2020. According to the OECD's statistics, in 2019 index grew and in 2020 decreased noticeably, but no so sharply as in 2009. According to the ADB's statistics, since 2020 the index has grown from ca. 37% to about 42% (the highest value in history).



Figure 1. GVC participation index of USA during 1995-2022 (percentage) Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-output-tables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

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According to the OECD's statistics, during 1995-2008, GVC participation index of Japan increased from ca. 27% to around 43% (see Figure 2). Year 2009 brought the slump of index. Period 2010-2011 can be described as a quite fast recovery. After that rebound index showed fluctuations (years 2012-2018). In 2019, just before the pandemic, the index dropped noticeably. In 2020 stagnation (OECD) or slight fall (ADB) was observed. According to the ADB's statistics, since 2020 the index has increased from ca. 36% to around 46% (the highest value in the history).





The values of GVC participation index of Germany before 2017 calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are very close to those derived from the Input-Output Tables prepared by the ADB. We can distinguish four periods: growth (1995-2008), collapse in 2009, recovery (2010-2011) and post-recovery stagnation (2012-2016). According to the OECD's statistics years 2017-2019 brought a moderate increase of index which was ended by the pandemic in 2020. According to the ADB's statistics, sharp increase occurred in 2017, later there was a stagnation and sharp fall in 2019 (the last year before the pandemic), and finally the index grew from around 45% in 2019 to ca. 53% in 2022 (the highest value in history).

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Figure 3. GVC participation index of Germany during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

According to the OECD's statistics, during 1995-2008 GVC participation index of the UK grew from ca. 32% to around 42% (see Figure 4). Year 2009 brought the crash of index. Period 2010-2011 can be described as a quite fast recovery. After that rebound, index was falling until 2013 (ADB) and until 2016 (OECD). Years 2017 and 2018 brought quite high increase after that index dropped in 2019 (just before the pandemic). It is debatable whether year 2020 bring another fall as basing on the OECD's statistics small increase was observed, but on the basis of the ADB's dataset we can notice decrease. Finally, according to the ADB's statistics, since 2020 the index has sharply grown to the highest value in the history (more than 46% in 2022).



Figure 4. GVC participation index of UK during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Trends in GVC participation index of France basing on the OECD's and the ADB's datasets are very similar, but the values of index are not so close to each other as in the case of Germany. We can distinguish five periods: growth (1995-2008), collapse in 2009, recovery (2010-2011), post-recovery stagnation (2012-2019) and fall in 2020. According the ADB, sharp increase occurred after 2020 and in 2022 index reached the record value of almost 53% (see Figure 5).

Figure 5. GVC participation index of France during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

The values of GVC participation index of Italy before 2020 calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are quite close to those derived from the Input-Output Tables prepared by the ADB (see Figure 6). We can distinguish four periods: growth (1995-2008), collapse in 2009, recovery (2010-2011) and post-recovery stagnation (2012-2019). The situation in 2020 is ambiguous as the fall (OECD) or slight growth (ADB) was noticed. According to the ADB's statistics, after 2020 sharp increase can be observed and in 2022 the index reached record value of ca. 53%.

Figure 6. GVC participation index of Italy during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Also the values of GVC participation index of Canada before 2020 calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are quite close to those derived from the Input-Output Tables prepared by the ADB (see Figure 7). In 2020 there was fall of the value of index for Canada. However, fall illustrated by the ADB's line is much more stronger than this illustrated by OECD's line. According to the ADB's statistics, year 2021 brought another decrease, but this time it was rather slight. In 2022 index grew significantly from ca. 37% to about 40%. But still it was not the highest value in the history as in the years 2018-2019 the index reached the value of almost 41%.

Figure 7. GVC participation index of Canada during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

To sum up, we can distinguish period of rapid globalization (1995-2008), global crisis and economic rebound (2009-2011), period of slowbalization somewhat strengthened by coronacrisis (2012-2020), and another recovery (2021-2022). The term slowbalization has recently appeared in economic literature. It means changes in the global economy slowing down or even ceasing the process of internationalization of economic activity.

For example, In January 2019, The Economist (2019) announced that globalization had entered a new stage – a path of sluggishness – and referred to the new era of globalization as slowbalization. As the turning point in globalization, The Economist indicated the financial crisis of 2008-2009, having caused cross-border investment, trade, bank loans and value chains to shrink or stagnate relative to global GDP. The issue of slowbalization was also raised in PWC (2020) report.

Additionally, Folfas and Odrobina (2020) scrutinized the symptoms and characteristics of slowbalization. They argue that slowbalization was demonstrated during the period 2012-2018 by the stagnation or even regression of world exports to world GDP ratio, global FDI inflows to world GDP ratio, and share of foreign value added in world exports of goods and services.

Moreover, slowbalization in the context of US-China decoupling is examined by Garcia-Herrero (2022). She claims that slowbalization started in 2008 and can be captured by decelerating trade and investment, as well as smaller global value chains. Also according to Aiyar and Ilyina (2023), slowbalization started in 2008 and is characterized by a slower expansion of cross-border lending and trade. In case of G-7 countries, the slowbalization is noticeable especially for years 2012-2016. After that period, some growths in GVC participation index happened but usually there were stopped by pandemic (2020) or even earlier in 2019. Apart from Canada, years 2021-2022 brought sharp recovery but it is too early to state that this is the end of slowbalization.

3. BRICS countries

According to the OECD's statistics, GVC participation index of China grew from ca. 29% in 1995 to around 40% in 2008. Since 2008 the index has fluctuated and there has been quite big difference between the values calculated on the basis of the OECD's dataset and the ADB's database (see Figure 8). The common regularities refer to year 2009 (collapse), to years 2010-2011 (recovery) and to year 2020 (noticeable fall). According to the ADB's statistics, since 2020 the index has been growing, but it did not reach the highest value in history (37% in 2007).

Figure 8. GVC participation index of China during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

According to the OECD's statistics, GVC participation index of India increased from ca. 24% in 1995 to almost 40% in 2008 (see Figure 9). Year 2009 brought the sharp fall to around 35% and year 2010 recovery to 37%. After 2010, we can observe quite strong fluctuations in values of the index, and also quite high differences between values calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD and values derived from Input-Output Tables prepared by the ADB. We are even not able to state whether in 2020 there was a fall or an increase. Moreover, it is ambiguous when the index reached the highest value in history (2012 or 2022).

Figure 9. GVC participation index of India during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Apart from year 2011, the values of GVC participation index of Brazil calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD are very close to those derived from the Input-Output Tables prepared by the ADB (see Figure 10). We can distinguish five periods: growth (1995-2008), collapse in 2009, recovery (2010-2011), post-recovery stagnation (2012–2018) and growth (2019-2022). We do not observe any fall of the index during pandemic.

Figure 10. GVC participation index of Brazil during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

According to the OECD's statistics, GVC participation index of Russia grew from ca. 33% in 1995 to around 46% in 2008 (see Figure 11). Year 2009 brought the collapse to around 41% and years 2010-2011 recovery to 47%. (the highest level in history). After 2011, we can observe some fluctuations in values of the index. According to the ADB's statistics, the index fell significantly from around 41% in 2017 to almost 40% in 2020. Year 2021 brought short recovery, but in 2022 the index again dropped.

Figure 11. GVC participation index of Russia during 1995-2022 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm; and on ADB MRIO. Retrieved on September 15, 2023, from https://kidb.adb.org/mrio

Unfortunately, the South Africa is not included in Inter-Country Input-Output Tables delivered by the ADB. Thus, Figure 12 shows only the index calculated on the basis of Input-Output Tables prepared by the OECD for years 1995-2020. Similarly to other countries, there was a growth during the period 1995-2008. Year 2009 brought collapse and years 2010-2012 recovery. Since 2013 the index has been decreasing. The value in 2020 (42%) was only slightly higher than value in 1995 (41%). The highest value in history refers to year 2008 (53%).

Figure 12. GVC participation index of South Africa during 1995-2020 Source: Own elaboration based on OECD ICIO Tables. Retrieved on September 15, 2023, from https://www.oecd.org/industry/ind/inter-country-input-outputtables.htm.

To sum up, we can again distinguish period of rapid globalization (1995-2008), global crisis and economic rebound (2009-2011), period of slowbalization partly strengthened by coronacrisis (2012-2020), and another recovery (2021–2022). It is worth to notice that the values of indexes for India and Brazil did not fall in 2020 (during the lockdowns). Additionally, drop in the value of index for Russia in 2022 is probably connected with sanctions imposed due to Russian attack on Ukraine in February 2022.

Additionally – referring to the combining two datasets (delivered by the OECD and the ADB) – we can make a conclusion that values of GVC participation index calculated on the basis of Inter-Country Input-Output Tables delivered by the OECD go more or less together with the values derived from Input-Output Tables prepared by the ADB. For years 2007-2020, Pearson's correlation coefficient can be calculated as a measure (probably very unperfect, but quite illustrative measure) of accompaniment. In case of G-7 countries, and also China and India, the values of Pearson's correlation coefficient was computed for each country separately) are higher than 0.65 what confirm quite strong accompaniment. Thus, the combining of two datasets appears to be rational.

Conclusion

If we treat the changes in the values of GVC participation index of G-7 and BRICS countries as a proxy of changes in speed of globalization, we can state that fast internationalization came to a halt in 2008. Since global financial crisis globalization has been quite slow despite some periods of recovery. Additionally, noticeable slowdown of globalization was somewhat strengthened by coronacrisis.

Even though in case of G-7 countries the values of GVC participation indices in 2022 were higher than in 2008, but they were not significantly higher (apart from France and Italy). Typical growth by about 5 percentage point during almost 15 years appears to be lacklustre.

In case of BRICS countries the situation is even worse as only the values of indices for India and Brazil were in 2022 higher than in 2008. Moreover, the value of GVC participation index of South Africa in 2020 (last available year) was lower than in 2009 (the bottom of the world crisis).

To sum up, study on GVC participation indexes of G-7 and BRICS countries confirmed the phenomena of slowbalization. Nowadays, it is hard to say whether and when phase of slowbalization will end. After coronacrisis we can notice quite sharp recovery of internationalization, but it is debatable whether this is a permanent tendency in the world economy. Thus, there is an implication for more detailed research on slowbalization – its grounds, tendencies and prospects (whether fast internationalization is possible in the future; what is the role of economic policy in stimulating the pace of globalization). In terms of slowbalization international value chains seems to be rather regional than global. This is another area of concern for further research.

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ARTICLES

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DEVELOPMENT OF NEW PAYMENT SERVICES AND THE ROLE OF THE FINTECH SECTOR DURING THE COVID-19 PANDEMIC

Abstract

Purpose: The purpose of the article is to present both theoretical and practical basis for development of payment services in Poland and in the whole world during the COVID-19 pandemic. Over this time there was a sharp rise in e-commerce along with a fast growth of the number of consumers making online payments. This resulted in changes in adoption of new technologies and payment services. Apart from those which were the consequence of quickening the pace of change

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in the consumers' behavior, a crucial role, especially in developing countries, was played by local regulators, who somehow forced financial institutions to create new solutions, which fintech readily made good use of. In numerous countries it fostered radical and groundbreaking quickening of the pace of shifting to electronic payments and creating a new sort of payment services, adjusted to the needs and expectations of younger consumers.

Methodology: The paper uses the method of an economic analysis and literature review – mostly electronic sources, descriptive and comparative analyses.

Findings: From customers' perspective, the impact of COVID-19 pandemic on development of new payment services should be acknowledged as positive, or even groundbreaking in some developing countries. Over the years 2020-2021 the number of customers making on-line payments, especially mobile payments, grew rapidly. This was the result of a fast, forced by pandemic, growth in sales in e-commerce. Consequently, it enabled to introduce and widely promote new financial services – based on open banking, and promoting solutions targeted at young consumers, e.g. deferred payments. Even though the pandemic is over, the interest rate rise and the consequences of the war in Ukraine are bound to bring further, dynamic development of such payment services, as well as their popularization on more and more new markets all over the world.

Practical implications: The analysis of relations between theoretical and practical bases of widespread adoption of new solutions concerning on-line payments in the world during the COVID-19 pandemic is an important factor in the development of e-commerce market and financial services. The fact that digital forms of payments have become very common brought about the network effect, a situation when the value for the customer depends on the number of users of a particular solution. Due to that, poorer, developing countries could, making use of the solutions based on open banking and the technology provided by fintech, quickly popularize cashless, and electronic payments. Only a few years ago it was estimated that in the countries lacking the standard payment infrastructure it would take decades to reach this level. Also, in developed countries the pandemic contributed to popularization among young consumers of solutions adapted to their preferences, being an alternative to traditional credit cards. Deferred payments are a solution which is commonly used in e-commerce, and their main merits include increasing both conversion rates and average order value. However, it needs to be emphasized that this goes with a less flexible business model of the companies providing such services in high

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interest rate environment, as well as adverse consequences of broad access to such services. Many countries have observed a growth of customer debt - which effects both credit worthiness and problems to pay off rising debts. This results in imposing formal regulations on deferred payments markets more and more frequently.

Keywords: fintech, e-commerce, deferred payments, COVID-19 pandemic.

JEL Classification: G20

1. Introduction: the impact of COVID-19 pandemic on economy in Poland and in the world

The COVID-19 pandemic posed a great challenge to global economy. First and foremost, it burdened healthcare systems in every country, resulting in extremely negative influence on inhabitants of the countries it affected. The consecutive lockdowns in numerous countries resulted in unemployment rise. It suddenly unsettled the market of raw materials and international trade (Jędrzejowska, Wróbel 2021). In 2020 the international turnover in services decreased by 20.1% whereas trade in goods decreased by 7.4% (Mroczek, 4.02.2022). All financial markets reacted negatively, which consequently, resulted in a threat to solvency of numerous companies affected by direct or indirect effects of closing many sectors of economy. With shrinking economy and tax revenues decline, some countries were forced to introduce helping shield programs, as well as take up costly actions to prevent the spread of the virus. As a consequence, budget deficits increased, and debt accumulated dangerously faster.

The impact of COVID-19 pandemic on particular sectors of economy was widely diverse and multidirectional. On one hand, the restrictions imposed in connection with the epidemic threat resulted in a slump in tourist, transport, and gastronomy industries. On the other hand, however, IT services observed continuous growth, which was related to a high demand for information technologies during lockdown. Services connected with trade in goods, fuel transport excluded, noticed relatively only slight decreases. One of the reasons for this was a rapid growth of e-commerce. According to the data presented by the World Trade Organization (WTO), the value of the world exports of services over the COVID-19 pandemic decreased from US\$ 6.1 trillion in 2019 to US\$ 4.9 trillion in 2020, which was the lowest level since 2013. It needs to be emphasized, however, that over the same period there was an increase in exports of information services - by 8% YOY, and financial services – by 4% YOY. That means that information services made up more than 12% of the world exports of services in 2020, and the contribution of financial services increased to 11% (Mroczek, 27.01.2022). This growth was strictly connected with the changes resulting from the effects of the pandemic within economies of individual countries. It was a consequence of the phenomenon when whole societies adapted to a new, unprecedented situation – an acceleration in the transformation of digital economy, but most of all, a rapid growth of retail e-commerce. The contribution of e-commerce in global retail trade increased from 13.8% in 2019 to 17.8% in 2020. In was an absolutely unprecedented growth of e-commerce.

In 2021 global retail e-commerce was close to US\$ 5 trillion, whereas forecasts indicate that by 2025 it may have exceeded even US\$ 7 trillion. This increase is thanks to rapidly growing local markets, such us Latin America. Over the period of COVID-19 pandemic, digital development surged there, which contributed to a rapid growth of e-commerce. Such a degree did it reach that Brazil and Argentina became the leaders as for the most quickly growing retail e-commerce markets in the world (Statista.com; 10.09.2023). This tendency strongly correlates with significantly accelerating better access to the Internet. The rate of the Internet users worldwide, as assessed by the International Telecommunication Union (ITU), is steadily growing. It was estimated that in 2005 13.8% of global population had permanent or occasional access to the Internet. This rate increased to 53.8% in 2019. However, the global data do not show important details. The numbers for developed countries (86.3%) were almost twice, and more than four times bigger than for developing countries, and the least developed countries respectively (47% and 19.1%). Access to the Internet in Europe (82.5%) is more than three times higher than in Sub-Saharan Africa (28.2%). In developing countries access to the Internet is restricted due to infrastructure and financial limitations. This situation is totally changing thanks to mobile broadband access, which democratized the possibility to use the Internet not only in less urbanized regions, but first and foremost, in developing countries, where access to conventional, stationary broadband Internet connection was limited. The higher demand for the Internet access put pressure on Internet service providers. Data transmission grew rapidly, and most networks observed at the beginning of the pandemic an annual increase from 30% to 45% as compared to the before-pandemic levels (UN, 2021).

In most countries cellular networks quickly adopted to the increased demand for data transmission. It also contributed to larger investment in infrastructure, and led to changes in regulations and business models. As a result, e-commerce benefited and thus surged. For example, according to OECD, the share of e-commerce in total retail sales in the USA increased from 11.8% to 16.1% between the first and the second quarters of 2020. In the UK the growth was even more spectacular, as e-commerce increased from 20.3% to 31.3% (OECD, 7.10.2020). The situation in this matter was similar in other countries. In China. the share of e-commerce in total retail sales increased from 19.4% in August 2019 to 24.6% in August 2020, whereas in Kazakhstan from 5.0% in 2019 to 9.4% in 2020 (UN, 2021). As for Poland, this rate grew from 7.6% in the whole year 2019, to nearly 12.0% in April of the following year (GUS, 22.06.2020). On the other hand, according to the data collected by PwC, in the whole year 2020 the online channel made up 14% of the total value of retail sales in Poland, which was attributed to the pandemic and an accelerated development of e-commerce platforms. The value of trade in goods online increased by 35% between 2019 and 2020, reaching the level of PLN 100 billion. Such a huge surge in e-commerce was commonly observed in the whole world. The analysts of this phenomenon referred to the analysis by IBM U.S. Retail Index. According to it, in the USA, the pandemic accelerated the shift from physical shops to online shops by about five years (Perez, 24.08.2020). Only a quarter of a year was enough to reach what was impossible over a few previous years, i.e. to significantly exceed 10% share in retail sales in this country (Sterling, 12.08.2020). Along with the rapid growth of e-commerce, the number of online shops and sales of e-services increased. All that had a significant impact on acceleration in the development of payment services.

The changes in consumers' behavior altered the operating environment of businesses all over the world. In case of the sector of payments, the global income fell approx. by 22% over the first six months of the year, as compared to the same period in 2019 (McKinsey&Company, 2020). However, in case of retail sales, the impact of COVID-19 pandemic was mainly connected with the change in consumers' behavior. The fear of catching the virus significantly influenced the methods of paying both in physical shops and on the Internet. For the fear the virus might be spread by banknotes and coins, the number of payments by credit cards extremely increased, especially contactless payments and mobile payments. It was facilitated by increasing transaction limits without PIN codes. In most countries the limit was doubled, just like in Poland – from PLN 50 to PLN 100 (Deloitte, 4.10.2020). Avoiding physical contact also had influence on using ATMs. In India, or in the UK this decreased by almost 50%.

The pandemic influenced e-commerce also because more attention was paid to contactless delivery, therefore avoiding payment in cash or by card on delivery. According to the data by the World Bank, over the pandemic, in developing countries, the number of people paying for their purchases by the means of a credit card, a mobile phone, or a transfer from the bank account increased by 40%. The number of people using these methods of payment for fixed expenses also increased – by one third. In Poland this figure is estimated to have grown by as much as 2 million (Obserwator Finansowy, 30.07.2022).

According to the data by the World Bank, in 2021 in developing countries, China excluded, 8% of people aged 15 and over paid for their purchases by the means of cashless methods. Including China, where such methods are already widespread (used by 82% of adult population), this share increases approximately to 20%. The numbers are impressive not only when presented in percentage, but also in absolute value. Since the outbreak of the pandemic, in China the number of people doing cashless shopping has increased by 100 million, and in India by 80 million (Demirgüç-Kunt, Klapper, Singer, Ansar, 2022).

The unprecedented and rapid increase in e-commerce, a growing number of consumers using on-line payment methods is the result of an accelerated change in a pattern of behavior, which happened in response to the crisis connected with the COVID-19 pandemic. It caused a fundamental change in adopting new technologies and payment services. A good example of a solution of this type is making use of the payment infrastructure between bank accounts in real time, but first and foremost, with the use of mobile applications. Although this solution has been known for many years, it laid the foundations for open banking. The pandemic accelerated, and in some cases was simply the driving force behind implementing suitable regulations in many countries. To this day (2023), almost 100 countries all over the world either have already accepted or are considering accepting one or other form of open banking.

Among those countries were Brazil (2020), Colombia (2022), Nigeria (2022), Saudi Arabia (2022), Russia (2020), Macedonia (2022), or Georgia (2020). On many markets the pandemic accelerated the implementation of the earlier accepted regulations, which had been mostly introduced by local regulators, who somehow forced financial institutions to create new solutions. Interestingly, in some countries, open banking embraced all financial institutions, not only banks. That was the case in e.g. Brazil, Colombia, Mexico, Nigeria, Saudi Arabia, the Philippines, or Jordan. This solution brings interesting effects. For example, over two years following the initiation of the Open Finance program in Brazil, customers gave 17.3 million consents to process their personal data. This country reached the number of 5 million bank accounts within less than a year (five times faster than the United Kingdom). That puts Brazil at the top as for the adoption of the idea of open banking. A broad extent of implementation covers not only banking services, but also insurances, payments, and investments. It allows a quick adoption of new solutions provided by fintechs (Open Bank Projekt, 2023).

2. The development of new financial services during the COVID-19 pandemic

The pandemic period made investments in instant banking bring higher benefits – both in physical points of sale and in e-commerce. This tendency was a response to customers' common expectations concerning the pace of money transfer, the comfort, but mainly, lower costs of such operations in comparison with previous solutions, such as e.g. PayPal. Also, a high adoption of mobile applications played a significant role. Thanks to them it was possible to make the customer experience be the same for all methods of payment, regardless of whether it took place in a physical shop, on an Internet website, or a mobile application. It contributed to a more widespread use of such systems as GrabPay in Singapore, or banking solutions such as MobilePay in Denmark, or BLIK in Poland. In Great Britain, an average daily value of transactions processed by the service FasterPayments increased by over 10% from the fourth quarter of 2019 to the end of March 2020. A spectacular increase in e-payments took place in India, where banks intensified their digital offers, integrating bill payments, e-commerce, and creating a unified payment interface (UPI). This local system of payments in real time is available in mobile banking applications, Internet shops, or mCommercer applications. The new solution noted a spectacular increase by about 70% over the first seven months of 2020. This growth is the most visible while comparing the number of traditional payment cards and other methods of payment,

as already in 2021, the number of transactions made by the use UPI was four times bigger, even though two years earlier it was on a similar level, and the system itself was introduced in 2016. UPI was a solution which supported the post-pandemic economic growth in India. Digital payments grew very rapidly in this country. According to the report by Worldline, UPI made up as much as 84% of digital payments in India in 2022. It set a new record in May 2023 with 9.41 billion transactions in volume over one month. According to the National Payments Council of India, in terms of value, it was INR14.3trillion (Indian rupees), which is about GBP 136 billion (Singh, 2.07.2023). UPI connects over 300 Indian banks and enables seamless financial transactions through mobile applications like Google Pay, Amazon Pay, PhonePe, and Paytm. In total, up to the date, UPI has about 260 million users all over India, which enables instant cashless payments in the whole country, but first and foremost, introducing a considerable number of citizens into the formal economy. It especially refers to rural population, financially excluded for a long time. India eagerly promotes their example abroad, recommending the benefits resulting from the digital infrastructure model to the countries facing similar challenges. A copy of UPI solution is, e.g. Pix system, which was introduced in November 2020 in Brazil. Also, in 2022 Nepal was the first foreign country to officially introduce UPI into their national payment system. The government of Nepal hope it will be equally successful (Stacey, 21.07.2023).

3. A dynamic development of deferred payments (BNPL – Buy Now Pay Later) during the COVID-19 pandemic

A payment service which surged enormously during the COVID-19 pandemic were deferred payments. The concept of postponing payments for obtained goods is nothing new. It was used as early as in 19th century in case of more costly purchases, such as e.g. sewing machines, but also furniture, pianos, or farm machines. It enabled to increase sales of products with higher markups (Boxell, 15.09.2021). In years to come, deferred payments were offered by banks issuing chargé or credit cards. However, it required official checking of customers' credit worthiness. The solutions which more remind of today's deferred payments, a combination of a form of payment and a form of financing, appeared thanks to gas stations and department stores, such as e.g. Nordstrom in the USA (PYMNTS, 3.04.2018). In 1980s and 1990s, big chain stores in the USA launched private label credit cards. They targeted at middle class customers, offering extra benefits while shopping, discounts, or even a free delivery. Apart from being an additional source of income, such cards also served the purpose of loyalty cards (Gray, 27.12.2021). The modern business of deferred payments was created in 2005 by a company founded in Sweden – Klarna. Initially operating only nationwide – in Sweden, this business entity quickly captured the European market. On American market, the first entity offering this type of solutions was Affirm, which was set up in 2012. Two years later Afterpay entered the market. The companies in question operated in a slightly different way, offering products adopted to the markets they had been operating on. While in the Anglosphere the standard solution is splitting your payment into 4 installments, paid every two weeks, with the first installment paid on the purchase, in Europe Klarna offered 'pay in 30 days', which allows customers to pay up to 30 days after the purchase. In most cases the business model included merchant fees. Depending on a country, they vary from 5% to 8% of each transaction, whereas standard credit card processing fees range from 2% to 3% of a transaction (Di Maggio, Katz, Williams, 2022). The differences in merchant fees, just like card processing fees can be observed on European markets, where on average, they range from 2% to 5%. However, it needs to be emphasized that height of fees charged by these companies is adjusted to the type of business, and is the highest in high markup clothes shops or shoe shops. This much higher level of fees results from a higher conversion rate, which is calculated by dividing the number of conversions (transactions made) by the total number of site visitors. In case of payments with Klarna, it increases by approx. 20%, whereas the value of orders increases to 30%. Also, an additional benefit is a bigger number of returning customers (Debek, 30.01.2020). In the USA those numbers may be even higher. RBC Capital Markets estimates that BNPL increases conversion rates by as much as 20-30%, and even more in case of an average basket value (ABV) – by 30-50% (Perlin, 9.04.2021). Similar data is reported by companies operating in Poland (Pallus, 2.08.2021).

Deferred payments quickly gained popularity with both customers and merchants. It results from the merits this unregulated product has. contrast to a credit card, BNPL products are constructed In as an installment loan (repaid in one or four scheduled and set automatic payments). Deferred payments are offered by retail merchants acting as a go-between, and are connected with purchasing a particular product. One of their major upsides are significantly more liberal conditions that need to be satisfied to have them granted. Customers do not have to present any credit documents, and the very process of approval is fast and easy. There are numerous further benefits, such as e.g. no extra charges - providing customers stick to the repayment schedule, no commission charges for approval or using them, but also no, or minimal, reporting such products to credit bureaus. All these contributed to the fact that deferred payments took e-commerce payment markets by storm in many countries. Their users are mostly young people, from the so called 'Z Generation' and 'Millenials' (Meola, 20.07.2021).

Low costs of financing, due to lowering interest rates by central banks during the COVID-19 pandemic, along with growing values of companies both in stock markets and in evaluation by Venture Capital funds, triggered a fast expansion of such companies on further markets. Thus, also the value of transactions financed in this way was growing rapidly. In 2019 it was US\$ 34 billion, and it took only two years to reach US\$ 120 billion (de Best, 18.09.2023).

At the same time, the number of users of such solutions was growing rapidly. According to analyses by Juniper Research, in 2022 there were approx. 360 million of BNPL users in the world (Smith, 8.08.2022). The biggest companies in this field included Klarna with 150 million users, PayPal – 60 million, Afterpay -16 million, and Affirm -13.9 million. In March 2023 Apple Inc. became a new player on this market. All this translated into a growing share of such payments in a total number of e-commerce payments. Globally, in 2022, BNPL made up 5% of all e-commerce transactions. However, in some countries, like e.g. Sweden or Germany, they exceeded the level of 20%, as presented in Table 1.

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Inventory	2016	2019	2020	2021	2022
In total	0,4%	1,6%	2,1%	3,0%	5,0%
Sweden	12%	25%	23%	25%	24%
Germany	3%	18%	19%	20%	23%
Norway	5%	13%	15%	18%	18%
Australia	-	8%	10%	11%	14%
Belgium	5%	6%	7%	9%	14%
The Netherlands	6%	8%	9%	12%	13%
Finland	-	8%	12%	13%	13%
Denmark	5%	7%	8%	12%	12%
New Zealand	-	-	10%	10%	10%
Great Britain	1%	3%	5%	6%	8%
Italy	-	1%	2%	4%	6%
Canada	-	-	-	3%	6%
The USA	-	1%	2%	4%	5%
Singapore	-	-	3%	4\$	5%
France	1%	2%	4%	4%	5%
Malaysia	-	-	-	4%	4%
Indonesia	-	-	3%	3%	4%
Ireland	-	-	-	2%	4%
India	-	-	3%	3%	4%
China	-	-	-	0%	4%
Japan	-	2%	3%	3%	3%
Spain	-	1%	2%	2%	3%
The United Arab Emirates	-	-	-	1%	2%
Poland	-	-	2%	2%	2%
The Philippines	-	-	3%	2%	2%

Table 1.	The share o	f BNPL in	e-commerce	payments in	selected	countries
in selected years from the period 2016-2022 (%)						

Source: R. de Best, 31.08.2023, Buy now, pay later (BNPL) share in e-commerce in 41 countries worldwide 2016-2022, Statista.com, https://www.statista.com/ statistics/1233850/online-bnpl-penetration-country/ [Access: 20.09.2023]

Rapidly increasing interest rates and the war in Ukraine significantly influenced the fintech market, the market of deferred payments included. The stocks of publicly traded fintech companies which offered such services recorded a fall by as much as 95% from their peak in March 2021. (Lee, McKay, 1.03.2023).

When in 2018 H&M invested US\$ 20 million in Klarna, purchasing 1% of the company shares, fintech was valued at US\$ 2.5 billion (Lunden, 8.10.2018). A year later, the value grew to US\$ 5.5 billion, making Klarna the most expensive startup in Europe, in fintech business (Milne, 6.08.2019). In the next funding round, in 2020, Klarna raised another US\$ 650 million, at a post-money valuation of US\$ 10.6 billion

(Wąsowski, 17.09.2020). After another investment, at the beginning of 2021, Klarna closed the round at a post-money valuation of as much as US\$ 31 trillion, which was higher than that of Deutsche Bank, the biggest bank in Germany (Forbes, 25.03.2021). In June 2021, after the next funding round, the value of Klarna increased to US\$ 46 trillion (Duszczyk, 10.05.2022). Just before the outbreak of the war in Ukraine it had been forecasted that the value of the company would rise to a titanic quote of US\$ 60 billion (Nair, Gopinath, Foerster, David, 9.02.2022). A sudden change in the global economy resulted in a drop in the value of most fintechs. This was mainly due to the rise of interest rates, which significantly increased the cost of capital. A distinct example of this situation was a rise in the 10-year U.S. Treasury bond yield, the highest since 2007 (Puls Biznesu, 16.08.2023), and FED decision in 2023 to raise interest rates to the highest level in 22 years. This, in turn, stopped most investments on the fintech market (Chiavarini, 26.06.2023). The valuation of Klarna plunged to the level of US\$ 6 billion, still in 2022 (Tan, Foerster, Roof, 1.07.2022), and the very company reported a US\$ 1 billion loss (Ringstrom, Mukherjee, 28.02.2023). Not enough flexible a business model of such companies was not ready for changes of market conditions. Therefore, the forecasts of the increase for the following years may be overestimated. The high cost of debt financing is just one of many problems facing this sector. The most serious one may be imposing formal regulations on the deferred payments market. In many countries, costumer debt growth has been observed, which influences creditworthiness and problems with paying off the present debt (Jones, 23.06.2022; Washington Post, 12.12.2022; Carrns, 29.12.2022)). For this reason, some markets either have already introduced, or are going to introduce regulations strengthening protection of consumers, and regarding deferred loans as a form of a loan (Norton Rose Fulbright 12.2022). However, it seems that all the changes may slow down, but still not halt the growth of this form of payment. A good example of this tendency is Allegro Pay, which is a service of deterred payments provided by Allegro.pl, the largest Polish marketplace. In the second guarter of 2023 purchases made with a use of this service made up as much as 11.9% of total gross sales on this platform (Wirtualnemedia.pl, 29.09.2023).

Summary

Deregulation and globalization of financial systems, along with quick implementing new IT solutions, significantly decreased the barrier of entering the banking sector and offering payment services, which for many years were a traditional and key area of bank activity. Within several years they led not only to a quality transformation of the banking environment, but also to their role itself. Those changes resulted from
a complex, but at the same time, multidirectional influence of technological, economic, political, legal, and social factors. However, it is hard to determine the individual influence of the particular factors on the changes. Even though they are of a different type and differently shape micro- and macro- environments, they are hard to separate, as they remain in a strong interrelation, which results in a 'cause and effect' relationship, or feedback loops. Nevertheless, the most important factors which shaped the areas of the most significant transformation include: deregulation, liberalization, and disintermediation of financial markets, a decrease in profit margins, a strong growth of competition in the sector of financial services, globalization, steady technological advances, but also an increase in customers' needs, resulting from growing awareness and financial education. From the very beginning of e-commerce development, it was clear that the key obstacle in its growth was the possibility of offering customers safe and fast payments. The effect of development of e-commerce was that a wide range of new, alternative to payment cards, methods of payment appeared on the market. One of them is deferred payment. It is becoming one of the forms of payment which increase the level of sales, especially with the younger customers. Their advantage over conventional credit cards is a quicker pace of credit-decision making, lower interest rates, but also adaptation to younger consumers' needs (The Economic Times, 18.09.2023). Further, dynamic development of BNPL will have to consider maintaining the environment of high interest rates for a longer period. It may involve consolidation of this market, as well as introducing additional fees imposed on the users for the services which so far have been free of charge (Gurman, Smith, 21.09.2023).

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ARTICLES

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DEVELOPMENT OF THE LNG MARKET IN THE EUROPEAN UNION IN THE CONTEXT OF WAR RUSSIA-UKRAINE

Abstract

According to the latest data from the International Energy Agency, global LNG trade increased by almost 6% year-on-year between January and August 2022. It was dominated by rising demand for the commodity in the European Union. This was driven by sharp cuts in linear gas supplies from Russia, which are linked to the EU's stance of abandoning Russian supplies due to Russia's war with Ukraine, and the subsequent imposition of sanctions by the European Union on Russia. In January-August 2022 alone, LNG imports into the EU increased by as much as 65% (43 bcm) compared to the same period in 2021. Such a significant increase in the supply of LNG to European countries was also made possible by a decline in demand for LNG in the Asia-Pacific region, due to the mild winter, high price levels, and disruptions related to Covid-19 and the aftermath of lockdowns in China. The cut-off of gas supplies from Russia has shown that the LNG market in the EU can play an important role in both the region's energy security and energy transition. In fact, the European Commission treats gas as a blue fuel, much less carbon-intensive than other conventional energy sources such as coal or oil. An additional advantage

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of LNG is the possibility to transport this fuel from various locations, rapid change of supply directions, and the more extensive possibilities for its storage. For an EU struggling for a stable supply of raw material, pursuing the Green Deal and carrying out an energy transition, this is an option that could become a strategic element in the long term. The research objective of this article is to investigate and analyze how the share of LNG in the EU's energy mix has changed and in what direction it is affecting EU energy security after Russia's aggression in Ukraine.

JEL Classification Code: Q41, Q34, Q32, Q47

Keywords: energy security, gas import, LNG, Russia-Ukraine War.

1. Introduction

Energy security is a multifactorial issue which keeps constantly evolving: it refers to either a unit, state, process or phenomenon. A debate about this problem concerns not only the question of energy security as such (both subjectively and objectively treated), but also its measurements, background and determinants (Pach-Gurgul, 2015). The literature of the subject presents a number of definitions, whilst the term keeps expanding, including new aspects added as a result of many national and international factors. Following the definition of Yergin (2006), energy security is defined as "ensuring adequate energy suppliers at affordable and reasonable prices". Mansson (et al. 2014) in turn, defines energy security as "the availability of energy at any time, in various forms, in sufficient quantity and at a reasonable price and/or an affordable price". Energy security can also be defined as "the availability of adequate energy at an affordable and reliable price, necessary both from the technological point of view and also from the perspectives of human security" (Wang et al., 2018; Sovacool, 2013, Augutis et al., 2012). Many contemporary researchers of the security emphasize the interdisciplinary approach to energy security, expanding the limits of the area of energy (Mansson, 2014; Cipollaro and Lomonaco, 2016; Löschel, Moslener and Rübbelke, 2010).

With time, also for the EU member states, energy security and its multiple aspects have become the main challenge, though treated in diverse ways. Within the last 30 years, there have emerged a number of key threats and factors which shaped the form of energy security, prioritizing it within the European Union. As Van de Graaf & Colgan, J. (2017), and also Goldthau & Boersma, (2014) observe, an important role in this process was played by gas cut-offs made by Russia in winter 2005/2006, and also in winter 2009 and in June 2010 which resulted in the withholding od the gas supplies for specific EU member states, leading to huge economic costs. Additionally,

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the growth of the significance of the energy security was also influenced by the following factors:

- Fluctuation of the oil prices on world markets;
- The execution of the particular interests of specific states, such as the Nord Stream project which caused many concerns on the part of some EU member states, i.e. Poland and some Baltic countries;
- The Fukushima nuclear accident in 2011, which resulted in the abandonment of the nuclear energy development and the extinguishment of the nuclear reactors in some EU counties, such as Germany;
- The impact of the Covid-19 pandemic on the global market of energy sources.

Currently, energy security belongs to the competencies shared within the EU, pursuant to article 194 of the Treaty on the Functioning of the European Union (TFEU), which provides the legal grounds for the EU energy policy. This means that there is no obvious legal obstacles for strengthening energy security on the EU level (Consolidated version of the Treaty on the Functioning of the European Union). However, the same article of the Treaty stipulates also that the member states are responsible for their energy baskets and the general structure of the energy supply. Thus, the co-ordination of the EU energy systems depends, to some degree, on the political choices of specific EU member states. Moreover, the member states play the main role in financing the share of renewable energy in their energy mixes and in increasing this share, for example by market incentives. These countries take also decisions about creating energy connections with other countries. The procedures of giving permissions for renewable sources of energy, even if facilitated thanks to the EU legislation (for example with in the REPowerEU and solar energy strategy), require also the participation of the national and local levels in order to guarantee measurable results.

The research objective of this article is to investigate and analyze how the share of LNG in the EU's energy mix has changed and in what direction it is affecting EU energy security after Russia's aggression in Ukraine. Diverse research methods were used to achieve the research objective of this article, including a critical review of the literature on the LNG market and EU energy security and an analysis of source material including reports from independent institutions, documents provided by EU institutions and selected companies.

2. A new dimension of energy security in EU in the context of Russia-Ukraine war

In the recent years, the significance of energy security within the EU policy was greatly affected by the process of energy transformation resulting

from the implementation of the sustainable development goals, and also the execution of the Paris Agreement (Esperanza Mata Pérez et al., 2019, Tagliapietra et.al, 2019). The European Union prioritized Europe's transformation into a zero-emission continent by 2050, which also means departing from carbon intensive conventional fuels and conversion to renewable sources of energy and other, alternative low-emission energy sources. As a consequence, energy security was strongly connected with the climatic policy. From today's perspective, it can be stated that perhaps the security of the supply of the energy resources and its diversification was then pushed to the background.

Currently, after Russia's aggression in Ukraine and the resulting energy crisis, energy security understood, first of all, from the perspective of reliable supplies of conventional fuels, such as crude oil, gas or coal, were placed again on the priority place on the EU agenda. This is the outcome of the fact that EU's energy import dependency rate in 2021 was 55.5%, making the European Union the largest net energy importer of the worldwide. In 2021, Russia was the largest supplier of energy to EU, providing 45% coal supplies, 36% gas supplies and 25% crude oil supplies (cf. Fig. 1).





Within 2022, the situation changed significantly, together with a few rounds of the sanctions imposed in the Russian energy products, political initiatives of the EU aiming to cut off from the Russian energy (e.g. REPowerEU) and the restrictions in gas transmission and setting prices, imposed by Russia. The most recent data available show that in the third quarter of 2022, EU did not import coal any more, but only 18% of its gas and 15% of crude oil from Russia. However, in spite of all these limitations on the import of the Russian energy resources and the decrease of the energy dependency from Russia, energy security has remained a longterm challenge for the EU, given its high total energy dependency. Moreover, energy crisis resulted not only in the problems with the supplies, but also influenced the price increase which translated into the rise of inflation in the EU countries, which, in turn, affected many household and company budgets. The concern of the availability of resources and their price, in some way, has created a pressure on the increase of self-sufficiency which resulted in reopening of coal mines, in such EU countries as France or Germany in order to survive the winter of 2022/2023, which unfortunately, contradicts the costly energy transformation which has been undertaken.

The impact of war on the energy situation of the EU was the most serious in the case of gas. In 2022, thanks to diverse actions undertaken, the EU managed to avoid disruptions and gas shortages during the winter. Yet the EU is still facing the challenge of intensifying its efforts during the transition from a short-term crisis management to solving the longer difficulty guaranteeing energy security, including the reliable gas supply in and strengthening its strategic autonomy in the energy field. The resolution from March 2022 on Russian aggression of Ukraine, contained an appeal to decrease the EU energy dependency, in particular from Russian gas, crude oil and coal, by means of the diversification of energy sources, development of LNG terminals and supply routes, separation of gas storage facilities, increase of energy efficiency and accelerating the transition to clean energy. Moreover, the EU undertook a number of other actions and issued many documents regulating its standpoint towards Russian aggression, in the context of the threats for reliable supplies of energy resources. These strategies and decisions have been described in the table below:

Table1. The main documents containing actions concerning energy security undertaken by the EU in the context of the Russian aggression in Ukraine

Document	The document essence
European Parliament resolution of 7 April 2022 on the conclusions of the European Council meeting of 24-25 March 2022, including the latest developments of the war against Ukraine and the EU sanctions against Russia and their implementation (2022/2560(RSP)) European Parliament resolution of 19 May 2022 on the social and economic consequences for the EU of the Russian war in Ukraine – reinforcing the EU's capacity to act (2022/2653(RSP))	The European Parliament called for the establishment of common strategic energy reserves and energy purchasing mechanisms at EU level to increase energy security and reduce external energy dependency and price volatility. It also called for a full embargo on Russian energy imports. Parliament stressed the importance of ensuring energy sovereignty and independence from Russian supplies and more strategic autonomy and energy security, by upgrading and ensuring major investment in the EU's energy infrastructure, including interconnections and cross-border infrastructure for renewable energy production, and energy efficiency.
European Commission, Brussels, 18.5.2022, COM(2022) 230 final Communication From The Commission To The European Parliament, The European Council, The Council, The European Economic and Social Committee And The Committee of the Regions REPowerEU Plan{SWD(2022) 230 final}.	Parliament highlighted the role of investments in renewable energy, energy efficiency and the necessary infrastructure – including targeted, well-defined cross-border projects with investments through NextGenerationEU and REPowerEU – in helping the EU achieve energy sovereignty, open strategic autonomy and energy security
Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) No 715/2009 with regard to gas storage (Text with EEA relevance).	In terms of boosting gas storage in response to limited supply, Regulation (EU) 2022/1032 of June 2022 on gas storage set a binding target of 80 % of EU storage capacity to be filled in by 1 November 2022, with a 90 % target set for subsequent years. The regulation was swiftly implemented and storage facilities reached a filling rate of 80 % as early as September and of 90 % as early as October 2022. The EU exited the winter season with record high storage levels of 57 % at the end of April 2023, while the current filling rate (May 2023) stands at 68 %,

Source: The Author's own elaboration on the basis of Future Shocks 2023: Securing energy supply in Europe, https://epthinktank.eu/2023/08/10/future-shocks-2023-securing-energy-supply-in-europe [Access: 20.11.2023]

At the beginning of 2023, the EU undertook a number of action with an aim to decrease its dependency on Russian energy, among others by means of the diversification of energy supplies, stocking the gas storage facilities, promoting joint purchases of gas, limiting the energy demand and promoting energy saving, increase of energy efficiency and also supporting the use of renewable sources of energy.

Both for the EU countries and the LNG suppliers, this was a clear message that now this type of fuel would be necessary as an alternative to the Russian gas supplies and that the development of the EU infrastructure making it possible to accept such supplies is necessary, requires.

3. LNG as clean conventional fuel – the process of its obtaining

Liquefied Natural Gas (LNG) is the cleanest fossil fuel. It is obtained as a result of the purification from contaminants and the change from liquid to gas under the influence of very low temperature of about -161°C. Thanks to its purification, as much as 95% of LNG is composed of methane. One cubic meter of liquefied natural gas is about 600 cubic meters of natural gas, which is especially beneficial from the point of view of profitability of transport and storage. When an LNG transport reaches its destination, it is then *re-gasified*, i.e. transferred into gas by means of heating the liquid. The purification makes gas combustion is less harmful because fewer harmful substances are emitted to the atmosphere. As LNG is natural gas in a fluid form, its physical and chemical properties will be similar to these of average natural gas.

In the context of Russia-Ukraine war, it may be surprising why Europe did not rely on the development of the LNG infrastructure and its supplies much earlier, making it a reliable alterative for the fuels coming from the Russian market? It seems that there were many causes for Europe's such a slow decision to convert to LNG as an alternative for the Russian gas with the leading one being the high cost of the entire process of LNG obtaining and processing, which results in the fact that today's commodity exchanges show significant price differences between the world price for natural gas and the price of LNG. This specific process of obtaining LNG which is called the *LNG life-cycle* in its final version is simply very costly and consists of four stages: obtaining, liquefying, transport and regassification.



Figure 2. Life cycle of LNG

Source: the Author's own elaboration on the basis of Maxwell D., Zhu Z. Natural gas prices, LNG transport costs, and the dynamics of LNG imports Energy Economics, Volume 33, Issue 2, March 2011, Pages 217-226

The process of obtaining natural gas and its transformation into LNG is very complex and undergoes continual modernizations and modifications. There are many techniques and methods which require the use of specialist equipment, protection measures and extensive knowledge.

The first link consists in obtaining LNG. The share of this component in the total costs depends on a number of factors, such as type of deposit from which the raw material is extracted, the distances from the terminals and also the costs of construction of production and transmission infrastructure. This link of the process makes up approximately 20% of total costs. There are either onshore or offshore deposits. Natural gas is extracted usually with vertical wells drilled in the earth's crust and there are various stimulation methods used to increase the flow of natural gas in the well (Brunner, 2013). One of them is hydraulic fracturing/fracking, which consists in pumping a mixture of water, sand and chemicals into the well under high pressure. This allows the formation or enlargement of rock fractures through which the gas travels. The opponents of this method point out that it requires significant amounts of water, plus dangerous and highly toxic wastewater is produced which might pollute the underwater sources (Jackson et al., 2013).

The next stage involves the purification of natural gas from carbon dioxide, hydrogen sulfide and steam. The compounds of sulfur and carbon dioxide must be removed as in the presence of water they have a corrosive effect on steel from which the pipeline is constructed (Roman-White et al., 2021). Moreover, hydrogen sulfide is highly toxic. After purification, natural gas

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is liquified. Nowadays there are there main methods of liquefying natural gas. They differ from each other with respect to the installation scale and energy consumption. These methods comprise (Brunner, 2013):

- Classical cascade cycle,
- Cascade cycle with mixed coolant,
- expansion cycle with turboexpander.

The classic cascade cycle involves a large-scale installation, yet the procedure itself is not very energy-intensive. It involves natural gas flow under pressure through the plant and undergoing cooling in three refrigeration cycles (so-called cascade system). The refrigerants are propane, ethane and methane. A large number of installations is associated with high costs of this method, but on the other hand it is energy efficient.

The mixed refrigerant cascade cycle is some modification of the classic cascade cycle, yet without advanced apparatus and equipment, but in this case more energy is consumed. This method uses only one compressor and one refrigerant (a mixture of hydrocarbons). Natural gas is first cooled using a propane refrigeration cycle, followed by a hydrocarbon mixture. This cycle and its variations are used more often than the classic cascade cycle mainly because of lower operating costs.

The turboexpansion cycle involves expanding a portion of the gas in a special device called a turboexpander and then cooling the gas down. The gas cooled with this method is used to liquefy another portion of the gas, which flows through the system. This method is relatively inexpensive and simple, but requires large amounts of energy.

The liquified natural gas is transported by sea or via land route. Special tankers, called methane tankers are used to transport LNG by sea, while tank cars or railroads are used to transport it by land. It should be noted that pipelines are also used in the transportation of LNG, but currently the transports are carried only over short distances from fields, for example. The liquefaction process and associated activities constitute the largest cost category estimated at about 38%. This part is most influenced by the cost of the presented liquefaction technologies.

The third link in the LNG supply chain is formed by transport, which contributes an average of 22% to the overall cost. LNG is transported on methane carriers, i.e. special vessels designed to transport LNG at very low temperatures. The cost of building them is about twice that of a tanker transporting crude oil. LNG is transported in cylindrical steel tanks with double walls, with insulation between them. The tanks are filled to 98.5% of their total volume, and about 10 m³ of LNG is left at the bottom at unloading. This is done to keep the temperature low during the return of the emptied methane carrier and to avoid regasification during the loading

of a new batch. During transport, a small amount of LNG vaporizes, but it is used effectively to generate steam for the ship's propulsion turbines.

Regasification is the process of turning LNG into natural gas in gaseous form by heating the previously liquefied raw material. There are several technologies for LNG regasification. The first of them is the SCV technology (Submerged Combustion Vaporizers), which consists in heating water with flue gases (15-20°C); the pipes carrying liquefied natural gas are submerged in this water². The water transmits heat to the pipes so the gas flowing in these pipes is also heated. Another LNG regasification technology is STV(Shell and Tube Vaporizers). In this method there is a closed system and two types of heating mediums: a heating medium (seawater, river water) and an intermediate medium (usually propane). The heat emitted from the turbines is picked up by the heating medium and exchanged with the intermediate medium until the latter vaporizes the LNG. Another method is ORV (Open Rack Vaporizers), where the heat source is seawater, which heats the apparatus with liquefied natural gas causing it to liquefy (Qi et al., 2019). It should have a temperature higher than 5°C. Once this is done, seawater is diverted back to the sea. It has a 5-12°C lower temperature than the surrounding water. The last method of LNG regasification is AAV (Ambient Air Vaporizers), where the heat for vaporizing LNG is taken from the ambient air. Therefore, this method is used in terminals located in warm and dry climates.

The comparison between natural gas and other fuels point to the advantages of using the blue fuel. First of all, the use of liquefied natural gas does not involve the need to store it, accumulate it or to create storage facilities. Moreover, in the process of transportation, a small amount of escaping gas is reused. The use of furnaces using natural gas is easy and safe. The high calorific value makes the energy produced significant. Natural gas burns without smoke, soot or ash, so the heat released with ash is not lost.

4. The LNG market in the UE and the perspectives of its development

Within the last decade (2011-2021) the primary energy production in the European Union, in the case of solid fossil fuels, crude oil, natural gas and nuclear energy has decreased. The production of natural gas has decreased the most, as by as much as by 63.1%, followed by solid fuels and crude oil and oil products (by 39,1 % and 36.0 %). In the same period, the production of renewable energy manifested an increasing tendency with the growth by 48.2% (cf. Fig.3).



Source: https://ec.europa.eu/eurostat/statistics-

explained/index.php?title=Energy_statistics_-_an_overview, [Access: 21.11.2023]

The decrease of primary energy production in the EU within the recent decades caused some increase of the import of primary and secondary energy products. This increase was slowed down in 2020 on account of a weaker demand caused by Covid-19 pandemic to increase again in 2021. The amount of natural gas imported in 1990-2021 in the EU increased almost twice, reaching the level of 13 012 PJ. This makes natural gas the second largest imported energy product in the European Union, with crude oil being the first. This result is, however, lower by 6.9 per cent than in 2019, which was a record year for the import of natural gas (cf. Fig 4).



Given the highly developed onshore gas pipeline network, as well as bilateral agreements containing privileged pricing, and also other agreements with EU member states, Russia has so far been the main supplier of gas to the EU since the 1990s. One could even speak of the institutionalization of the energy dialogue between Russia and the EU, which started with the declaration signed at the EU-Russia summit in Brussels, in October 2001, known as "The Future Direction of the Energy Dialogue between the European Union and the Russian Federation." All these circumstances resulted in the share of Russian gas in the overall total gas imports by EU countries reaching the level of 35-40%.

Russia-Ukraine war changed the reality of the gas trade between Russia and the EU. The winter of 2022/2023 created an unprecedented anxiety for the European Union connected with the loss of the Russian gas supplies, which was the outcome of the imposed sanctions and the lack of any alternative at an affordable price. In order to prevent any gas supply disruptions, the European took actions to obligate the member states to guarantee 80% filling of gas storage facilities at the beginning of the 2022/23 winter season and up to 90% for subsequent years, in addition to a number of diversification measures aimed at obtaining gas from sources different than Russia. To this end, the European Commission has given the green light for member states, first of all, to increase their LNG import capacity, either by expanding existing onshore regasification facilities or chartering floating storage and regasification units (FSRU).

Since the end of 2021 a monthly gross import of LNG to UE has significantly increased, which is the outcome of the exceptional situation in the gas market and the necessity to fill the storage facilities with gas. Since the beginning of 2022, the EU has imported 98 billion m³ of LNG, which is 39 billion m³ than at the same moment of 2021; between January and September 2022 the EU imported more than in the record breaking year 2019 (Shell LNG Outlook 2023).

In 2022, the regasification capacity of onshore LNG terminals in the EU27 countries will be 141 billion m³ of natural gas per year, with another 28 billion m³ of natural gas per year in FSRU floating terminals. This volume is sufficient to satisfy approximately 40% of total current gas demand. However, there are bottlenecks and infrastructure constraints in some regions of the European Union. Some EU countries, such as Germany, are increasing their LNG import capacity through accelerated investment in LNG terminals. Based on the list of EU projects of common interest (PCI- Projects of Common Interests), the LNG strategy includes a list of key infrastructure projects that are necessary to ensure that all EU countries can benefit from LNG (these projects include, for example, the construction of the Gdansk LNG terminal or the CyprusGas2EU LNG terminal, (Document 32022R0564 Commission Delegated Regulation (EU) 2022/564 of November 19, 2021 amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest). For any new infrastructure, commercial viability is very important; i.e. in the case of the LNG terminal, its use throughout the region or the choice of lower cost and more flexible technologies, such as floating storage and regasification units (FSRUs), which can significantly improve its profitability.

Modern LNG infrastructure in EU countries is relatively developed, yet its development will be intensified over the next few years in the context of events in Ukraine. Seven onshore LNG terminals are located in Spain, which is the largest number in Europe (Cf. Fig.6).

The European LNG infrastructure



Figure 5. Land LNG terminals in Europe Source: https://energy.ec.europa.eu/system/files/2022-02/EU-US_LNG_2022_2.pdf [Access: 15.11.2023]

Their total regasification capacity is 67.1 bcm of natural gas per year (Cf. table 1).

Location of the terminal	Year of construction	Capacity
Barcelona	1968	17.1 bcm
Huelvie	1988	11.8 bcm
Cartagena	1989	11.8 bcm
Bilbao	2003	7.0 bcm
Sagunto	2006	8.8 bcm
Mugardos	2007	3.6 bcm
Giión (El Musel)	2012	7.0 bcm

Table 2. LNG terminals in Spain

Source: Own elaboration based on https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en6 [Access: 18.11.2023]

On the Iberian Peninsula, apart from 7 Spanish terminals, there is also an LNG terminal in Sines, Portugal, which has been in operation since 2004, with an annual capacity of 7.6 bcm of natural gas.

France ranks second with respect to the regasification capacity of the onshore terminals. The total of its four facilities is 33.0 bcm of natural gas per year. The oldest of the terminals is Fos Tonkin, which has been in operation since 1972. Its capacity is only 1.5 bcm of natural gas per year and is therefore it is the smallest LNG terminal in the EU. Another long-operating terminal is the Montoir de Bretange, located on the Bay of Biscay, which has been in operation since 1980. The terminal's throughput is 10.0 bcm of natural gas per year. The French Fos Cavaou terminal has been in operation since 2010, with an annual capacity of 8.5 bcm of natural gas. There are plans to expand it by 1.5 bcm of natural gas per year and 2.0 bcm of natural gas per year from 2030. The terminal will thus be able to supply 12 bcm of natural gas per year from the beginning of the next decade. Dunkirk is home to France's newest and largest LNG terminal, which started to operate in 2016. Its capacity is 13.0 bcm of natural gas per year.

These EU countries also have one onshore terminal each: Belgium, Greece, the Netherlands, Poland and Italy. One of the oldest installations of this type in the EU is the Panigaglia terminal, operating in Italy since 1971, with a capacity of 3.4 bcm of natural gas per year.

In Belgium, in Zeebruge, an LNG terminal started to operate in 1987, whilst its current capacity is 11.4 bcm of natural gas per year. There are plans to expand it by 3.9 bcm in 2024 and 1.8 bcm in 2026. After 2026, the terminal will be able to deliver 17.1 bcm of natural gas per year, thus it will become one of the largest facilities of its kind in the EU.

On the south of the Continent, in Greece, in the vicinity of Athens, there is an LNG terminal,

Revithoussa. Since 2011 in Rotterdam, the Gate terminal has been in operation with the current throughput of 12.0 bcm of natural gas per year. There are plans to expand it by 1.5 bcm in 2024 and by 2.5 bcm of natural gas per year in 2026. This terminal, after 2026 will develop an ability to supply 16 bcm of natural gas per year.

In 2016, Świnoujście, an LNG terminal started to operate and its current capacity is 6.2 bcm of natural gas per year in. There are plans to expand it by 2.1 bcm of natural gas per year already in this year.

The LNG supply, in some sense saved the EU countries from the loss of gas supply liquidity during the winter of 2022/23 and the disruptions related to the loss of energy security. Therefore, EU plans for the construction of onshore LNG terminals include the construction of new installations in Estonia – two terminals (Paldiski – 2025 and Tallinn), in Germany – two terminals (Brunsbuttel – 2023 and Stade – 2026) and in Italy (Porto Empedocle – 2024).

Between January and September 2022, the largest exporters of LNG to the EU were the United States (44%), Russia (17%) and Qatar (13%). The role of the United States in gas supplies to the EU is continually increasing. At the end of March 2022, the EU and the US passed a joint declaration on increasing LNG trade and expressed their common interest in the further increase of the LNG imports to the EU from the US by 15 bcm in 2022, compared to the preceding year. This objective was achieved at the end of August 2022, 4 months ahead of schedule. Currently, the countries in Europe which have access to LNG import terminals and liquefied natural gas markets are much more resilient to potential supply disruptions than those dependent on a single gas supplier.

The analysis of the data for the third quarter of 2023 and their comparison it with those concerning the third quarter of 2021, it can be concluded that as a result of the increase in LNG import capacity, the structure of the share of countries in the supply of gas to EU member states has remodeled (cf. Fig.6). In addition to the record inflow of LNG, EU member states have also started to diversify their gas imports via pipelines from countries other than Russia. An example is the opening of the Baltic Pipe in the autumn of 2022. The EU has adopted a voluntary target of reducing gas demand by 15 percent between August 1, 2022 and March 31, 2023, compared to a five-year average. This commitment was followed by a 10 percent drop in European natural gas demand (or 54 billion cubic meters) in 2022. It's worth observing that this is the largest decline in consumption of this commodity in history. The result is a smaller share of Russia in EU natural gas imports, which decreased from the level of 39% in the third quarter of 2021 to 12% in the third quarter of 2023 (see Figure 6).



Figure 6. The main gas suppliers to the EU member states in Q3 2021, 2022 and 2023

Source: the Author's own elaboration on the basis of Main partners for extra-EU imports of natural gas updated in Nov 2023, https://ec.europa.eu/eurostat/statistics explained/index.php?title=File:Main_partners_for_extra-EU_imports_of_natural_gas_upd_Nov_2023.png [Access: 18.11.2023] In the third quarter of 2023, the highest percentage share of EU gas imports (23%) belonged to the United States. From 2021 to 2023, the share of Algeria, the United Kingdom and Norway in total EU gas supplies also increased.

Conclusions

The dependence of the European Union from the Russian natural gas has been a controversial and widely discussed issue even long before Russia's invasion in Ukraine. The security of the energy supplies in the general energy security of the EU has long been one of the key priorities of the European Commission. However, once seen from the point of view of stable and reliable supplies of energy resources, it has been largely overshadowed by other challenges with the energy transition being one of them.

The EU has imposed extensive and unprecedented sanctions on Russia after its invasion of Ukraine, yet Gazprom and other Russian gas suppliers have so far escaped the packages of the EU's sanctions. This is because the 27 EU member states must vote as a bloc, and several EU countries, such as Hungary, Austria and Slovakia are still dependent on receiving gas from Gazprom and thus continue to import Russian gas.

The European Union with its member states have taken a number of measures aiming at increasing the security of supplies and market resilience before the 2022/23 winter season. The above measures, in particular, concern the regulation of gas storage and the determination of minimum filling levels in storage facilities. The solution for these problems turned out to be the possibility of LNG imports, which reached unprecedented levels in the European Union and remodeled the EU gas supply market, and, as a result such countries as the USA, Algeria, Norway, Qatar have become the main partners in this respect. This allowed to avoid major disruptions in supplies, which are one of the pillars of energy security. In this context, the reduction of Russian gas supplies from 39% in 2021 to 12% in Q3 2023 and the securing of LNG supplies on a permanent basis seems to be a great success.

In the context of the need to secure a larger amount of the LNG in Europe, the LNG suppliers and the developers of the new LNG export projects (also in the USA and Qatar), intending to replace the Russian pipeline gas, are now asking themselves whether the European buyers are ready to commit to long-term (i.e., more than 10 years) fixed-price LNG contracts, which is crucial for financing LNG infrastructure projects. The answer does not seem to be simple. The European Union needs large quantities of LNG by 2030, but the trajectory is less clear. It depends on many factors, including the speed at which alternative energy sources such as wind power and hydrogen will be developed, as well as the long-term outlook for LNG prices and many other economic (conjunctural) and political factors.

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ARTICLES

CENTRAL EUROPEAN REVIEW OF ECONOMICS & FINANCE Vol. 44. No 3 (2023) pp. 99-124 DOI https://doi.org/10.24136/ceref.2023.016

Jacek Pera¹

THE WAR IN UKRAINE AND THE RISK OF LOW IMPACT OF WESTERN SANCTIONS IMPOSED ON RUSSIA

Abstract

In 2022, the Russian Federation became the most sanctioned country on Earth due to its full-scale invasion of Ukraine.

The aim of this article is to measure the effectiveness of the economic sanctions adopted against the Russian Federation.

The research main hypothesis was the following: the impact of Western sanctions imposed on Russia caused by the war in Ukraine remains low.

The research methodology was based on literature research and a linear regression model with two variables: dependent and independent.

The results of the study lead to the following conclusions:

- 1. Sanctions adopted on Russia since 2014 and since 2022 have a direct negative impact on Russian trade (imports and exports in value) with the EU countries and the US.
- 2. Sanctions adopted against Russia since 2014 and 2022 have a direct negative impact on its trade (imports and exports in value) with the trade partners that have a neutral position concerning the war.

JEL classification codes: D24, G14, F41, F51, F62

Keywords: sanction, effectiveness, dependent and independent variables.

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1. Introduction

A state that does not respect the established rules or accepted norms of international behaviour must expect an adverse reaction from an aggrieved party: a state, a group of states or an international organisation. This reaction is, according to the principle of reciprocity, is the punishment of a subject for non-compliance with an established order or norms referred to as a 'sanction'. Sanctions in international law are 'the negative reaction of the international community faced by a state that violates the norms of international law' (Bierzanek, Symonides, 2003; Wiśniewska, 2005). In foreign policy, sanctions are a means of pressure to enforce rules of behaviour that are considered desirable. They are used by states or international organisations and are referred to as non-war coercive measures, for example reprisals, retaliation, any recommendations or decisions and other measures taken to achieve an objective. 'Economic sanctions in the largo sense constitute all measures of an economy-wide nature' ((Hendry, Hyett, 1996). They can be total - covering the entirety of trade relations, or partial – referring to certain areas of economic activity of states. They come in a variety of forms, ranging from the mildest form, which is the suspension of trade agreements, to their termination or the establishment of total import and export embargoes (Bergeijk, 1994; Wiśniewska, 2005). Sanctions are defined using derivative or substitute terms, i.e. embargo, ban, barrier, boycott, trade blockade, discrimination. They are defined as 'measures used in relations between states to achieve specific goals' (Kasprzyk, 2001; Wiśniewska, 2005). 'Economic sanctions consist of an entity of international law (a state, an international organisation or a group of entities) using its economic potential against another entity (or group of entities) in order to: a) punish the latter for the violation of a particular rule or norm, or b) prevent the sanctioned country from violating a particular rule or norm or achieving its objective or benefiting from the results of its conduct' (Anusz, Sulimierski, 1995; Wiśniewska, 2005). Taking this definition into account, it is concluded that the actions of an economic sanctioner are the application of economic coercion against the sanctioned country, preventing it from achieving certain objectives (Lacy D, Niou, 2004). The sanctioning entity demands a change in the existing policy or behaviour of the sanctioned 'target' country. The application of economic sanctions does not lead to the severance of diplomatic relations, possibly to their reduction. Rarely, however, does it go to war (Baldwin D.A., (1985), (Hufbauer, Schott, 1985). The effectiveness of economic sanctions depends on the methods and means available to the state or organisation applying the economic sanctions. Generally accepted sanctions of this type include: - export and import restrictions as selective and partial embargoes to deprive the sanctioned country of imports of goods vital to the functioning of the state

(embargoes on the supply of oil, arms, strategic goods, high technology); service restrictions covering the international flow of services provided to the sanctioned country as well as by the sanctioned country to others (maritime, air transport services, satellites, undersea cables); - financial and capital transaction restrictions, i.e. any restrictions on the financial operations of the sanctioned country (restrictions on the ability to make purchases abroad, suspension of the flow of funds to the sanctioned country, seizure of funds deposited in bank accounts or freezing of reserves). The entity imposing the sanctions, i.e. the state, international organisation or institution, acts on the basis of its own interests, justifying the rightness of its actions to protect its own economic values or to pursue its political interests. The use of the instrument of economic sanctions is an action in a situation where the lack of response could be interpreted as an expression of the powerlessness of the entity concerned or an acquiescence to the violation of the established order. It is intended to contribute to the correction of the conduct of the sanctioned entity and, above all, to produce effects on a political level. The use of sanctions does not always achieve the desired effect, but can be a cause of political and economic isolation of the sanctioned country, causing its economic imbalance, which in the long run is not profitable for the state and forces it at least partly to change its behaviour (Wiśniewska, 2005).

The aim of the study is to analyse the effectiveness of the impact of Western sanctions imposed on Russia as a result of the war in Ukraine. The realisation of the objective was based on the discussion of the following issues: the essence and scope of Western sanctions against Russia in 2014-II 2023; assessing the state of the Russian economy in light of Western sanctions; and the impact of sanctions imposed on Russia: an empirical approach.

The limitations of the study were due to the research sample adopted. Substantial sanctions began to be adopted only in 2022. The 2014-2021 research period is not characterized by the intensity of activities in this area. Further years of researching sanctions adopted against Russia shall bring a more representative data.

Recommendation for future research is to analyze sanctions implemented every year not only in quantitative measures, but also in qualitative. The effectiveness of the sanctions imposed does not depend on their quantity but on their quality. One sanction imposed may be more effective than a large number of other sanctions of lower quality imposed.

The following specific research hypotheses were adopted:

1. Sanctions adopted on Russia since 2014 and since 2022 have a direct negative impact on Russian trade (imports and exports in value) with the EU countries and the US.

2. Sanctions adopted against Russia since 2014 and 2022 have a direct negative impact on its trade (imports and exports in value) with the trade partners that have a neutral position concerning the war.

The research methodology was based on literature research and a linear regression model with two variables: dependent and independent.

2. The substance and scope of Western sanctions against Russia 2014-2023

When in 2014 Russia occupied Crimea and invaded the East of Ukraine, the West adopted sanctions against Russia – however, the overall response to the aggressor state was weak and indecisive. On 24 February 2022, Russia started its full-scale invasion of Ukraine which mobilized the whole Western world to condemn Russian aggression, help Ukraine militarily and humanitarianly and adopt many more sanctions against Russia, making Russia by far the most sanctioned country in the world. Russian response was to create a list of countries unfriendly to Russia which included: all the EU countries, the USA, Canada, Japan, Australia, New Zealand, several other European states and Micronesia.

The sanctions are designed to weaken Russia's economic base, i.e. depriving the country of access to critical technologies and markets and significantly reducing its war-making capabilities. They cover the period from 2014 to the present and include:

- The illegal annexation of Crimea.
- Russia's aggressive war against Ukraine.
- The unlawful annexation of the Ukrainian regions of Donetsk, Luhansk, Zaporizhia and Kherson (Przegląd Prawa Międzynarodowego, 2014).

The sanctions consist of targeted individual sanctions, economic sanctions and visa sanctions. The economic sanctions are intended to result in severe economic consequences for Russia in the face of its actions and effectively inhibit its further aggression. Individual sanctions target individuals who support, finance or carry out activities that undermine the territorial integrity, sovereignty and independence of Ukraine or benefit from such activities. Western sanctions for actions that undermine or threaten Ukraine's territorial integrity, sovereignty and independence currently apply to almost 1,800 individuals and entities. In June 2023, the EU covered a further 71 individuals and 33 entities. Sanctions against specific individuals consist of entry bans and asset freezes. In practice, this means: EUR 21.5 billion of frozen assets in the EU and EUR 300 billion of Central Bank of Russia assets blocked in the EU and G7 countries (Mulder, 2022).

As part of the economic sanctions, Western countries have imposed a number of import and export restrictions on Russia. European entities

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cannot sell certain products to Russia (export restrictions) and Russian entities cannot sell certain products to the EU (import restrictions). The list of banned products has been drawn up in such a way as to maximise the negative impact of sanctions on the Russian economy, while limiting the undesirable effects on EU companies and citizens. With the Russian population in mind, products intended primarily for consumption as well as medical, pharmaceutical and agri-food products were excluded from the export and import restrictions. According to the European Commission, as of February 2022 The EU has banned EUR 43.9 bn worth of exports to Russia and EUR 91.2 bn worth of imports to the EU. This means that, compared to 2021, 49% of exports and 58% of imports are now sanctioned.

The EU, in cooperation with other like-minded partners, also adopted a declaration reserving the right to discontinue the application of the World Trade Organisation (WTO) Most Favoured Nation (MFN) clause to Russia. It decided that instead of increasing import duties, it would adopt a set of sanctions that would include a ban on the import or export of certain goods. The EU and its partners have also suspended all work related to Belarus' accession to the WTO.

A detailed list of export and import sanctioned goods and services is included in Tables 1, 2 and 3.

No.	Export commodity groups
1	state-of-the-art technology (e.g. quantum computers, advanced semiconductors,
	electronic components and software)
2	certain types of machinery and transport equipment
3	specific goods and technology needed for oil refining
4	equipment, technology and services used in the energy industry
5	aerospace goods and technology (e.g. aircraft, aircraft engines, spare parts and
	equipment for aircraft and helicopters, jet fuel)
6	maritime navigation equipment and radio communication technology
7	a range of dual-use products (which can serve both civilian and military purposes),
	such as drones and drone software and encryption devices
8	luxury goods (e.g. cars, watches, jewellery)
9	firearms for civilian use, their parts and other military equipment
10	other goods with the potential to increase Russia's industrial potential

Tabele 1. List of goods prohibited from export to Russia

Source: Own work based on: Załączniki XVII, XXI, XXII rozporządzenia Rady (UE) nr 833/2014, dotyczącego środków ograniczających w związku z działaniami Rosji destabilizującymi sytuację na Ukrainie, Dz.U.UE.L.2014.229.1.

Załącznik VI rozporządzenia Rady (UE) 2023/427 z dnia 25 lutego 2023 r. w sprawie zmiany rozporządzenia (UE) nr 833/2014 dotyczącego środków ograniczających w związku z działaniami Rosji destabilizującymi sytuację na Ukrainie, Dz.U.UE.L.2023.59I.6.

Table 2. List of goods prohibited from import from Russia

No.	Import commodity groups
1	crude oil (from December 2022) and refined petroleum products (from February
	2023), with limited exceptions
2	coal and other solid fossil fuels
3	steel, iron and steel products
4	gold, including jewellery
5	cement, asphalt, wood, paper, synthetic rubber and plastic
6	seafood and alcohol (e.g. caviar, vodka)
7	cigarettes and cosmetics

Source: Own work based on: Załączniki XVII, XXI, XXII rozporządzenia Rady (UE) nr 833/2014 dotyczącego środków ograniczających w związku z działaniami Rosji destabilizującymi sytuację na Ukrainie, Dz.U.UE.L.2014.229.1.

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Table 3. List of services prohibited from being provided to Russia

No.	Type of service
1	accounting
2	audit
3	statutory and accounting research
4	tax consultancy
5	business consulting
6	management consulting
7	public relations
8	lobbying
9	IT and legal advice
10	architectural and engineering
11	advertising and market and opinion polls

Source: Own work based on: Załączniki XVII, XXI, XXII rozporządzenia Rady (UE) nr 833/2014 dotyczącego środków ograniczających w związku z działaniami Rosji destabilizującymi sytuację na Ukrainie, Dz.U.UE.L.2014.229.1.

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In order to hit the Russian economy, which depends heavily on imported services from European companies, the EU has banned the provision of certain business-related services to Russian authorities or legal persons (such as companies and other entities or bodies based in Russia).

As of 4 June 2022, the provision – directly or indirectly – of accounting, auditing (including statutory audits) and bookkeeping services, tax, business and management advice and public relations services is prohibited. Lobbying services may be public relations services, and are therefore also subject to the prohibition. To increase the pressure on Russia's industrial capacity, in October

2022 the EU decided to expand the range of services that cannot be provided to the country. It banned IT and legal consultancy and architectural and engineering services. In December 2022, a ban on the provision of advertising and market and opinion research services and product testing and technical inspection services by EU entities came into force. Western sanctions must be complied with by EU-based entities, including subsidiaries of companies based in Russia. In June 2022, the Council adopted a sixth package of sanctions: it banned, among other things, the purchase, import or transfer of oil transported by sea and certain petroleum products from Russia to the EU. The ban is effective from 5 December 2022 for crude oil and from 5 February 2023 for refined petroleum products. Since most of Russian oil enters the EU by sea, sanctions cover almost 90% of Russian oil imports to Europe from the end of 2022 (Rozporządzenie Rady UE, 2014; Rozporządzenia Rady UE, 2023).

Russian and Belarusian road hauliers are not allowed to enter the EU. even if they only carry goods in transit. This is expected to limit the Russian industry's ability to procure key commodities and hinder trade using road transport from and to Russia. In February 2022 the EU banned all Russian carriers from accessing EU airports and flying through EU airspace. This means that aircraft registered in Russia or elsewhere but leased or rented by a Russian national or Russian entity cannot land at any EU airport or fly over EU countries. The ban also applies to private aircraft, such as business jets. The EU has also banned exports to Russia of goods and technology used in the aerospace industry. It is also prohibited to provide insurance and maintenance services and technical assistance related to these goods and technologies. The US, Canada and the UK have introduced similar restrictions. This means that Russian airlines cannot buy aircraft, spare parts or equipment for their fleet. They are also not allowed to carry out necessary repairs or technical inspections. As three-quarters of Russia's current commercial fleet was manufactured in the EU, US or Canada, over time the ban is likely to ground a significant proportion of Russia's civil aviation fleet, even domestic flights. The EU has closed its ports to the entire Russian merchant fleet of more than 2,800 ships. The ban will also apply to vessels that attempt to evade sanctions and, to this end, change their Russian flag or registration to the flag or registration of another country or tranship 'side-by-side'. Port authorities can detect an attempted change of flag or registration by checking the IMO number of the ship in question (a unique number that identifies the ship, assigned on behalf of the International Maritime Organization). The EU has banned the maritime transport of Russian oil (from 5 December 2022) and oil products (from 5 February 2023) to third countries. It also prohibited the provision of related technical assistance, brokering services, financing or financial assistance (Rozporządzenie Rady UE, 2014; Rozporządzenia Rady UE, 2023).

The banking system in Russia was also sanctioned. The exclusion of banks from the SWIFT system means that ten Russian banks and four Belarusian banks cannot make or receive payments using the system. As a result, sanctioned banks are not allowed to acquire foreign currencies (as their transfer between two banks is generally a foreign transfer involving a foreign intermediary bank) or transfer assets abroad. This has negative consequences for the Russian and Belarusian economies.

The European Union has banned all transactions with the Central Bank of Russia involving the management of the bank's reserves and assets. As a result of the asset freeze, the central bank no longer has access to assets held at central banks and private institutions in the EU. In December 2022, the EU added the Russian Regional Development Bank to the list of entities owned or controlled by the Russian state subject to a total transaction ban (Rozporządzenie Rady UE, 2014; Rozporządzenia Rady UE, 2023).

Sanctions are more effective the more international partners participate in them. The EU works closely with like-minded partners such as the US, in coordinating sanctions. The EU works with the World Bank Group, the European Bank

for Reconstruction and Development (EBRD), the Organisation for Economic Co-operation and Development (OECD), and other international partners to prevent Russia from obtaining funding from them. In order to coordinate international action, the EU is cooperating in the implementation of sanctions in the newly created Task Force on Russian elites, proxies and oligarchs (REPO) with the G7 countries France, Japan, Canada, Germany, the US, the UK and Italy – as well as Australia. Although the EU works closely with many partners, each non-EU country decides for itself on the sanctions to be imposed.

3. Assessment of the state of the Russian economy in the light of Western sanctions

The sanctions do not block the export of agri-food products or transactions related to these products. Western sanctions do not affect food security. They only concern bilateral trade between the EU and Russia, not international trade. Food supplies and fertilisers are explicitly excluded from EU sanctions: food exports from Russia to world markets are not subject to restrictions. Activities involving food and fertilisers from Russia are permitted, as are their acquisition, transport and delivery. Restrictions on imports of certain potash fertilisers due to EU sanctions only apply to products imported into the EU. They do not cover exports of these fertilisers to Ukraine from the EU or from Russia.

As part of the sanctions, the Union has also provided for derogations: despite the closure of European airspace to Russian aircraft, Member States

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may allow them to fly over if this is done for humanitarian purposes. Member States may also allow Russian-flagged vessels to call at an EU port and Russian road hauliers to enter the EU, as long as the purpose is to import or transport agricultural products, including fertilisers and wheat, which are not subject to restrictions.

Russia's macroeconomic performance in 2022 turned out to be much better than forecast a year ago - in the first weeks after the invasion of Ukraine. The first months of 2022, when Russian companies generated strong profits, had no small impact on the results achieved. Over the past year, both Russian business and society there have shown considerable adaptability, making it much easier to stabilise the economic situation in the country. Growing repression and the threat of loss of assets by those outside the Kremlin's immediate circle meant that Russian business not only did not protest against the war and the losses incurred, but also actively joined the process of 'technological transformation' (as the head of the Central Bank of Russia (CBR) calls the country's progressive technological regression) and adaptation to the new conditions. The past year has led to an increase in the state's presence in the economy and a strengthening of the economic model that has been in place so far: state capitalism with all its pathologies, such as corruption, the consolidation of assets in the hands of the president's entourage and a biased judicial system. According to Rosstat's (Rosstat, 2023) preliminary estimates, Russia's GDP in 2022 declined by 2.1% (prior to the invasion, growth of 3% was forecast) ((Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022). However, in the first weeks of the aggression, on a wave of massive sanctions imposed by the West, it was expected that the Russian economy could shrink by up to a dozen per cent. Despite many doubts about the quality of the statistics presented by the authorities there, it must be acknowledged that Russia has managed to avoid deep declines, influenced by a number of factors. For example, the Kremlin managed to limit the negative consequences (devaluation of the rouble and inflation) of the financial sanctions imposed in the first days after the invasion.



Figure 1. Russia's GDP dynamics 2020-2022 Source: Own compilation based on: Global Stability Report IMF 2020-2023

This was made possible by very high revenues from energy exports (restrictions on Russian exports were implemented with a delay of several months) and the actions of the CBR which, among other things, reduced the convertibility of the rouble. In turn, thanks to accumulated stocks and cooperation with intermediaries from countries that did not join the sanctions, Russian companies have been able to maintain production despite corporate boycotts, import cut-offs and disrupted logistics chains. As a result, Russia's plunge into the crisis has been gradual (with the most difficult situation occurring in late 2022 and early 2023), but it has been prolonged. Most forecasts assume a decline in Russian GDP this year as well, including the World Bank at 3 per cent, although there are also positive predictions, e.g. the IMF predicts 0.3 per cent growth – see Figure 1.

An important factor in slowing down the rate of GDP decline was the strong performance of agriculture and construction. In 2022, the value of agricultural production increased by more than 10%. 154 million tonnes of cereals were harvested from the fields, 27% more than a year earlier (of which wheat 104 million tonnes – an increase of 37% y-o-y). The fertility and limited export of the previous agricultural season's harvest (1 July 2021 – 30 June 2022), in which 38 million tonnes of cereals were exported abroad (11 million tonnes less than the previous year), resulted in an oversupply on the internal market and price falls (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022).
Good results were also reported in the construction industry, although the figures are questionable. Last year, the value of work in this sector officially increased 5%. Government by support programmes, e.g. preferential mortgages, renovation of old residential houses, contributed strongly to this result. Almost 8 per cent of all construction work was financed with state funds. The significant (by around 5% of GDP) increase in budget expenditure also had a significant impact on sustaining production in Russia in 2022. The necessary adaptation to the new economic conditions, including the change of suppliers and commodities, technological regression or the creation of new logistics chains, contributed to the fact that, despite the ongoing economic crisis, Russian state-supported business increased investments - see Figure 2. In the first nine months of last year (no data available for the fourth guarter), they increased by almost 6% y-o-y. For example, Gazprom's capital expenditure rose by 100% y-o-y in 2022 (to over USD 30 billion) (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022), driven by the need to expand its export potential in the eastern direction (expansion of the Siberian Power pipeline leading to China and further development of the fields feeding it) and gasification of the country.



Figure 2. Investment in Russia's economy in 2021-2022 Source: Own compilation based on: Global Stability Report IMF 2020-2023

Reduced demand and the actions of the Russian authorities (including raising interest rates and strengthening the rouble) have contributed to a slowdown in inflation. At the end of the year, it had reached just under 12% – see Figure 3.

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Jacek Pera
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Source: Own compilation based on: Global Stability Report IMF 2020-2023

The situation in individual industries – see Figure 4 – varied widely. Industrial production for the year as a whole officially declined by only around 0.5% y-o-y, mainly due to a very strong performance in the first few months of the year, as well as state orders related to the handling of the war (this includes industries such as machinery, textiles and food). The upstream sector, mainly due to the postponement of the EU embargo on Russian oil imports at the end of the year, recorded a slight increase (oil sector output increased by 2% y-o-y). Already in February this year, however, the government announced a 'voluntary' reduction in its production of this crude by 0.5 million barrels per day, i.e. by almost 5%, in response to the difficulty of finding importers of Russian petroleum products in particular. The situation also varied strongly between the different regions of Russia. Lower industrial production in 2022 was notably recorded by those dependent on the automotive sector, i.e. Kaluga (by 20%) and Kaliningrad regions (by 18%), and the timber industry, e.g. Karelia (by 9%). On the other hand, regions related to the arms sector, such as Bryansk Oblast (up 18%), the energy sector, i.e. the Nenets Autonomous Okrug (up 12%), or both sectors at the same time, such as Tatarstan (up 6%), recorded growth (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022).



Figure 4. Industrial production in Russia in 2022 Source: Own compilation based on: Global Stability Report IMF 2020-2023

The high prices of natural resources on world markets and the continued significant level of their supply abroad, especially in the first half of last year, allowed Russia to obtain significant revenue, even though imports were restricted due to sanctions. Available data from the Central Bank of Russia shows that the Russian Federation's receipts from exports of goods and services in 2022 (as of spring 2022 the CBR only publishes aggregated balance of payments data) – see Figure 5, amounted to more than USD 628 billion, 14% more than the year before. The value of imports, on the other hand, shrank by 9% to USD 346 billion (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022).



and services in 2022 in USD billion Source: Own compilation based on: Global Stability Report IMF 2020-2023

Since the middle of the year, with the entry into force of sanctions on Russian exports (metals, timber, coal, oil), supplies abroad have gradually decreased. At the same time, thanks to intensified relations with non-Western countries, mainly with China, local imports were recovering. However, it is not known to what extent this was associated with an increase in the price of imported goods.

Mirroring data from Russia's most important trading partners, it appears that China (a 12% y-o-y increase in exports) and Turkey (an 80% increase) will see the largest increases in supplies of goods to the Russian Federation in 2022. At the same time, Western countries were reducing their exports to the Russian Federation: the European Union reduced its exports by more than 35% (figures for the first 11 months of 2022), the USA by 70% and the United Kingdom by 80% (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022).

The value of Russian sales abroad increased primarily to China (by 45%), Turkey (by 120%) and India (by 400%, mainly crude oil was exported). Exports to the EU also increased (by 35%, as a result of high energy commodity prices, especially in the first half of the year), while decreases were recorded by the USA (by 50%) and the United Kingdom (by 60%).

As a result, Russia achieved a record current account surplus in 2022, i.e. USD 227.5 billion (see Figure 6), noting that it was declining dynamically towards the end of the year. In December, it amounted to a mere USD 1.7 billion (while as recently as November it stood at over USD 10 billion). In turn, it increased again in January 2023 – to USD 8 billion.

It is unclear whether this was due to the maintenance of export earnings or the traditional decline in imports in the first months of the year (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022).



Figure 6. Russia's current account in 2022 in USD billion Source: Own compilation based on: Global Stability Report IMF 2020-2023

Data published by the Ministry of Finance of the Russian Federation shows that, despite a fall in the price of Russian exports in the second half of 2022, budget revenues for the year as a whole turned out to be RUB 2.5 trillion (i.e. 10%) higher than in 2021 (see Figure 7). This was largely made possible by the increased burden imposed on Gazprom. The corporation turned out to be the largest contributor to the state coffers, as it paid a total of more than RUB 5 trillion (almost USD 73 billion) to the federal and regional budgets, including RUB 1.2 trillion in additional one-off mining tax (paid in three equal tranches). In addition, in the autumn it also paid the dividend for the first half of 2022 in advance (it had previously paid it once a year), which injected a further RUB 600 billion into the budget. As a result, payments from Gazprom have replaced declining regular revenues from the oil and gas sector. The Kremlin has also increased taxation on the oil, coal, metallurgy and mineral fertiliser sectors. A blow to the Russian budget was the introduction (5 December) of an EU embargo on crude oil and the implementation of a price cap on its supply by sea to non-Western countries. In parallel, the Kremlin has been dynamically increasing budget spending. In 2022, they increased by 25% compared to the previous year, with expenditure on national defence expected to increase by at least 30% (as of spring 2022, the government does not publish itemised expenditure data). Funds were spent unevenly, with December accounting for more than 20% of total expenditure.



Source: Own compilation based on: Global Stability Report IMF 2020-2023

In 2022, the Russian currency strengthened. The average dollar exchange rate was 68.5 roubles, compared to 73.7 roubles a year earlier (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022) – see Figure 8.



Figure 8. Average monthly dollar exchange rate in roubles Source: Own compilation based on: Global Stability Report IMF 2020-2023

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In 2022, Russia saw record capital outflows, reaching more than USD 250 billion (see Figure 9). This was largely driven by individuals transferring their savings out of the country. The total deposits of Russians in foreign banks more than doubled to around USD 82 billion. Russian entities, mainly businesses, were also reducing their foreign liabilities. In the whole of last year, debt decreased by USD 100 billion (Global Stability Report IMF 2020-2023; Wiśniewska, 2023 A; Sułek, 2014/2015; World Economic Outlook 2022).







Figure 10. Net capital outflows from Russia in USD billion Source: Own compilation based on: Global Stability Report IMF 2020-2023

4. Impact of sanctions adopted on Russia: empirical approach *4.1. Empirical assumptions*

The study period adopted in the analysis covers the years: 2014-2022. It includes the annexation of Crimea and the ongoing war in Ukraine. It covers an essential part of the sanctions that have been imposed by the countries of the European Union and the US, Canada, Japan, Australia, New Zealand and Micronesia in the area and dimension of bilateral trade.

The empirical part is based on a linear regression model. The classical linear regression model is a very useful tool for analyzing empirical data. Regression analysis deals with the description of the relationship between a selected variable (called the dependent or explanatory variable) and one or more variables called independent variables or explanatory variables. A linear regression model with two variables, dependent and independent, was adopted as the primary research method. Linear regression analysis aims to calculate such regression coefficients (coefficients in a linear model) that the model best predicts the value of the dependent variable, so that the estimation error is as small as possible. Thus, regression analysis "fits" such a straight line to the subjects (linear relationship), so that how the model is the best possible (with the lowest possible random error). Linear regression is the simplest variant of regression. It assumes that the relationship between the explanatory and explanatory variables is a linear relationship. As in correlation analysis, if one value increases then the other increases (positive correlation) or decreases (negative correlation). In linear regression, it is assumed that an increase in one variable (predictor, predictors) is accompanied by an increase or decrease on the other variable.

The significance of the dependency will be measured by a p-value considering the option of three acceptable thresholds: in which 0.01 or less, 0.05 or less and 0.1 and less p-value means a relation significancy. R squared determines the proportion to which the dependent variable can be explained by independent variable (numbers of sanctions). A fitted regression line or curve represents the estimated expected value of a variable y with specific values of another variable or variables x. Regression in general is the problem of estimating conditional expected value. Linear regression is called linear because the assumed model of the relationship between the dependent and independent variables is a linear (affine) transformation with respect to the parameters, represented in the multivariate case by a matrix.

The y variable is traditionally called the explanatory or dependent variable. The x variables are called explanatory or independent variables. Both explanatory and explanatory variables can be scalar quantities or vectors. The linear regression model assumes that there is a linear (affine) relationship between the dependent variable y and the vector $p \ge 1$ of the regressors x.

$$y_i = \beta_0 + \beta_1 X + \epsilon$$
 [1]

where:

- Y is the dependent variable (also called the explanatory variable) whose values we want to explain,
- X is the independent variable (aka the explanatory variable) is also called the predictor, this variable is not degenerate to a constant,
- \in is a random error (or disturbance, noise), the only source of randomness, β_0 is the free expression which is the point of intersection of the line
- $y_i = \beta_0 + \beta_1 X + \epsilon$ with the axis of ordinates,
- β_1 is the directional coefficient, i.e. the tangent of the angle at which the line $y_i = \beta_0 + \beta_1 X + \epsilon$ is inclined to the abscissa axis (Kostrzewski, 2020).

The research calculations are based on two main steps: 1) Conducting tables that consist of three columns: time limit of the research (2014-2022); the independent variable (number of sanctions established); the dependent variable which differs depending on the assumption. 2) Running a regression analysis in the MS Excel program to establish the character of the relations between the dependent and independent variables.

The scope of the research includes: sanction vs. import from Germany to Russia, sanction vs. export from Russia to Germany, sanction vs. import from the US to Russia, sanction vs. export from Russia to the US, sanction vs. import from France to Russia, sanction vs. export from Russia to France, sanction vs. export from Russia to Italy, sanction vs. export to the Netherlands from Russia, sanction vs. import from China to Russia, sanction vs. export from Russia to China, sanction vs. import from Turkey to Russia, sanction vs. export from Russia to Turkey, sanction vs. import from Kazakhstan to Russia, sanction vs. export to India from Russia, sanction vs. export to North Korea from Russia, sanction vs. import to Russia from North Korea, sanction vs. export to Australia from Russia, sanction vs. import to Russia from Australia, sanction vs. export to Japan from Russia, sanction vs. import to Russia from Japan, sanction vs. export to Canada from Russia, sanction vs. import to Russia from Canada, sanction vs. export to New Zealand from Russia, sanction vs. import to Russia from New Zealand.

4.2. Discussion and conclusions

Research calculations are based on two main steps:

1) Conducting tables that consist of three columns: time limit of the research; the independent variable (number of sanctions

established); dependent variable which differs depending on the assumption.

2) Running a regression analysis to establish the character of the relations between dependent and independent variables.

1-15. This relation lacks significancy as the p-value is much lower than 0.01; 0.05; 0.1. While Russian exports to and imports from Australia decreased significantly since 2016. This relation is statistically significant because the p-value is much lower than all three thresholds: 0.01; 0.05; 0.1. Negative coefficient means that as the independent variable increases (number of sanctions), the dependent variable decreases.

2-16. This relation lacks significancy as the p-value is much lower than 0.01; 0.05; 0.1. While Russian exports to and imports from Canada decreased significantly since 2015. This relation is statistically significant because the p-value is much lower than all three thresholds: 0.01; 0.05; 0.1. Negative coefficient means that as the independent variable increases (number of sanctions), the dependent variable decreases.

3-17. This relation is statistically significant as the p-value is lower than 0.1, only a little bit higher than 0.05; however, much higher than 0.01. The coefficient is high and positive which means that the higher the sanctions adopted on Russia, the more Russia imports from China.

This relation is statistically significant because the p-value is much lower than 0.01; 0.05; 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (export from Russia) also increases. R-squared equals 72%, which means that in the proportion of 72%, export from Russia to China can be explained by the sanctions adopted on Russia. Russan exports to China grew significantly as well as its imports from China.

4-18. This relation is statistically significant because the p-value is much lower than 0.05 and 0.1. It's higher than the 0.01 threshold, though. Negative coefficient means that as the independent variable increases (number of sanctions), the dependent variable (import to Russia), decreases. R-squared equals 49%, which means that in the proportion of 49%, imports from France can be explained by the sanctions adopted on Russia. Russian imports from France were decreasing since 2014, coming closer to the 2013 level of imports only in 2021, after which falling dramatically by 72%.

5-19. This relation lacks significancy for two thresholds: the p-value is much higher than 0.01; 0.05. However, it fits almost perfectly into the p-value of 0.1. Import from Germany decreased significantly from 2014 to 2016; however, it was on a steady rise since 2017. It significantly decreased again in 2022 after a new bigger wave of sanctions. Below is presented the table with the same trading partner, with the only difference that now Russian exports to Germany are measured. This relation lacks

significancy as the p-value is much higher than 0.01; 0.05; 0.1. Russian exports to Germany are highly inconsistent to the relation of sanctions adopted against Russia. It decreased a little from 2014 to 2015 and more from 2015 to 2016 however, Russian exports to Germany started rising again even to the levels before the first wave of sanctions in 2014, peaking in 2022. This can be explained by the German dependency on Russian gas and oil, the products which EU restricted at the end of the year 2022, beginning of 2023. It's expected that Russian exports to Germany in 2023 will be much lower.

 Tabela 4. Sanction vs. export/import Russia to countries in the period

 2014-2022. Results of theregression model

No.	Variable	p-value	Explanatory	Explanatory	R-	No.	Variable	p-value	Explanatory	Explanatory	R-
	explained		variable	variable	squared		explained		variable	variable	squared
	Export						Import				
1	Australia	0.013933	-0.310014	0.184166	0.18416	15	Australia	0.000660	-0.010024	0.351176	0.35117
2	Canada	0.001753	-0.210004	0.151111	0.15111	16	Canada	0.012263	-0.500031	0.171177	0.17117
3	China	0.051608	2.078122	0.395061	0.39506	17	China	0.001961	6.037302	0.718214	0.71821
4	France	0.000000	0.000000	0.000000	0.00000	18	France	0.023963	-0.510054	0.491177	0.4911
5	Germany	0.334563	0.397598	0.116440	0.11644	19	Germany	0.105625	-0.897153	0.293690	0.29369
6	India	4.869463	2.736560	0.988461	0.98846	20	India	0.024100	0.214050	0.392322	0.39232
7	Italy	0.173740	0.905752	0.217954	0.21795	21	Italy	0.000000	0.000000	0.000000	0.00000
8	Japan	0.101111	-0.225113	0.102591	0.10259	22	Japan	0.003311	-0.596121	0.191380	0.19138
9	Kazakhstan	4.768251	3.233393	0.911231	0.91123	23	Kazakhstan	0.025102	0.264858	0.485740	0.48574
10	Netherlands	0.192977	-1.784674	0.201636	0.20163	24	Netherlands	0.000000	0.000000	0.000000	0.00000
11	N. Zealand	0.001000	-0.086111	0.701102	0.70110	25	N. Zealand	0.000101	-0.056111	0.501100	0.50110
12	N. Korea	3.564423	2.535550	0.951362	0.95136	26	N. Korea	0.001111	4.035201	0.904215	0.90421
13	Turkey	5.719276	3.264394	0.932838	0.93283	27	Turkey	0.042560	0.347573	0.420469	0.42046
14	USA	0.000000	0.000000	0.000000	0.00000	28	USA	0.002505	-0.997231	0.701102	0.70110

Source: Own compilation based on: data from the American State Department (2021) and TradeMap (2023)

6-20. This relation is statistically significant because the p-value is much lower than 0.01; 0.05; 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (exports to Russia) also increases. R-squared equals 99%, which means that in the proportion of 99%, export from India to Russia can be explained by the sanctions adopted on Russia. Russian export to India increased by 78% in 2022 over 2021. This relation is statistically significant because the p-value is lower than 0.05 and 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (imports to Russia) also increases. R-squared equals 39%, which means that in the proportion of 39%, imports from India can be explained by the sanctions.

7-21. This relation lacks significancy as the p-value is much higher than 0.01; 0.05; 0.1. Russian exports to Italy were inconsistent, rising to levels higher in value than before the first wave of sanctions in 2014.

8-22. This relation lacks significancy as the p-value is much lower than 0.01; 0.05; 0.1. While Russian exports to and imports from Japan decreased significantly since 2018. This relation is statistically significant because

the p-value is much lower than all three thresholds: 0.01; 0.05; 0.1. Negative coefficient means that as the independent variable increases (number of sanctions), the dependent variable decreases.

9-23. This relation is statistically significant because the p-value is lower than 0.05 and 0.1. It's higher than 0.01, though. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (imports to Russia) also increases. R-squared equals 49%, which means that in the proportion of 49% imports from Kazakhstan to Turkey can be explained by the sanctions adopted on Russia. This relation is statistically significant because the p-value is much lower than 0.01; 0.05; 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (export from Russia) also increases. R-squared equals 91%, which means that in the proportion of 91% exports from Russia to China can be explained by the sanctions adopted on Russia. Russan exports to China grew significantly as well as its imports from China.

10-24. This relation lacks significancy as the p-value is much higher than 0.01; 0.05; 0.1. While Russian exports to Netherlands decreased significantly since 2014, there's been high growth in trade observed between the countries between 2014 and 2022.

11-25. This relation lacks significancy as the p-value is much lower than 0.01; 0.05; 0.1. While Russian exports to and imports from New Zealand decreased significantly since 2017. This relation is statistically significant because the p-value is much lower than all three thresholds: 0.01; 0.05; 0.1. Negative coefficient means that as the independent variable increases (number of sanctions), the dependent variable decreases.

12-26. This relation is statistically significant because the p-value is much lower than 0.01; 0.05; 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (exports to Russia) also increases. R-squared equals 95%, which means that in the proportion of 95% exports from North Korea to Russia can be explained by the sanctions adopted on Russia. Russian exports to North Korea increased by 70% in 2022 over 2021. This relation is statistically significant because the p-value is lower than 0.05 and 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (imports to Russia) also increases. R-squared equals 90%, which means that in the proportion of 90% imports from North Korea can be explained by the sanctions.

13-27. This relation is statistically significant because the p-value is lower than 0.05 and 0.1. It's higher than 0.01, though. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (imports to Russia) also increases. R-squared equals 42%, which means that in the proportion of 42% imports from Turkey

to Russia can be explained by the sanctions adopted on Russia. Russia significantly increased its imports from Turkey. This relation is statistically significant because the p-value is significantly lower than 0.01; 0.05; 0.1. Positive coefficient means that as the independent variable increases (number of sanctions), the dependent variable (imports to Russia) also increases. R-squared equals 93%, which means that in the proportion of 93% export from Russia to Turkey can be explained by the sanctions adopted on Russia.

14-28. This relation is statistically significant because the p-value is much lower than all three thresholds: 0.01; 0.05; 0.1. Negative coefficient means that as the independent variable increases (number of sanctions), the dependent variable (import to Russia), decreases. R-squared equals 70%, which means that in the proportion of 70% imports from the USA can be explained by the sanctions adopted on Russia. US exports to Russia fell significantly after implementing sanctions in 2014. There was a steady increase in exports to Russia from 2015; however, there was much less import value than before 2014. The peak of the post 2014 increase in trade was in 2021, after which American exports to Russia fell by 90% in 2022.

Summary

The adopted research hypothesis: the impact of Western sanctions imposed on Russia caused by the war in Ukraine remains low – was positively verified. This is evidenced by the following research findings:

- There are no statistically significant relations between sanctions adopted against the Russian Federation since 2014 and Russian GDP. For this analysis a nominal GDP was chosen which might be misleading, however - the analysis of the real GDP, adjusted to inflation, showed 2.07% of a decline in 2022 compared to the year 2021. It is a much lower GDP decline than Russia had because of the covid pandemic or because of the large-scale economic crisis. It is a much lower decline than scholars and economists forecasted and predicted in the spring of 2022.
- 2. Sanctions adopted against Russia since 2014 had a direct impact on Russian import from the EU countries and the USA. There is also a negative correlation: the more sanctions imposed on Russia by the Western countries, the less imports in value Russia receives from these countries. The situation is different for Russian export to the same countries. This relation was not found statistically significant due to the inconsistencies of trade and dependency of European countries on Russian oil and gas.
- 3. Sanctions adopted against Russia since 2014 have had a direct impact on Russian trade (import and export in value) with the main trade partners that have maintained a neutral position concerning the war.

There is a statistical significance in all six measured outcomes both in Russian export and import with friendly countries. As the EU and other Western countries are breaking ties with the Russian Federation due to its full-scale invasion of Ukraine, trade volume with the main trade partners non-aligned with Ukraine and friendly to Russia only increases. Among these countries are China, Turkey, India, Kazakhstan, North Korea and Belarus. (Russia expanded the trade both in imports and exports with its main non-Western trade partners).

4. Economic sanctions do not have a huge impact on Russia in the short run. At least it is not the impact expected by many public figures and politicians. Most scholars agree that expectations from the impact of sanctions on the Russian economy were much higher in the spring of 2022.

A recommendation for future research is to analyze sanctions implemented every year not only in quantitative measures, but also in qualitative. One sanction implemented against an especially important individual or entity can be more influential and decisive than 15 sanctions adopted against other entities and individuals.

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ARTICLES

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A STUDY OF MACROECONOMIC VARIABLES THAT EFFECTED EMPLOYMENT IN THE UNITED STATES FROM 1948 TO 2021

Abstract

The paper provides an analysis of important U.S. macroeconomic variables that effect aggregate employment. The paper seeks to answer the question "What are the determinants of changes in aggregate employment in the United States of America (U.S.)?" This is an important research topic because significant increases in unemployment can have a profound effect on an entire society, not just on its unemployed workers. When employment declines, public health declines, crime increases, suicides increase, and public revenues decrease.

This paper uses quarterly data from 1948-2021 to estimate the effect of important macroeconomic variables on aggregate employment. The macroeconomic variables include personal consumption expenditures, U.S. federal government expenditures, nominal GNP, international trade (imports plus exports), M3 money stock, the minimum wage level, non-residential fixed investment, non-manufacturing employment, and U.S. federal tax receipts.

Keywords: Expected Demand, Employment, Consumption, Money Supply, Trade.

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JEL Codes: D840, E200, E290, E510, F470, J230

1. Introduction

The paper analyzes available data series on variables such as: consumption, government spending, GNP, and international trade. The objective of the paper is to decide which data series are the best proxy for each variable. For example, the paper concludes that the personal consumption expenditures data series is the best proxy for the consumption variable.

The study of employment is an old issue in economics. Different schools of economics (e.g., Keynesian and Neoclassical) are based on economists' analysis of the causes of employment and unemployment. The classical theory of employment was developed by Smith (1776), Ricardo (1817), Say (1834), Mill (1848); and Pigou (1933). Their theories postulate that if market forces are allowed to operate in an economic system, they will eliminate overproduction and make the economy produce output at the level of full employment. Say is famous for the development of Say's Law, which states that the production of a product creates demand for a different product.

More modern theories of employment include the neoclassical theory of employment (Vercherand, 2014), and Keynesian theory as described in "The General Theory of Employment, Interest, and Money." (Keynes, 1936)

Neoclassical economists argue that employment policy should attempt to achieve greater labor market flexibility and wage flexibility so that perfect competition can be achieved. According to neoclassical economists, perfect competition will lead to the solution to the problem of unemployment. (See Bentolia and Saint-Paul, 1992; and Emerson, 1988)

The central belief of Keynesian economics is that government intervention should be used to stabilize the economy during booms and busts in economic activity. Jahan *et. al.* (2014) has explained that Keynesian theory is based on three principles. These three principles are: (1) aggregate demand is influenced by public and private economic decisions; (2) prices and wages respond slowly to changes in aggregate demand; and (3) changes in aggregate demand have their greatest short-run effect on real output and employment, not on prices.

2. Theory of Employment

My research hypothesis is that firms increase and decrease employment in response to changes in expected demand. This paper uses two proxies for expected demand: personal consumption expenditures (PCE) and nonresidential fixed investment (NFI). Businesses experience consumption daily and incorporate either the level of consumption (PCE) or the change in consumption from a previous period into their mathematical models. Typically, these model results indicate the level of demand in some future period and how much they should invest as measured by nonresidential fixed investment. In turn, increases in NFI will result in the hiring of additional workers.

For example, a business might purchase additional equipment, expand existing offices, or open new offices. If a firm had a risk factor of 1.00, businesses would simply adopt the model results and increase or decrease NFI. However, firms are risk averse (Shackle, 1939). Because of their risk aversion, a firm will effectively multiply their risk factor by the level of expected demand indicated by their model. This process may occur either qualitatively or quantitatively.

A simple theoretical model of the relationship between expected demand and employment is provided in Equation 1. The simple form of the relationship between expected demand and the level of aggregate employment in a future period can be expressed algebraically as:

$$E_{t+n} = E_t + k(bD_t) Eq. 1$$

where:

 E_t – is aggregate employment at time *t*.

- E_{t+n} is aggregate employment at time t + n, where n is the number of quarters between the analysis (time t) and the hiring or laying off workers. For an individual firm, the value of n is a function of the type of industry, marginal productivity of new workers, amount of training time required, competitive considerations, and other factors.
- k is a risk factor whose value ranges from 0 to 1.
- Dt is the level of expected demand for a company's goods and services at time *t*. Expected demand is composed of two variables: personal consumption expenditures and nonresidential fixed investment.
- b is the estimated coefficient of expected demand.

A variant of the method suggested by Liow *et. al.* (2006) was used to estimate the risk factor. They took the GARCH term in a GARCH (1,1) model as an estimate of the risk factor in a paper on the property stock market. My paper estimated a risk factor (k) of 0.72 using an FIGARCH (1,1) model. Regression results are given in Table A-1 of Appendix A.

The model given in Equation 1 provides a good approximation of the mean of the two series, which are the first difference of aggregate employment (EMP) and the estimated value of aggregate employment (ESTE). ESTE has a mean of 352.6206 compared to a mean of 354.4305 for EMP (a difference of approximately 0.5%).

3. Literature Review

The purpose of this literature review is to identify variables that some economists believe influence aggregate employment. The typical literature on employment focuses on a small number of variables that the researcher believes are statistically or theoretically significant. For example, Okun focuses on GNP, Keynes on effective demand, and neoclassical economists on perfect competition.

The literature review helped me to identify the following variables that some economists believe influence aggregate employment. The variables (or groups of variables) suggested by the economic literature are:

- 1. Personal Consumption Expenditures.
- 2. Government Spending.
- 3. Gross National Product (GNP).
- 4. International Trade (Imports plus Exports).
- 5. Investment.
- 6. Minimum Wage Level.
- 7. Money Supply.
- 8. Non-Manufacturing Employment.
- 9. Labor Productivity.
- 10. Taxation.
- 11. Education Level (only available annually).
- 12. Unionization (only available annually).
- 13. Inflation.

The literature review explored the three theoretical doctrines listed below. These doctrines were chosen because, taken together, they help explain much of the effect of the suggested variables on aggregate employment during the period of the study. The three doctrines are rational expectations, growth models, and labor economics.

3.1. Rational Expectations

Thomas Sargent has explained that "The theory of rational expectations was first proposed by John F. Muth of Indiana University in the early 1960s. He used the term to describe the many economic situations in which the outcome depends partly on what people expect to happen." (Sargent, 1986)

Muth's original work (Muth, 1961) was popularized by Robert Lucas in the 1970s. Lucas incorporated the idea of rational expectations into a dynamic general equilibrium model. (Lucas, 1972) Lucas has argued that expected inflation influences price-setting behavior, and therefore expected inflation becomes actual inflation. Employment is affected by a similar process: expected demand affects the behavior of employers regarding increases or decreases in employment.

If employers expect that demand for their products and services will increase in a future period, they will increase employment to ensure that they meet demand and are able to retain their existing customers. Conversely, if employers expect that demand for their products and services will decline in a future period; they may dismiss workers in order to maximize profits or to reduce expected losses.

3.2. Growth Models

Although the paper addresses the relationship between expected demand and employment, it is also useful to review the predictions of economic growth models. Okun's Law is a linear model which states that a 2% increase in output (GNP) corresponds to a 1% decline in the rate of cyclical unemployment; a 0.5% increase in labor force participation; a 0.5% increase in hours worked per employee; and a 1% increase in output per hours worked. (Okun, 1962)

In the U.S., nominal GNP and total non-farm employment are highly correlated (0.80) for the period 1948 Q1 to 2021 Q4. This paper found that the relationship between GNP and non-farm employment was similar to the relationships predicted by Okun's Law. As preliminary evidence, the paper estimated that the coefficient of a 1% change in GNP with respect to the percent change in employment was 0.50, which means that a 1% increase in nominal GNP should result in a 0.50% increase in total non-farm employment. Regression statistics are given in the Appendix to this document. (See Table A-2)

Christopoulos *et al.* (2019) found that Okun's threshold variable was endogenous and suggested a non-linear model. Guisinger *et al.* (2018) found that "indicators of more flexible labor markets (higher levels of education achievement in the population, lower rate of unionization, and a higher share of non-manufacturing employment) are important determinants of the differences in Okun's coefficient across states."

Nebot *et al.* (2019, p. 203) found that "differences between Okun coefficients below and above the threshold are consistent with the firm's 'risk aversion hypothesis,' according to which unemployment responds more strongly [to changes in GNP] during recessions than during expansions".

3.3. Labor Economics

Labor markets function via the interaction of workers and employers. Labor economics looks at the suppliers of labor services (workers) and the demanders of labor services (employers), and attempts to understand the resulting patterns of employment, wages, and income. These patterns exist because each individual in the market is presumed to make rational choices based on the information that they know regarding wages, the desire to provide labor, and the desire for leisure. Using a New Keynesian model, Gali (2013) found that wage flexibility (*e.g.,* no minimum wage) does not always improve social welfare. Gali criticized the classical theory of employment for implicitly assuming that firms view themselves as facing no demand constraints.

Labor economists have suggested four subject areas that may explain changes in aggregate employment. These subject areas are discussed below.

3.3.1. The Minimum Wage Level

The effect of increasing the minimum wage on employment is a controversial subject. Alan Manning has pointed out that "A central concern in the [employment] estimates is whether one has controlled appropriately for economic conditions affecting employment other than the minimum wage. Failure to do so effectively will lead to bias if the minimum wage is correlated with the omitted economic conditions." (Manning, 2021, p. 12)

Meer and West (2016) found a negative employment effect using long lags in aggregate employment data. Neumark *et. al.* (2014) used a synthetic control effect and found a negative employment effect. These authors used a typical synthetic control effect by comparing data between different counties in the same U.S. state.

Bailey *et. al.* (2022) studied the large rise in the minimum wage due to the 1966 amendment to the Fair Labor Standards Act. They found that the amendment increased wages and reduced aggregate employment. Giuliano L. (2013) and Hirsch B. et. al. (2015) used payroll data and found that increases in the minimum wage resulted in wage effects but did not result in significant decreases in employment.

Finally, Manning recently reviewed some of the literature on the economic effect of changes to the minimum wage. He concluded that: "A balanced view of the evidence makes it clear that existing evidence of a negative employment effect is not robust to reasonable variation in specification, even when the wage effect is robust. One has to acknowledge that the impact of the minimum wage on employment is theoretically ambiguous." (Manning, 2021)

3.3.2. Distortionary Taxation

Distortionary taxes are taxes that affect the prices of items in a market. "Harberger triangles" refers to the deadweight loss occurring in the trade of a good or service due to the market power of buyers, of sellers, or because of government intervention. The size of a deadweight loss is proportional to the size of the Harberger triangles. Greenwood and Huffman used 1948-1985 U.S. annual data and found that the Harberger triangles were associated with distortionary taxation. Major weaknesses of their analysis are (1) it did not account for the effect of the costs and benefits of government spending programs; (2) it measured government spending, not taxation;

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and (3) it incorrectly assumed that all government spending is funded by federal income taxes.

Baxter and King found that "output falls in response to higher government purchases when these are financed by general income taxes." (Baxter and King, 1993, p. 333) McGrattan (1994) studied the effects of distortionary tax policies using a dynamic recursive stochastic equilibrium model. She estimated that the welfare costs of taxation were eighty-eight cents per dollar for capital taxes, and thirteen cents per dollar for labor taxes.

3.3.3. Consumption

Mortensen and Pissarides (1994) found that an aggregate shock induces negative correlations between job creation and job destruction, whereas a dispersion shock induces positive correlations. The job-destruction process is shown to have more volatile dynamics than the job-creation process. Their work implies that firms are risk averse.

Mian and Sufi (2012) studied the decline in U.S. employment from 2007-2009. They found that the decline in aggregate demand (consumption) was driven by shocks to household balance sheets. They estimated that 65% of the employment losses were caused by the decline in aggregate demand during this period.

Evi Pappa (2009) studied the effect of fiscal shocks on employment and on the real wage using U.S. federal government and state government data. Pappa used Real Business Cycle (RBC) and New Keynesian models to evaluate the data. She found that aggregate increases in government employment raise both the real wage and total employment.

3.3.4. International Trade and Employment

Nickell S. (1984) studied manufacturing employment in the United Kingdom (U.K.) for the period 1958-1974. Nickell hypothesized that manufacturing employment is a function of industrial output, investment in plant and machinery, earnings, effective price of capital goods, output prices, real share prices, and M3 money supply.

There is substantial disagreement among economists about the effect of trade on manufacturing employment. Papers by Yang (2021) and Pierce and Schott (2016) are indicative of this disagreement. Yang used an instrumental variable approach and found that U.S. exports to different markets created more than 1.6 million manufacturing jobs between 1991 and 2007. Pierce and Schott found that the sharp drop in US manufacturing employment after 2000 was strongly affected by a change in U.S. trade policy that eliminated potential tariff increases on Chinese imports.

Acharya (2017) estimated the impact of imports on Canada's level of employment, skill structure, and wages by level of education for the period 1992-2007. Achara stated that "In particular, we decompose the effects of trade based on Canada's three major trading partners (USA, China and Mexico) to determine whether increasing trade with emerging economies has significantly altered labour market outcomes." Acharya found that imports affected only about 6,000 jobs annually.

4. Data Discrepancies

There are two general methods used by various countries to report employment data: survey results and recorded data. The U.S. Bureau of Labor Statistics (BLS) conducts a monthly survey (Current Employment Statistics) of business establishments in the U.S. The BLS has explained that: (United States Bureau of Labor Statistics 2021)

The Current Employment Statistics (CES) survey is based on a sample of 651,000 business establishments nationwide. The survey produces monthly estimates of employment, hours, and earnings for the Nation, States, and major metropolitan areas.

Because the BLS uses survey data, it does not consider administrative data such as the number of people who receive unemployment benefits. (Carey, 2021) The BLS use of survey data may cause their results to be biased, although the amount of bias is probably small due to the large number of observations in their study.

5. The Variables

The following variables were taken from the literature review consumption, government spending, Gross National Product (GNP), international trade, investment, the minimum wage, money supply, the non-manufacturing employment percentage, nonresidential fixed investment, labor productivity, taxation, and government spending.

5.1. Consumption

There are two variables that can be used to measure domestic consumption: personal consumption expenditures (PCE) and personal consumption expenditures less food and energy (PCELFE). Proponents of the use of PCELFE argue that food and energy consumption is more volatile than PCE and that the use of PCE may present a biased picture of domestic consumption.

Over the monthly period 1959:1 to 2021:12, PCE has a mean of 60.46027, a standard deviation of 31.7857, and a volatility of (52.91%). PCELFE has a mean of 61.78117, a standard deviation of 32.32358, and a volatility of 52.32%. I will use PCE in my models because it includes food and energy consumption and because there is only a minor difference between the volatility of the two series. The summary results of these two series are given in Figures 1 and 2 below.



Figure 1. Histogram and Summary Statistics of PCE



Figure 2. Histogram and Summary Statistics of PCELFE

5.2. Government Spending

A review of economic theory indicates that an increase in government spending might have three major effects on employment. First, it increases employment by putting more money into the economy; second, it crowds out private investment; and third, it increases inflation which in turn decreases employment.

The BLS publishes three variables that measure government spending: federal government current expenditures (FCE), government total expenditures (GTE), and federal government consumption and gross investment (GCI). Government consumption and investment is used in the calculation of both gross national product and gross domestic product. An explanation of the differences in the three variables is given in Table 1 below.

Variable	Includes	Data Starts
Federal Current Expenditures (FCE)	nt Federal government consumption expenditures, plus spending on social benefits and other transfer payments, interest payments, and subsidies to businesses.	
Government Total Expenditures (GTE)	All expenditures of the federal, state, and local governments.	1960 Q1
Government Consumption and Gross Investment (GCI)	All government expenditures used to produce and provide services to the public. These include national defense, education, and highway construction.	1947 Q1

Table 1.	Government	Spending	Variables
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Source: U.S. Bureau of Economic Analysis (2023)

For the period 1960 Q1 to 2021 Q4, the first difference of two of the three series (FCE and GTE) are highly correlated with each other. FCE and GTE have a correlation coefficient of 0.94. However, GCI has a low correlation with FCE and GTE. The correlation coefficient between GCI and FCE is 0.32 and the correlation coefficient between GCI and GTE is 0.36. The difference is caused because GCI does not include items such as transfer payments and interest payments.

Thus, government current expenditures provide a more complete picture of total government spending than does government consumption and gross investment.

5.3. Gross National Product (GNP)

The econometric models will use GNP instead of GDP because GNP was the variable suggested by Okun (1962) in his model of the U.S. economy. Real GNP or real GDP will not be used in the models because the real value of a series is simply the nominal value of a series adjusted for inflation. Since inflation (as measured by CPI) will be one of the modeling variables, the use of real GDP or real GNP would mean that inflation is counted twice: once in the CPI variable and once in the real GNP or real GDP variables.

GNP is a measure of a domestic economy and GDP is a measure of an international economy. The only difference between GNP and GDP is that GDP includes net exports (exports minus imports). Measured over the period 1948 Q1 to 2021 Q4, GDP and GNP are highly correlated with a correlation coefficient of 0.97.

5.4. International Trade

Imports plus exports is used as a proxy for the value of international trade instead of net exports (exports minus imports). The former method is used by many practitioners such as First Trust Data Watch. Economists at First Trust have recently stated that "We like to focus on the total volume of trade, imports plus exports, as it represents the extent of business and consumer interactions across the US border." (Wesbury and Stein, 2023)

In nominal terms, U.S. net exports have been negative since 1980. As shown in Figure 3, the value of net exports as a percent of GDP is a small part of the U.S. economy and has been declining since 2005. The absolute value of net exports as a percent of GDP has ranged over time, from 2.7% in 1948 to 3.8% in 2021 Q4 with a low of 0.0% in 1950, a high of 6.0% in 2005, and a mean of $1.8\%^2$.



Figure 3. The value of net exports as a percent of GDP (1947-2023)

Two econometric regressions were run with the first difference of GDP as the dependent variable in order to show the full effect of international trade on GDP. Both regressions had a single independent variable, the first difference of net exports and the first difference of total trade (imports plus exports). A moving average term (MA1) was used to control the effect of serial correlation. A summary of the two regressions is provided in Table 2 and the full regression output is given in Tables A-3 and A-4 of Appendix A.

Item	Net Exports Model	Total Trade Model		
Independent Variable Coefficient	-2.3757	1.4984		
P-value	0.0000	0.0000		
Constant term coefficient	74.1130	47.9734		
P-value	0.0000	0.0000		
Durbin-Watson statistic	1.9570	1.8600		
R-squared	0.1220	0.7254		
F-statistic p-value	0.0000	0.0000		

Table 2. Comparison of International Trade Regression Results

Source: Author

² Source: Bureau of Economic Analysis 2023, calculations by author.

As shown in Table 2, the total trade model captures over 72% of the variance of the first difference of GDP compared to 12% in the net exports model. In 2021 Q4, the first difference in GDP was approximately \$798 billion and the first difference in net exports was minus \$25 billion or approximately 3% of the first difference of GDP. The net export model indicates that the net exports coefficient was -2.38, which equates to a negative effect of approximately \$59.5 billion on GDP in 2021 Q4.

In 2021 Q4, the first difference of total trade was \$362 billion or approximately 45% of the first difference of GDP. The total trade model indicates that trade (imports plus exports) increased GDP by approximately \$546 billion compared to \$59.5 billion for the net exports model.

5.5. Investment

Total private investment can be estimated as the sum of two variables: private residential fixed investment and private nonresidential fixed investment. Private residential fixed investment (RFI) consists of purchases of private residential structures and residential equipment that is owned by landlords and rented to tenants. Private nonresidential fixed investment (NFI) consists of purchases of nonresidential structures, equipment, and software. (Bureau of Economic Analysis, 2023)³

In 2021, total private investment (NFI+RFI) was approximately \$4.302 trillion and nominal GDP was \$26.137 trillion. Thus, total private investment constituted 16.46% of nominal GDP. For the period 1948 Q1 to 2021 Q4, the nominal values of RFI and NFI had a correlation of approximately 0.94.⁴ The first difference of these two series has a correlation of only 0.11. This implies that quarterly changes in these two series tend to move in opposite directions. This was true in 106 out of 292 quarters in the study.

NFI's share of total investment has grown from 58.34% in 1950 to 73.33% in 2021, although NFI has declined from a high of 83.70% in 2011. RFI is primarily housing investment and housing investment is sensitive to changes in interest rates as shown in Figure 4. If RFI rises more than NFI in a given period, then NFI's share of total investment will decline.

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³ NFI is one of the proxies for expected demand.

⁴ The nominal values of NFI and RFI are non-stationary series. Thus, using only the nominal values to estimate correlation may yield a biased estimate of the correlation between the two series.



Figure 4. The long-term bond yield and the RFI percentage (1948-2021)

5.6. The U.S. Federal Minimum Wage

The effect of the federal minimum wage variable is difficult to estimate in a first difference model because of a lack of variance in the series and the small number of minimum wage workers. The United States Bureau of Labor Statistics (BLS) has reported that 181,000 workers earned the minimum wage in 2021, and 910,000 workers earned less than the minimum wage compared to a total of 149.2 million employed workers. Thus, minimum wage workers account for less than 0.8% of all workers in the United States. (Bureau of Labor Statistics, 2022)

The U.S. last increased the federal minimum wage in 2009. Thus, the first difference of the minimum wage series is zero in many quarters. Out of 296 quarters in the study, the first difference in the minimum wage variable was zero in 271 quarters. A history of changes to the minimum wage is provided in Table 3 below.

The United States established a federal minimum wage of \$.25/hour when President Franklin Roosevelt signed the Fair Labor Standards Act (FLSA) in 1938.⁵ The federal minimum wage has increased from \$0.25/hour in 1938 to \$7.25/hour in 2023 for eligible employees.

In 1961, minimum wage coverage was extended to employees in large retail and service enterprises, local transit, construction, and gasoline service station employees. The 1966 amendments extended coverage to state and local government employees of hospitals, nursing homes, and schools;

⁵ The FLSA was only applicable to employees engaged in interstate commerce or in the production of goods for interstate commerce. The FLSA has been amended several times since 1938 and coverage has been expanded.

and to laundries, dry cleaners, large hotels, motels, restaurants, and farms. Subsequent amendments extended coverage to uncovered federal, state, and local government employees, certain workers in retail and service trades, and to domestic workers in private households. Table 3 provides a history of changes to the federal minimum wage in the United States.

Effective Date	Hourly Rate	Hourly Rate Increase	Inflation Rate
	(\$)	(%)	Increase (%)
October 24, 1938	\$0.25	NA	NA
October 24, 1939	\$0.30	20.00%	NA
October 24, 1945	\$0.40	33.33%	NA
January 25, 1950	\$0.75	87.50%	9.91%
March 1, 1956	\$1.00	33.33%	11.38%
September 3, 1961	\$1.15	15.00%	11.47%
September 3, 1963	\$1.25	8.70%	2.71%
February 1, 1967	\$1.40	12.50%	6.99%
February 1, 1968	\$1.60	14.29%	3.65%
May 1, 1974	\$2.00	25.00%	45.76%
January 1, 1975	\$2.10	5.00%	7.90%
January 1, 1976	\$2.30	9.52%	7.13%
January 1, 1978	\$2.65	15.22%	12.05%
January 1, 1979	\$2.90	9.43%	8.99%
January 1, 1980	\$3.10	6.90%	13.25%
January 1, 1981	\$3.35	8.06%	12.35%
April 1, 1990	\$3.80	13.43%	50.23%
April 1, 1991	\$4.25	11.84%	4.82%
October 1, 1996	\$4.75	11.76%	16.99%
September 1, 1997	\$5.15	8.42%	1.97%
July 24, 2007	\$5.85	13.59%	28.88%
July 24, 2008	\$6.55	11.97%	4.94%
July 24, 2009	\$7.25	10.69%	-1.22%
December 31, 2021	\$7.25	0.00%	30.77%

Table 3. History of Changes to the U.S. Federal Minimum wage

Source: U.S. Bureau of Labor Statistics

As shown in Table 3, increases to the minimum wage (in percent) exceeded the inflation rate in most periods prior to the last increase in the minimum wage in 2009. Inflation has increased by 30.77% with no increase to the minimum wage from 2009-2021. Thus, the real minimum wage in 2021 dollars is only \$5.54/hour.

As a result, the current U.S. minimum wage is not high enough to allow workers to maintain an adequate standard of living.⁶ However, it is higher than the minimum wage in twenty of the twenty-seven countries in the European Union. (Eurostat, 2023). Only seven European Union countries have a minimum wage higher than the U.S. minimum wage. These countries are Belgium, France, Germany, Ireland, Luxembourg, the Netherlands, and Spain.

5.7. Money Supply

Money supply (also referred to as money stock) is the total of all the currency and liquid assets in a country's economy on a particular date. In their undergraduate textbook, Hall and Taylor present a short-run growth model in which the growth in the price level is equal to the growth of money supply. (Hall and Taylor, 1993, p. 136) Of course, the operations of the money market are far more complex than the short-run model presented by Hall and Taylor. Table 4 provides a description of the different ways that money supply is measured and the available data for each method.

Туре	Includes	Data Availability	Correlation with M3
M0	Notes and coins in circulation	None ⁷	NA
MB	M0 plus note and coins in bank vaults and Federal Reserve Bank credit ⁸	None	NA
M1	M0 plus travelers checks of non-bank issuers (e.g., American Express), demand deposits, checkable deposits, and savings deposits.	1959:Q1 to 2023:Q2	0.74
M2	M1 plus time deposits of less than \$100,000 and individual money market deposit accounts ⁹	1959:Q1 to 2017:Q1	0.99
М3	M2 plus large time deposits, institutional money market funds, short- term repurchases, and other larger liquid assets	1948:Q1 to 2023:Q1	1.00
MZM	M1 plus all money market funds	1980:Q4 to 2021:Q1	0.84

 Table 4. Types of Money Supply and the availability of data on each variable

Source: Federal Reserve Bank of St. Louis (2022)

 ⁶ A minimum wage worker will earn \$15,080 annually if they work 2,080 hours per year (40 hours per week multiplied by 52 weeks). The federal poverty level for a single person is \$14,580 per year in the lower 48 states, \$16,770 in Hawaii, and \$18,210 in Alaska. (Reed, 2023)
 ⁷ M0 (monetary base) is not published in the United States although it is included in other

M0 (monetary base) is not published in the United States although it is included in other measures of money supply.

⁸ MB is the most liquid measure of money supply.

⁹ M2 is a key economic indicator used to forecast inflation.

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The correlations given in Table 4 are for the first difference of the variables for the period 1980 Q4 to 2017 Q1. This time period was chosen because this was the only time period in which data was available for all of the variables. All of the measures of money supply are highly correlated with M3, with correlation coefficients ranging from 0.74 to 0.99.

The econometric models will use M3 to measure money supply because it is the broadest measure of money supply and because M3 data is available for the entire length of the study (1948 Q1 to 2021 Q4).

5.8. Manufacturing Employment

The percentage of employees employed in manufacturing (MEP) has fallen from 32.15% in 1948 to 8.41% in 2021. The non-manufacturing employment percentage is 1 – MEP. As shown in Figure 5, the MEP has been relatively stable since 2011, falling only forty-eight basis points, from 8.89% to 8.41%.

The MEP declined significantly in every decade until 2010 when it stabilized at under 9%. Both the MEP and the number of manufacturing employees have fallen over the length of this study. By the end of 1978, there were 19.334 million manufacturing employees. By 2021, there were only 12.555 million, a loss of almost seven million manufacturing jobs.



Figure 5. The percentage of workers employed in manufacturing (1948-2021)

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The decline both in the MEP and in manufacturing employment has been affected by technological change, innovation, and productivity as manufacturers needed fewer workers to produce the same level of output. (See Gruss and Natova, 2018) However, the primary cause of the decline in MEP has been the change in U.S. trade policy since 1948. At that time, the U.S. was almost a closed economy as measured by the import percentage (Imports/GNP).

The import percentage rose from 3.6% in 1948 to 17.1% in 2011 and then fell to 14.9% in 2021. The decline in imports as a percent of GNP has been a major contributor to the stabilization of MEP since 2011.¹⁰ Figure 6 provides a comparison of the percent of imports with the MEP. It shows that as the percentage of imports rose, the MEP fell.



Figure 6. Imports and the MEP

5.9. Labor Productivity

Labor productivity is nominal GDP divided by total hours worked. Labor productivity has fallen by about 2% since 2021 Q2. Figure 7 provides a graph of a seasonally adjusted index (2012=100) of labor productivity from 1948 to 2023.

¹⁰ The MEP fell only 47 basis points during this decade from 8.88% in 2011 to 8.41% in 2021.





Figure 7. Labor Productivity Index (1948-2023)

Kenton (2023) has explained that "Labor productivity growth comes from increases in the amount of capital available to each worker (capital deepening), the education and experience of the workforce (labor composition), and improvements in technology (multi-factor productivity growth)."

Kenton argues that "Investment in an economy is equal to the level of savings because investment has to be financed from savings. It is only when monetary policy is tightened, and rates rise that the economy encourages saving and ultimately future investment." Unfortunately, the data does not support Kenton's arguments.

In 2022, gross savings were approximately \$5.2 trillion compared to total private investment of approximately \$8.9 trillion, a difference of over 70%. For the period 1948 to 2022, gross savings averaged approximately \$1.5 trillion compared to an average of \$1.2 trillion in private investment, a difference of 25%.

As measured by the long-term bond yield, interest rates rose from 1948 Q1 (2.44%) to 1981 Q3 (15.32%) and then fell to 0.68% in 2020 Q3. The savings rate (Gross Savings/GNP) rose from 16.27% in 1948 to 23.27% in 1981 and then rose to 30.67% by 2020. The savings rate increased by 700 basis points when interest rates were increasing and rose by 740 basis points when interest rates were declining. The correlation between the savings rate and interest rates is only .001875, which indicates that changes in interest rates have almost no effect on savings.

5.10. Taxation

The U.S. Internal Revenue Service is the federal agency responsible for administering the U.S. tax code. Many economics papers have used the marginal tax rate as a proxy for taxation. The current U.S. federal individual marginal tax rate ranges from 10% to 37% depending on an individual's adjusted gross income. The top marginal tax rate was over

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90% in the 1950s. However, the effective tax rate was only 16.9%. (Greenberg, 2017)

This paper uses government total receipts (GTR) as a proxy for taxation because GTR provides a more accurate picture of the tax burden faced by individuals and businesses. In 2022, federal income taxes were \$1.7 trillion (York, 2023) and total federal tax receipts were approximately \$3.2 trillion. Thus, income taxes constituted about 53% of total federal government tax receipts.

Messerli (2011) has identified over 100 different taxes. In his article, Messerli quotes Robert Brault's joke that the "U.S. Internal Revenue Service: [is] an agency modeled after the revenue raising concepts of the 19th century economist, Jesse James".¹¹ - Robert Brault.

The marginal tax rate provides an incomplete picture of the amount of taxes paid by Americans and thus an incomplete picture of the amount of disposable income. Disposable income can be saved, used to consume goods and services, or invested. Therefore, models that rely on the marginal tax rate could yield biased estimates of other macroeconomic variables such as GDP, consumption, or investment.

The effective tax rate is total taxes paid divided by total income. The effective tax rate is much lower than the marginal tax rate, because of the number of deductions, exemptions, and credits that can be claimed both by individual and by corporate taxpayers. For example, all individual taxpayers who file a joint return receive a standard deduction of at least \$25,000 (\$30,500 for people over 65).

Other deductions and credits for individual taxpayers who do not itemize deductions include contributions to an individual retirement account, exempt interest, exemptions related to social security benefits and pensions, qualified business income deductions, child care credit, education deductions and credits, educator expenses, health savings account deduction, health insurance deduction, self-employment tax deduction, student loan interest deduction, alimony deduction, foreign tax credit, and the residential energy credit.

Taxpayers who itemize deductions do not receive the standard deduction. However, they can claim deductions for medical and dental expenses, state and local taxes, home mortgage interest, investment interest paid, charitable contributions, casualty and theft losses, and job-related expenses such as uniforms and union dues. Small businesses can claim deductions for all reasonable expenses incurred, automobile expenses, depreciation and amortization, and expenses incurred for business use of their home.

¹¹ Jesse James was an infamous 19th century pro-slavery outlaw from the state of Missouri.

Conclusion

This paper has provided a theoretical model of employment and an analysis of the macro variables that some economists believe influence total employment in the United States. The paper compared the mean of the first difference of aggregate employment (EMP) with the estimated value of aggregate employment (ESTE). The theoretical model provides a good approximation of the mean of the two series. ESTE has a mean of 352.6206 compared to a mean of 354.4305 for EMP (a difference of only 0.5%).

An analysis of the variables indicates that:

- There is only a minor difference between the volatility of personal consumption expenditures and the volatility of personal consumption expenditures minus food and energy.
- In nominal terms, U.S. net exports have been negative since 1980. The absolute value of net exports as a percent of GDP is a small part of the U.S. economy and has been declining since 2005. The absolute value of net exports as a percent of GDP has ranged over time from 2.7% in 1948 to 3.8% in 2021 Q4 with a low of 0.0% in 1950, a high of 6.0% in 2005, and a mean of 1.8%.
- Nonresidential Fixed Investment (NFI's) share of total investment has grown from 58.34% in 1950 to 73.33% in 2021, although NFI has declined from a high of 83.70% in 2011.
- Minimum wage workers account for less than 0.8% of all workers in the United States. (Bureau of Labor Statistics 2022b) The current U.S. minimum wage is not high enough to allow workers to maintain an adequate standard of living. However, it is higher than the minimum wage in twenty of the twenty-seven countries in the European Union.
- The percentage of manufacturing employees (MEP) has fallen from 32.15% in 1948 to 8.41% in 2021. The MEP has been relatively stable since 2011, falling only forty-eight basis points, from 8.89% to 8.41%. The primary cause of the decline in MEP has been the change in U.S. trade policy since 1948. At that time, the U.S. was almost a closed economy as measured by the import percentage (Imports/GNP).
- As measured by the long-term bond yield, interest rates rose from 1948 Q1 (2.44%) to 1981 Q3 (15.32%) and then fell to 0.68% in 2020 Q3. The savings rate (Gross Savings/GNP) rose from 16.27% in 1948 to 23.27% in 1981 and then rose to 30.67% by 2020. The savings rate increased by 700 basis points when interest rates were increasing and rose by 740 basis points when interest rates were declining. The correlation between the savings rate and interest rates is only .001875, which indicates that changes in interest rates have almost no effect on savings.

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■ Government total receipts (GTR) is a better proxy for taxation than the marginal tax rate because GTR provides a more accurate picture of the tax burden faced by individuals and businesses. In 2022, federal income taxes were \$1.7 trillion (York, 2023) and total federal tax receipts were approximately \$3.2 trillion. Thus, income taxes constituted approximately 53% of total federal government tax receipts.

The paper found that PCE is a better proxy for consumption than PCELFE because PCE includes all personal consumption. Government current expenditures (GCE) is the best proxy for government spending because GCE includes spending by all levels of government: federal, state, and local. Total trade (imports plus exports) is a better proxy for international trade than net exports because imports plus exports captures the true value of international trade on the U.S. economy.

M3 is the best proxy for money supply because it is the broadest measure of money supply and because M3 data is available for the entire length of the study (1948 Q1 to 2021 Q4). Finally, the paper found that Government total receipts (GTR) is a better proxy for taxation than the marginal tax rate because GTR provides a more accurate picture of the tax burden faced by individuals and businesses.

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Appendix A

Table A-1. The Expected Demand Risk FactorDependent Variable: DEMPMethod: ML ARCH - Normal distribution (BFGS / Marquardt steps)Date: 11/04/23 Time: 23:37Sample (adjusted): 1948Q2 2021Q4Included observations: 295 after adjustmentsConvergence achieved after 45 iterationsCoefficient covariance computed using outer product of gradientsMA Backcast: 1948Q1Presample variance: backcast (parameter = 0.7)GARCH = C(5) + C(6)*RESID(-1)^2 + C(7)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LOG(GARCH) C DNFI+DPCE MA(1)	-283.1912 3369.276 5.984439 0.609121	77.79020 901.3517 0.129360 0.056442	-3.640448 3.738026 46.26196 10.79206	0.0003 0.0002 0.0000 0.0000
	Variance	Equation		
C(5) RESID(-1)^2 GARCH(-1) D	9690.060 0.213582 0.723222 0.785238	8362.471 0.191421 0.244812 0.440471	1.158756 1.115773 2.954200 1.782724	0.2466 0.2645 0.0031 0.0746
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood Durbin-Watson stat	0.767474 0.765076 479.9790 67040545 -2194.784 1.917029	Mean depende S.D. dependen Akaike info crite Schwarz criterie Hannan-Quinn	nt var t var erion on criter.	354.4305 990.2822 14.93413 15.03411 14.97416
Inverted MA Roots	61			

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Table A-2. The Effect of GNP on Non-Farm Employment in the United States

Dependent Variable: @PCH(EMP) Method: ARMA Maximum Likelihood (OPG - BHHH) Date: 12/01/21 Time: 13:54 Sample: 1948Q2 2021Q2 Included observations: 293 Convergence achieved after 16 iterations Coefficient covariance computed using outer product of gradients

Variable	Coefficient Prob.	Std. Error	t-Statistic	
С	-0.003171 0.0000	0.000464	-6.840449	
@PCH(GNP)	0.416702	0.014375	28.98843	
AR(1)	-0.041145 0.4511	0.054530	-0.754534	
SIGMASQ	3.91E-05 0.0000	2.13E-06	18.32298	
R-squared 0.003342	0.470095	Mean dep	endent var	
Adjusted R-squared 0.008606	0.464594	S.D. depe	ndent var	
S.E. of regression 7.283855	0.006297	Akaike inf	o criterion	-
Sum squared resid 7.233613	0.011460	Schwarz o	riterion	-
Log likelihood 7.263732	1071.085	Hannan-Q	uinn criter.	-
F-statistic 1.989493	85.46017	Durbin-Wa	atson stat	
Prob(F-statistic) Inverted AR Roots	0.000000 04			

Table A-3. The effect of Total Trade (Imports plus Exports) on GDP in the United States

Dependent Variable: DGDP Method: ARMA Maximum Likelihood (OPG - BHHH) Date: 06/16/23 Time: 02:51 Sample: 1948Q2 2021Q4 Included observations: 295 Convergence achieved after 128 iterations Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C DTRADE MA(1) SIGMASQ	49.97338 1.498387 0.265573 9285.001	8.872743 0.012324 0.021138 337.8333	5.632235 121.5817 12.56384 27.48397	0.0000 0.0000 0.0000 0.0000
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.725378 0.722547 97.01871 2739075. -1766.206 256.2134 0.000000	Mean depende S.D. dependen Akaike info crite Schwarz criterie Hannan-Quinn Durbin-Watson	nt var t var erion on criter. stat	81.63857 184.1879 12.00140 12.05139 12.02142 1.859993
Inverted MA Roots	27			

Table A-4. The effect of Net Exports (Exports minus Importson GDP in the United States

Dependent Variable: DGDP Method: ARMA Maximum Likelihood (OPG - BHHH) Date: 06/16/23 Time: 02:47 Sample: 1948Q2 2021Q4 Included observations: 295 Convergence achieved after 250 iterations Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C DNE MA(1) SIGMASQ	74.11299 -2.375667 -0.049117 29686.34	13.15624 0.314496 0.024791 560.3213	5.633295 -7.553892 -1.981273 52.98092	0.0000 0.0000 0.0485 0.0000
R-squared Adjusted R-squared S.E. of regression Sum squared resid Log likelihood F-statistic Prob(F-statistic)	0.121970 0.112918 173.4774 8757469. -1937.608 13.47462 0.000000	Mean depende S.D. dependen Akaike info crit Schwarz criteri Hannan-Quinn Durbin-Watson	nt var t var erion on criter. stat	81.63857 184.1879 13.16345 13.21344 13.18346 1.957016
Inverted MA Roots	.05			

ARTICLES

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THE IMPORTANCE OF BORDER SURVEILLANCE AND BORDER TRAFFIC CONTROL AT THE EASTERN BORDER OF THE REPUBLIC OF POLAND TO THE CROSS-BORDER SECURITY OF THE EUROPEAN UNION²

Abstract

The main non-military criterion of border surveillance is border control; due to the geopolitical situation in Ukraine, preceded by the COVID-19 pandemic, the issue of border surveillance with regard to the eastern border of the Republic of Poland, also performing the function of one of the longest sections of the European Union's external land border, has become extremely important. Therefore, the article aims to point to the importance of border surveillance and border traffic control at the eastern border of the Republic of Poland to the cross-border security of the EU. To achieve this objective, it presents the main characteristics of border control and cross-border security at the external borders of the EU, describes the 'Polish' section of the EU's external land border, indicates the efficiency of control measures taken and identifies the threats and challenges to the protection and surveillance of border traffic. The article is theoretical

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and partly comparatively analytical in nature. It relies on traditional research methods: deductive reasoning and comparative analysis.

Keywords: border surveillance, border control, cross-border security, European Union, threat.

JEL: F10, F15, F50, M21

Introduction

For every country, its border is of particular value and performs three possible main functions, with varying intensity: (1) the military function as a barrier preventing an armed attack (aggression, e.g. hybrid aggression); (2) the economic function – a barrier protecting from free (uncontrolled and undesirable) movement of goods (arms, chemical and biological materials) and services (undeclared work); (3) the social function - an obstacle verifying free (unauthorised, restricted or selectively distributed) movement as well as stopping illegal migration and trafficking in human beings and organs [Jakubczak, 2019]. Building border security is a multi-faceted task of great difficulty, particularly in the case of the Republic of Poland, playing an important role of the guardian of cross-border security due to its membership of the European Union (EU) and of the Schengen area. The borders of the Republic of Poland with the Russian Federation, the Republic of Belarus and Ukraine are not only Poland's national borders but also the external borders of the EU and of the Schengen area. Therefore, due to the lack of checks at the internal borders of the EU, the crossing of the eastern border of the Republic of Poland materialises the principle of the free movement within the territory of the Member States of all persons staying in the area. In 2022, the EU's external border in Poland was crossed by more than 37.3 million people, with over 21 million persons crossing the land border section [Komenda Główna Straży Granicznej 2023a]. It means that the daily average number of persons crossing the border (including the land border) was about 102,000 (57,500). As a result of the Russian invasion, the movement of persons at the border with Ukraine nearly doubled (rising to 17.3 million). Ukrainian citizens accounted for more than 46% of all travellers crossing the EU's external border in Poland in 2022.

The article aims to point to the importance of border surveillance and border traffic control at the eastern border of the Republic of Poland to the cross-border security of the European Union. The hypothesis to be verified is as follows: since the present-day cross-border security environment is subject to constant change and Poland's national borders with Ukraine, the Republic of Belarus and the Russian Federation are also the external borders of the EU, their surveillance is a priority for the security of all the Member States. The main criterion of border surveillance is border control; therefore, the border services responsible for its organisation must ensure the highest level of security by protecting the Member States from unauthorised or dangerous individuals and goods on the one hand, whereas no measures taken should hinder legal passenger and freight traffic on the other hand. In order to achieve the objective so defined, the article reviews various literature sources and acts of secondary legislation regarding the main characteristics of border control and cross-border security as well as the role of entities combating and countering cross-border criminality. The theoretical part is complemented by analyses of statistical data from sources published by the Polish Border Guard, the force responsible for both national border surveillance and border traffic control. The approach adopted includes the application of the following research methods: deductive reasoning and comparative analysis.

The security of external borders is a topical problem in the EU; due to the existing conditions, various issues related to border surveillance at the eastern border of the Republic of Poland, also performing the function of one of the longest sections of the external land border of United Europe, have become more important than ever. At present, the subject of border surveillance and border traffic control is frequently discussed in the mass media, which proves its major role not only in the security system of the Republic of Poland but also of the whole EU. However, the main focus of most scientific studies is on the institutional or military dimensions of border management, hence the need for more theoretical insights into the problem. It must be noted that the article does not aim at preparing an exhaustive description or explaining all the research dimensions of the phenomenon under examination - particularly in the face of the war in Ukraine and the unstable geopolitical situation, the considerations presented should be treated as the starting point for further discussion and in-depth analysis.

1. The main characteristics of border surveillance and border traffic control at the external borders of the EU

Border surveillance is a multi-faceted task, consisting in arranging a set of administrative, political, policy making, sanitary and military activities, with a varying degree of rigour, carried out by every sovereign State with a view to preventing illegal crossings of its national border or unauthorised movement of specified goods, countering the cross-border transmission of infectious diseases [Laprus 1979], whereas the process resulting from all such measures taken by border services and aimed at ensuring (physical, technical, social, health, economic, environmental) security in crossing the EU's external border must be understood as the cross-border security of the EU [Świerczyńska 2022]. The present-day cross-border security has multiple dimensions and includes various aspects and areas of threats: from economic, social, cultural, environmental to political and military in nature. The main purpose of the EU's external border surveillance is to prevent unauthorised border crossings, to counter cross-border criminality and to take measures against persons who have crossed the border illegally [Regulation (EU) 2016/399]. In accordance with EU legislation, the term 'external borders' of the EU means the Member States' land borders, including river and lake borders, sea borders and their airports, river ports, sea ports and lake ports, provided that they are not internal borders, i.e. the common borders of the Member States (Regulation (EU)) 2016/1624]. The total length of the external border of the EU is 44,752 km, including the land border of 12,033 km. In the EU, the border surveillance system is based on the European Union Integrated Border Management (EU IBM) system, consisting of components such as: border control (border checks and border surveillance); the detection of cross-border crime and conducting investigations in cooperation with all authorities competent for maintaining law and order; cooperation between various services involved in border management; international cooperation, the coordination and coherence of activities carried out by the Member States and the Union institutions and other bodies [Regulation (EU) 2016/1624]. Border control in each Member State is the responsibility of its border services (or the national authorities responsible for border management), whereas operational cooperation is managed and coordinated and the carrying out of border control tasks is supported by the European Border and Coast Guard Agency – Frontex [Regulation (EU) 2016/1624]. Frontex monitors the migration situation (migratory flows) in Europe and provides the Member States with operational assistance in the form of joint operations and rapid border interventions at the external borders as well as taking measures aimed at returning illegal immigrants from the territory of the EU [Szymańska 2018]. Specific rules for border control and the requirements to be fulfilled by third-country nationals subject to border checks are contained in the Schengen Borders Code [Regulation (EU) 2016/399]. Border control is in the interest not only of the Member State at whose external borders it is carried out but of all Member States which have abolished internal border control [Regulation (EU) 2016/399]. All the Member States, including those without external borders, are jointly responsible, although to a varying degree, for external border surveillance [Bujalski & Błędzki 2008]. Border control should help to combat illegal immigration and trafficking in human beings and to prevent any threat to the Member States' internal security, public policy, public health and international relations [Regulation (EU) 2016/399]. The coordination of measures aimed at detecting, preventing and combating irregular migration and cross-border crime is supported by the European Border Surveillance System (EUROSUR) [Regulation (EU) No 1052/2013]. Border control comprises not only checks on persons at border crossing points and surveillance between those border crossing points, but also an analysis of the risks for internal security and of the threats that may affect the security of external borders [Regulation (EU) 2016/399].

2. The border of the Republic of Poland as the 'external border' of the European Union

The EU's external border concerns all the Member States whose external borders are identical with the external borders of the Community and basically performs the same functions as those of any national border with the exception that the external border marks the limits of the control of the whole Union – as the most developed economic community – rather than of that of a single country [Balawajder 2018]. As regards the Republic of Poland, its national border is a vertical surface running through the border line and separating the territory of the Polish State from (1) the territories of other countries, (2) open sea, (3) the airspace, (4) the Earth's interior [Ustawa (Act) 1990/461]. The length of the border of the Republic of Poland is 3,572.69 km, including its sea border of 500.94 km. In international terms (i.e. as a Member State of the EU), Poland has internal and external borders. The function of the internal border of the EU concerns the national borders of the Republic of Poland with the following four countries: the Republic of Lithuania (104.38 km), the Slovak Republic (541.06 km), the Czech Republic (795.91 km) and the Federal Republic of Germany (489.37 km, including its land section – 467.15 km). At the same time, Poland's borders with the Russian Federation (232.04 km, including its land section - 209.83 km), the Republic of Belarus (418.24 km) and Ukraine (535.18 km) perform the function of the EU's external border. The total length of the internal and external land borders is 1,908.5 km and 1,163.25 km respectively, which means that the Polish section of the border is one of the longest sections of the external land border of the EU. The border surveillance policy is the essence of border traffic management, including border control. In that regard, a special role is played by the Polish Border Guard (hereinafter also: the PBG). The PBG is a uniform, uniformed and armed force, responsible for tasks such as national border surveillance, border traffic control, countering crime as well as preventing and combating illegal migration [Ustawa (Act) 2022/1061]. With regard to the surveillance and control of the movement of goods, the role of the guardian is played by the National Revenue Administration (Krajowa Administracja Skarbowa) and the Customs and Tax Service (Służba Celno-Skarbowa), the latter being a separate structure within the former [Ustawa (Act) 2016/1947].

Cross-border movement is allowed at designated places, i.e. at border crossing points. Their number and locations result from arrangements such as international agreements. At the land section of the EU's external border in Poland, there are 33 border crossing points: 18 for road traffic, 14 for rail

traffic [Table 1] and one river border crossing point (the border with the Republic of Belarus) [cf. Obwieszczenie (Announcement) 2015/636].

Border of the Republic of Poland	Legal basis	Road border crossing points	Rail border crossing points
Belarus	Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on border crossing points, done at Warsaw on 24 April 1992	passenger and freight traffic: Kuźnica Białostocka – Bruzgi, Bobrowniki – Bierestovica, passenger traffic: Białowieża – Piererov, Terespol – Brest, Sławatycze – Damachava, freight traffic: Kukuryki – Kozłowiczy	passenger and freight traffic: Kuźnica Białostocka – Grodno, Terespol – Brest freight traffic: Zubki Białostockie – Bierestovica, Siemianówka – Svislach, Czeremcha – Vysoko- Litovsk.
Russian Federation	Agreement between the Government of the Republic of Poland and the Government of the Russian Federation on border crossing points, done at Moscow on 22 May 1992	passenger and freight traffic: Bezledy – Bagrationovsk, Gołdap – Gusev, Grzechotki – Mamonovo II, Gronowo – Mamonovo,	passenger and freight traffic: Braniewo – Mamonovo, freight traffic: Głomno – Bagrationovsk Skandawa – Zheleznodorozhny
Ukraine	Agreement between the Government of the Republic of Poland and the Government of Ukraine on border crossing points, done at Warsaw on 18 May 1992	passenger and freight traffic: Dorohusk – Jagodzin, Hrebenne – Rava- Rus'ka, Budomierz – Hrushiv, Korczowa – Krakovets', Krościenko – Smil'nytsya, Medyka – Shehyni, passenger traffic: Zosin – Ustilug, Dołhobyczów – Uhryniv	passenger and freight traffic: Dorohusk – Jagodzin, Hrubieszów – Volodymyr-Volynsky, Przemyśl – Mostys'ka, passenger traffic: Hrebenne – Rava- Rus'ka, Krościenko – Khyriv, freight traffic: Werchrata – Rava- Rus'ka

Table	1.	Border	crossing	points	and	the	authorised	type	of	border	traffic
		at the P	olish secti	ion of th	ne EU	l's e	xternal land	bord	er		

Source: Prepared on the basis of the Annex to Announcement 2015/636 (Załącznik do Obwieszczenia 2015/636)

The land border crossing points account for the dominant share of border traffic, constituting the pivotal element of the system of border crossing points at that section of the external border of the Union [Świerczyńska 2022].

Border traffic at the Polish border crossing points has been significantly affected by the two recent crises, i.e. the COVID-19 pandemic and the war in Ukraine. In March 2020, pursuant to Article 16 of the National Border Surveillance Act, an ordinance was issued to introduce a temporary suspension or restriction of border traffic at specified border crossing points, including with the Russian Federation, the Republic of Belarus and Ukraine [Rozporządzenie 2020a/435]. The provisions were subsequently amended a number of times [Rozporządzenie 2020b/469; 2020c/1030; 2020d/1183; 2020e/1379; 2020f/1424; 2020g/1448; 2020h/1597; 2020i/1623; 2020j/1704; 2020k/2144; 2020l/2403; 2021a/545; 2021b/1088; 2021c/1126; 2021d/1384; 2021e/1536; 2021f/1654; 2021g/1835]; under the amending ordinance of 18 February 2022, the words 'the Russian Federation, the Republic of Belarus and Ukraine' were replaced by the words 'the Russian Federation and the Republic of Belarus' [Rozporządzenie 2022/423]. Thus, the suspension of border traffic ceased to apply to Ukraine. The statistical data contained in Tables 2 to 5 show the intensity of the cross-border movement of nationals of and vehicles from the neighbouring countries at the Polish section of the external land border of the EU.

Border section	2020	Change 2020/ 2019	2021	Change 2021/ 2020	2022	Change 2022/ 2021	2023 1 st semester					
Russia	417,383	-78%	135,062	-68%	156,792	+16%	104,818					
Belarus	1,811,151	-56%	1,574,371	-13%	1,394,919	-11%	539,214					
Ukraine	2.463.647	-51%	3.309.101	+34%	3.925.879	+19%	1.998.764					

 Table 2. Cross-border movement of vehicles by section of the border of the Republic of Poland in 2020–2023 (1st semester)

Source: Prepared on the basis of the Border Guard Headquarters data [Komenda Główna Straży Granicznej: 2021; 2022b; 2023a, 2023b]

Table	3.	Cross-border	movement	of	persons	by	section	of	the	border
		of the Republ	ic of Poland	in 2	2020-2023	(1 st	semeste	r)		

Border section	2020	change 2020/ 2019	2021	change 2021/ 2020	2022	change 2022/ 2021	2023 1 st semester
Russia	743,525	-79%	234,287	-68%	369,204	+58%	232,727
Belarus	3,024,134	-66%	2,180,133	-28%	3,358,099	+54%	1,442,623
Ukraine	7,819,324	-64%	8,730,051	+12%	17,288,970	+98%	8,571,820

Source: Prepared on the basis of the Border Guard Headquarters data [Komenda Główna Straży Granicznej: 2021; 2022b; 2023a, 2023b]

Table 4. Cross-border movement of foreign nationals by section of the border of the Republic of Poland in 2020-2022

Border	TOTAL				From I		To Poland			
section	2020	2021	2022	2020	2021	2022	2020	2021	2022	
Russia	518,598	208,647	327,563	259,447	102,573	171,129	259,151	106,074	156,434	
Belarus	2,642,677	2,009,776	3,145,728	1,413,036	1,083,567	1,593,120	1,229,641	926,209	1,552,608	
Ukraine	7,336,577	8,245,506	16,812,924	3,691,306	4,100,072	7,376,721	3,645,271	4,145,434	9,436,203	
Source	Source: Prepared on the basis of the Border Guard Headquarters data [Komenda									

Table 5. Cross-border movement of Polish nationals by section of the border of the Republic of Poland in 2020-2022

Główna Straży Granicznej: 2021; 2022b; 2023a]

Bordor costion		TO	TAL		From		To Poland		
Border Section	2020	2021	2022	2020	2021	2022	2020	2021	2022
Russia	224,927	25,640	41,641	112,555	12,988	20,747	112,372	12,652	20,894
Belarus	381,457	170,357	212,371	191,904	87,275	107,573	189,553	83,082	104,798
Ukraine	482,747	484,545	476,046	236,538	243,069	235,001	246,209	241,476	241,045
Source: Prepared on the basis of the Border Guard Headquarters data [Komenda									
Główna Straży Granicznei: 2021: 2022b: 2023a]									

The year 2020 saw a downward trend of border traffic, which obviously stemmed from the mobility restrictions imposed in connection with the COVID-19 pandemic. Major changes took place in 2022. In the aftermath of the Russian invasion of Ukraine on 24 February 2022, Poland experienced a mass influx of Ukrainian nationals as well as of third-country nationals residing in Ukraine. In the 1st guarter of 2022, more than 4.2 million people crossed the EU's external border with Ukraine (up by 172% on the 1st guarter of 2021), including nearly 3.2 million Ukrainian citizens. Another 4.1 million persons crossed the border in the 2nd quarter of the year [Komenda Główna Straży Granicznej 2022a]. In response to such intensive flows of persons fleeing the war, extraordinary simplification of border controls was introduced [European Commission, 2022]. In its Communication – Providing operational guidelines for external border management to facilitate border crossings at the EU–Ukraine borders – the European Commission included, inter alia, facilitation measures concerning border controls, e.g. the simplification of border controls for certain categories of persons, including vulnerable persons, such as children, citizens that found themselves in Ukraine while working or studying; special arrangements for crossing the borders by rescue services, etc. It lifted the requirements related to documents and compulsory vaccinations of pet animals travelling with their owners from Ukraine [European Commission, 2022].

3. Cross-border threats at the eastern section of the EU's external border

The cross-border aspect of threats, or phenomena causing uncertainty, means that they concern areas located in two or more countries. Depending on their nature, they may affect millions of people; in the case of the eastern border of the Republic of Poland, such threats may impact nationals of all the EU Member States. Cross-border threats have external and (or) internal causes, national, internal and global conditions; they are most likely to materialise in places lacking safeguards and when least expected. The first dimension, and the most dangerous one, is obviously the military violation of the border by another country's armed forces; as the situation in Ukraine has shown, it is still a genuine threat in Europe. Considering the geopolitical location of the Republic of Poland, no military threats must be neglected - they should be seen as real and likely to materialise in a combination of unfavourable political events. Special attention must be given to possible spying activities or to provocations, especially in the form of provocative violations of the territory of the Republic of Poland in its border area and border disputes caused by organised militarised units with the intention of activating components of Poland's defence system [Wiśniewski 2013].

Another dimension comprises non-military threats; although they present no risks to territorial security, in practice they pose serious problems adversely affecting cross-border security. Due to the nature and scope of their influence, the range of non-military threats is very wide, it is an open catalogue. For example, the COVID-19 pandemic forced a change in the perception of health threats. Measures taken at the Polish section of the EU's external border to ensure border surveillance and effective control of border traffic were extremely important as the external borders of the EU then served as filters for the movement of persons and helped mitigate the effects of the pandemic, thus protecting not only Poland's residents but also those of the other EU Member States.

Significant non-military threats include risks related to cross-border criminality, frequently in the form of organised crime. Organised cross-border crime exists in a very wide variety of forms, manifestations, on a varying scale. That form of crime is a dynamic phenomenon, impossible to describe in very general terms. It is extremely difficult to reliably and comprehensively assess the scale of its impact on the security of individual countries and of the international system [Wawrzusiszyn 2013]. The two main criminal offences related to the cross-border security of the external border of the EU in Poland concern illegal immigration and smuggling various goods.

The term 'illegal immigration' is used to describe third-country nationals who enter the territory of a Member State illegally by land, sea and air, which is often done by using false documents, or with the help of organised criminal networks of smugglers and traffickers [European Commission 2006/0402]. One form of tackling illegal crossings of national borders is the possibility to refuse entry (Table 6).

UIFU		1 2020-20	23				
Border section	2020	change 2020/2019	2021	change 2021/2020	2022	change 2022/2021	2023 1 st semester
Russia	273	-79%	132	-52%	303	+130%	80
Belarus	8,713	-74%	1,610	-82%	2,623	+63%	1,209

 Table 6. Foreign nationals refused entry at the eastern border of the Republic

 of Poland in 2020-2023

Source: Prepared on the basis of the Border Guard Headquarters data [Komenda Główna Straży Granicznej: 2021; 2022b; 2023a, 2023b]

-22%

5,967

-59% 29,106 +18% 22,578

The size and intensity of the phenomenon of illegal immigration is determined by a number of variable factors, e.g. threats to life and health, persecution on religious, political, racial or ethnic grounds, armed conflicts and globalisation processes (Suduł, 2012-2013: p. 374). At the Polish border, people are most frequently smuggled outside authorised border crossing points, i.e. by crossing the so-called 'green border'. It primarily results from the fact that smuggling people at border crossing points is virtually impossible. Therefore, people smugglers use routes difficult to access for border guards. The problem of illegal migration has become particularly serious at Poland's border with Belarus. As a consequence of political tensions between the EU and Belarus, having arisen in 2020 due to challenging the results of the Belarusian presidential election and to subsequent sanctions imposed by the EU, the national institutions of Belarus created an artificial migratory route for nationals of the Middle Those activities Eastern countries. caused a record-high level of apprehensions at the border with Belarus in 2021 (+1070%). In the following year, the number of apprehensions went down (Table 7). It resulted from decreased migratory pressure and enhanced surveillance at the Poland-Belarus border, i.e. the putting into use of the engineering and electronic border barriers, the former 187 km long and 5.5 m high. Whereas the physical barrier is not always effective as migrants are often well-prepared to overcome it (special anti-slip gloves, telescopic ladders, grinders, petards), in the case of the electronic border barrier any signals received by the surveillance centre allow sending patrols immediately to places where illegal border crossings are attempted. The migratory pressure at the Poland–Belarus border has increased again since May 2023. As regards the Poland–Ukraine border, in 2022 the fall in the number of apprehensions primarily resulted from the extraordinary simplification of border controls with regard to Ukrainian nationals (Table 7).

Ukraine

24,628

Table	7.	Persons	appr	ehended	by	the	Poli	ish	Border	Gua	rd a	at the	eastern
		border o	of the	Republi	c of	f Pol	land	for	crossi	ng th	ie b	order	illegally
		in 2020-2	2023 (1 st seme	ster)							

Border section	2020	change 2020/2019	2021	change 2021/2020	2022	change 2022/2021	2023 1 st semester
Russia	32	-76%	17	-47%	23	+35%	9
Belarus	246	+13%	2,877	+1070%	588	-80%	362
Ukraine	1,581	+46%	3,712	+135%	1,053	-72%	101

Source: Prepared on the basis of the Border Guard Headquarters data [Komenda Główna Straży Granicznej: 2021; 2022b; 2023a]

The falsification of travel documents is strictly related to illegal migration. In the case of foreign nationals failing to fulfil the necessary entry conditions, one option to enter the territory of the EU is crossing the border of the Republic of Poland by using false documents or documents which do not authorise such third-country nationals to cross the border. The scale of detected false documents is presented in Table 8. In the period in question, the highest number of such detections concerned Ukrainian nationals (2020 - 1,423,2021 - 3,325,2022 - 659) and Poland's border with Ukraine (2020 - 1,311,2021 - 3,426,2022 - 649).

Table 8. Falsification of documents – the number of persons using false documents authorising them to cross the border as detected by the Polish Border Guard in 2020–2023

YEAR	2020	change 2020/2019	2021	change 2021/2020	2022	change 2022/2021	2023 1 st semester
DETECTIONS	1,863	+55	4,460	+139%	1,249	-72%	401
-							

Source: Prepared on the basis of the Border Guard Headquarters data [Komenda Główna Straży Granicznej: 2021; 2022b; 2023a, 2023b]

As the European Union is an important market for illegal goods, smuggling poses a serious threat. In legal terms, smuggling primarily includes various forms of customs and border wrongs (tax offences and petty offences). From the point of view of finance, due to budgetary revenue foregone, smuggling affects the level of economic security [Księżopolski 2011]. At the eastern border of the Republic of Poland, smuggling activities most frequently involve the use of structural components of vehicles for road and rail transport, e.g. in cars or lorries – special double floors, double walls of vehicles, spaces in the interior, in the wheel tyres; in freight wagons – under the cargo carried or in empty spaces. The phenomenon can be illustrated on the basis of the performance of Polish border guards in combating cross-border crime (Table 9). It must be pointed out that, however, that it is hardly possible to estimate the actual scale and size of smuggling.

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Table	9.	Value	of	goods	detected	by	the	Polish	Border	Guard
		(and in	l coc	peration	with other	' serv	vices)	at the El	J's exterr	nal land
		border by type of item and by place of apprehension in 2020-2023								
		(estima	ated	data, PL	N)		-	-		

goods	2020	change 2020/2019	2021	change 2021/2020	2022	change 2022/2021	2023 1 st		
							semester		
	RUSSIA								
total	1,521,670	-52%	1,652,090	+ 9%	624,573	-62%	1,317,901		
vehicles	461,400	-32%	363,500	-21%	355,000	-2%	1,255,000		
alcohol	33,153	+710%	782	-98%	15,580	+1894	-		
cigarettes	759,545	-57%	504,520	-34%	103,687	-79%	14,147		
tobacco	187,589	-59%	714,368	+28%	94,307	-87%	-		
other goods	79,983	-72%	68,920	-14%	56,000	-19%	14,147		
			BE	LARUS					
total	30,872,418	-5%	54,054,530	+ 75%	5,878,497	-89%	8,522,507		
vehicles	2,251,100	-67%	5,315,500	+136%	3,554,755	-33%	2,781,000		
alcohol	116,944	+944%	14,420	-88%	7,259	-50%	4,835		
cigarettes	27,143,130	+469%	35,820,630	+32%	2,036,709	-94%	5,585,078		
tobacco	546,394	+681%	40,548	-93%	27,840	-31%	19,596		
other goods	814,851	-96%	251,934	+1479%	12,862,486	-98%	131,999		
			Uł	RAINE					
total	19,339,082	-44%	18,050,525	- 7%	15,814,049	-12%	10,002,031		
vehicles	7,919,840	-32%	7,893,397	-0.3%	11,846,750	+50%	6,176,500		
alcohol	42,193	+24%	20,441	-52%	14,261	-30%	4,517		
cigarettes	5,931,241	-40%	5,133,170	-13.5%	1,333,613	-74%	398,564		
tobacco	347,509	+4804%	348,240	+0.2%	243,948	-30%	59,940		
other goods	5,098,299	-60%	4,656,772	-9%	2,375,476	-49%	3,362,511		

Source: Prepared on the basis of the Border Guard Headquarters data [Komenda Główna Straży Granicznej: 2021; 2022b; 2023a, 2023b]

Cross-border crime is a dynamic phenomenon, taking various forms and posing a significant threat not only to the cross-border security of the Republic of Poland but also to that of the other EU Member States. Each day tests the effectiveness of border controls. The statistical data shown above with regard to combating cross-border crime at the borders with Ukraine, Belarus and Russia represent a measurable contribution to improving the state of security in the EU as a whole and prove the important role played by the Polish border services in ensuring cross-border protection and surveillance.

4. Challenges to the protection and surveillance of border traffic at the eastern border of the Republic of Poland

The border services of the Republic of Poland, responsible for border surveillance and border traffic control at the external land border of the EU, have been facing serious challenges with regard to arranging and ensuring

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appropriate border traffic controls. Those challenges arose in the aftermath of two crises combined: first, the COVID-19 pandemic, followed by the war in Ukraine and the related migration crisis, very different in nature. Whereas the COVID-19 pandemic pushed down the intensity of border traffic due to closures of border crossing points or to mobility restrictions and the main task of border guards was to ensure compliance with the limitations imposed, the war in Ukraine made a great number of people attempt to cross the border of the Republic of Poland in a short period. Preventing congestion at or near the border traffic while maintaining a high level of security was extremely challenging to the border services. The task was made no easier by the impossibility to verify the identities of migrants the majority of whom had no documents allowing their identification or by the provisions introducing the facilitation and simplification of border checks. Those crises also highlighted the significance of crisis management as a border management component. It is extremely important to alleviate and minimise the effects of crisis situations or emergencies at the border on account of the security of all the Member States. Reducing vulnerability to crises and events at borders requires detailed understanding of short-term and long-term risks as well as of existing vulnerabilities. It involves proper situational awareness and information sharing, systematic and regular risk analysis and quality control [Frontex, 2021]. As assessed by Frontex, crisis management will become a permanent feature of EU border management [Frontex, 2022]. Only cooperation across policy areas and authorities – at the national and EU levels, with non-EU countries and international organisations - with full implementation of the European Border Surveillance System (EUROSUR) and improved information and intelligence management and sharing through appropriate channels will enable effective prediction and prevention of the occurrence of crises and events [Frontex, 2021]. Neither is it doubtful that the EU needs a border security and control system that would address everrising mobility [Gajda 2018], especially in the face of the increased risk of an influx of illegal migrants across the Poland–Belarus border – migrants having become weapons in the ongoing hybrid attack. Although the border services have a variety of options at their disposal, unfortunately those are not always adequate to the actual problems faced (Table 10).

	WEAKNESSES
STRENGTHS	
- committee and well-trained border guards;	- insufficient organisational solutions adversely
- controls carried out on the basis of risk	affecting the quality of work performed by
analysis, risk profiling;	border guards;
- a pro-active approach to using innovative	- the shortage of personnel, mostly resulting in
methods for fighting cross-border crime;	longer waiting times for travellers before their
 technical conditions at border crossing 	border checks,
points enabling proper handling of the	 infrastructure not suitable to meet the actual
movement of persons (passenger traffic);	needs, e.g. insufficient numbers of lanes for
 efficient collaboration of border services; 	border checks, checkpoints;
- barriers: the engineering and electronic	 the removal at the eastern border of the
barriers at the border with Belarus; the	Republic of Poland of 'green lanes', intended
electronic barrier at the border with Russia;	for quick checks on persons without goods to
 increased awareness of the actual 	declare;
importance of border surveillance and	- overlapping control activities of border guards
border traffic control to the security of all the	(e.g. with regard to checking documents,
EU Member States;	entering data in IT systems, checks on
	baggage);
	- insufficient responses to the changing
	intensity of border traffic, resulting in delayed
	redeployment of the available forces, means
	and resources between directions of checks:
	- insufficiently comprehensible and/or hardly
	accessible information on the applicable rules
	to be followed at the relevant border crossing
	point by persons crossing the border.
	the lack of uniform procedures and quality
	standards for handling traffic – border checks –
	at all border crossing points.
	inadequate conditions of waiting for checks
	outside the premises of the relevant border
	crossing point (the lack of lovatories, parking
	crossing point (the lack of lavatories, parking
	INCAIS
- continuous modernisation of the	- sudden disruptions in smooth flows of border
equipment of border services;	tramic;
- iuriner digilisation of border controls;	- Poland's geopolitical location (with transport
- regular monitoring of migratory flows;	corridors being transit corridors as well)
- possible real-time access to information	- long land sections of the national borders with
based on a single search query to all	Russia, Belarus and Ukraine,
(operating, analytical and ancillary)	- increased migratory pressure,
databases;	- hybrid threats in the form of cybernetic attacks
- support in situations requiring enhanced	on Polish border infrastructure or the artificial
technical and operational assistance within	creation of migratory routes;
the tramework of collaboration with Frontex;	- problems in communication with the border
- the separation within the structures of the	services of the Republic of Belarus, Russia and
National Revenue Administration (KAS)	Ukraine with regard to ongoing information
of the Customs and Tax Service (Służba	sharing;
Celno- Skarbowa), as a separate,	

Table 10. The Polish section of the EU's external land border - SWOT analysis

Continued table 10.

In the next few years, the challenges at the Polish section of the EU's external land border will multiply; it is difficult to unambiguously and precisely describe today their future trends. But the most important non-military threats will include increased risks of illegal migration, cross-border crime and hybrid threats.

Summary

Every country has the right to border security. Secure and well-functioning external borders largely depend on effective border control. For both persons and goods, the crossing of the eastern border of the Republic of Poland involves the rights of free movement within the territory of the EU. If the Polish border should be inappropriately protected, such insufficient surveillance would adversely affect the security of all the Member States and their citizens. The objective of the article – pointing to the importance of border surveillance and border traffic control at the eastern border of the Republic of Poland to the cross-border security of the EU – is achieved and the hypothesis put forward is confirmed. Border surveillance and border traffic control, whether in conditions of 'normal' functioning of the Schengen area or in a crisis, requires significant engagement and involvement from

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and efforts by the border services of the Republic of Poland. As shown by the war in Ukraine, preceded by the COVID-19 pandemic, it is possible to cope with such difficult and unexpected challenges. The two crises have not undermined security in the field of responsibilities of the border services of the Republic of Poland or decreased the effectiveness of their actions; therefore, they have not jeopardised the feeling of security among Union citizens, which was confirmed by the results of the analysis carried out in the empirical part of the article.

European unity, paradoxically consisting in diversity, is the sum of various elements, e.g. those resulting from the open internal borders of the Schengen area; therefore, external border surveillance is of utmost importance to the EU's cross-border security. The awareness of the challenges faced and the knowledge of threats must be seen as the main conditions for finding solutions and implementing preventive measures. Threats to cross-border security may arise in any place and at any time, in various forms and circumstances, which makes the existence of effective border traffic control necessary at all times, regardless of the conditions, time of day or season. From the point of view of the cross-border security of the EU's external border in Poland, it is essential to seek more precise recognition and identification of threats and to rapidly react to such challenges since unaddressed challenges may transform into serious security threats.

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ARTICLES

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THE IMPACT OF THE CAPITAL MARKET ON ECONOMIC GROWTH IN LUXEMBOURG

Abstract

In this article, a detailed analysis of the impact of capital markets on economic growth in Luxembourg is presented, utilizing annual economic data. The study spanned from 1975 to 2020. As part of the analysis, an econometric model was constructed and estimated using the GRETL software. The results obtained confirm that the capital market has a statistically significant impact on Luxembourg's economic development. This research provides new insights into the role of capital markets in shaping economic growth dynamics, which is crucial for understanding the economic mechanisms in small, open economies like Luxembourg.

Keywords: GRETL, GARCH, OLS, economic growth, capital market.

JEL classification: G10

Paper type: Research article.

1. Introduction

The capital market serves as a vital conduit for amassing financial resources. In this process, issuers of financial instruments acquire capital that can be channeled into further corporate growth, while security purchasers have the opportunity to invest their surplus funds in ventures that

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promise future returns (Hartana, 2019, p. 41-42). For issuers, this mechanism is advantageous as it targets a broad spectrum of potential investors. Conversely, investors often possess a deep understanding of both the issuer and the market context, enabling them to make well-informed decisions about their investments, including evaluations of potential returns and prevailing investment trends within specific sectors (Omonov, 2021, p. 1-5).

The capital market predominantly deals with medium to long-term financial instruments, indicating that the timeframe for investment returns extends significantly beyond the initial capital transfer, typically exceeding one year. This characteristic fosters the aggregation of substantial capital within this market, significantly influencing economic processes (Tan, Yu and Ma, 2018, p. 3539-3545).

Economic growth encompasses a range of aspects: economic outcomes, the quantitative dynamics of input and output enhancement, and the underlying mechanisms driving growth, including societal interactions that maintain systemic stability. Consequently, the growth process incorporates both the functional architecture and the social interest system, as well as the institutional framework of the economy. Moreover, temporal shifts in production levels are also pivotal considerations (Bosma, Content and Sanders, 2018, p. 483-487; Kuznets, 2019, p. 25-29; McClelland, 2019, p. 53-63).

This article delves into the interplay between the capital market and economic growth, a subject that ignites considerable public debate. Opinions on this topic vary widely, with some emphasizing the detrimental effects of financial development on economic stability, while others highlight its beneficial role in capital allocation and productivity enhancement. Given the significant impact of the 2007-2011 financial crisis on perceptions of the capital market's benefits, this investigation is particularly salient (Alshubiri, 2021, p. 2-4).

The objective of this study is to assess the extent to which the development of the capital market influences long-term economic growth in Luxembourg, focusing on the period from 1975 to 2020. The research methodology commenced with a comprehensive review of pertinent literature, encompassing a broad array of sources and empirical data. The subsequent phase involved the collection and selection of essential statistical data. The final stage encompasses an econometric analysis, utilizing a specially developed econometric model for estimation purposes. This multifaceted approach aims to provide a thorough understanding of the capital market's role in shaping Luxembourg's economic landscape over this extended period.

2. The Impact of Capital Markets on Economic Development as Explored Through Scholarly Investigations.

The study of the capital market's influence on economic growth, as revealed through scientific investigations, provides a multifaceted view

of the interconnections between these two areas. Theoretical analyses have consistently pointed to a linkage between capital markets and economic growth, a connection that is further substantiated by empirical research into the financial markets' impact on economic development. Various theoretical frameworks support the hypothesis of a correlation between capital markets and economic growth (Pan and Mishra, 2018, p. 661-666; Guru and Yadav, 2019, p. 113-119; Batuo, Mlambo and Asongu, 2018, p. 168-172; Asteriou and Spanos, 2019, p. 238-243; Durusu-Ciftci, Ispir and Yetkiner, 2017, p. 290-305; Caporale, Rault, Sova and Sova, 2015, p. 48-57). According to the expanded Q-Tobin theory by W. Brainard, favorable stock market conditions are influential in boosting investment levels (Brainard, Tobin, 1968). This theory is supported by the causality derived from higher stock prices. B. Malkiel posits that the overall effect of stock exchanges on economic growth manifests through the wealth effect, which in turn triggers an increase in consumption levels (Malkiel, 1999). Additionally, literature in this field also suggests that a thriving economy positively interacts with stock exchanges, enhancing corporate credibility in capital markets and leading to a rise in individual share prices.

To delve deeper into this subject, the authors devised an econometric model, which was subsequently estimated using select research methodologies (Stulz, 2004, p. 146-147). A recurring theme in many published studies is the examination of relationships within specific country groups, taking into account factors such as:

- The maturity of the capital market;
- The level of economic development;
- Participation in the international community;
- The existing financial system.

The prognostic model proposed by R. Levin and R.G. King is a foundational econometric framework for analyzing the interplay between financial market development and the economic growth of various countries. This model, illustrated in Equation 1, is a regression model for economic growth (King, Levine, 1993, p. 717-736).

Equation 1: Economic Growth Regression Model Formula

$$Y_{it} = \alpha_0 + \alpha F_{it} + \beta X_{it} + u_{it}$$

Where:

- Y_{it} represents the real GDP growth rate per capita of the i-th country in period t;
- F_{it} is an indicator of the financial development of the i-th country in period t, encompassing metrics like the ratio of non-financial private sector loans

to total domestic loans, the ratio of the financial sector's current liabilities to GDP, and the ratio of domestic deposits to bank assets;

X_{it} – includes specific explanatory variables influencing the economic growth of the i-th country in period t, such as the ratio of foreign trade turnover to GDP, budget deficit to GDP ratio, and government consumption to GDP.

This model was estimated using the double least squares method. By substituting GDP per capita in the equation with other indicators, such as the rate of investment in GDP or the rate of capital per capita growth, the influence of individual financial development indicators on other variables can be examined. After analyzing data from 80 countries spanning 1960-1989, the authors utilized panel data to demonstrate a robust relationship between financial development and economic growth in individual countries (Caporale, Howells and Soliman, 2005, p. 166-175).

However, the impact of capital markets on economic growth is not universally positive. Some literature suggests that the liquidity of buying and selling shares on capital markets might negatively affect corporate governance, potentially leading to economic growth stagnation. Despite these mixed assessments, the majority of literature supports a positive correlation between capital markets and economic growth.

Over time, various models have been employed to understand the influence of financial/capital markets on different countries' economies (Jin and Boubakari, 2010, p. 14-19). From these studies, a pattern of observations emerges, leading to several collective conclusions about the tested model:

- Stock market capitalization has a strong and statistically significant positive impact on the growth of real GDP and physical capital, underscoring the need for firms to invest in long-term ventures within the real sector,
- A statistically significant correlation exists between financial market development and economic growth in the analyzed period,
- The relationship between total bank assets and the exchange rate has a substantial and statistically significant positive effect on real GDP growth.

3. A Detailed Empirical Examination of the Correlation Between Capital Market and Economic Growth

For the purpose of examining the influence of capital market progressions on the economic growth of Luxembourg, data were sourced from the following repositories:

- The World Bank;
- The Statistics Portal of the Grand Duchy of Luxembourg.

In the empirical investigation, annual datasets spanning from 1975 to 2020 were utilized. The inclusion of data prior to 1975 was not feasible as datasets suitable for econometric scrutiny were only available starting from 1975. Moreover, the research did not extend beyond 2020, a decision primarily driven by the unavailability of certain critical statistics in the recent years. This unavailability would necessitate the omission of other pivotal variables, potentially skewing the research findings.

Further, the decision to limit the data analysis up to 2020 was reinforced by the onset of the COVID-19 pandemic and the subsequent military invasion of Ukraine by the Russian Federation. These significant global events introduced unprecedented economic disruptions and uncertainties. Including data from the period affected by these events could potentially distort the research outcomes, given the atypical and extraordinary economic conditions imposed by the pandemic and geopolitical tensions.

Given the 46-year span of the study, the chosen temporal boundaries ensure a consistent and undistorted analysis of the capital market's impact on Luxembourg's economic growth. This period allows for a comprehensive understanding of the capital market dynamics and their correlation with economic development, while circumventing the confounding effects of recent global crises.

- The following statistics were used:
- 1. GDP- Gross Domestic Product;
- 2. CAPINV- capital investments;
- 3. HOUCON- consumption of households;
- EX- export of goods and services;
- 5. IM- import of goods and services;
- 6. GOV- government expenditure;
- 7. KAP- stock market capitalization;
- 8. NUMCOM- number of listed companies;
- 9. POP- number of population.

The financial data obtained are unified, and the unit of account is US dollars. Also, applying the deflator (2015) to them to get the true value, which is crucial when analyzing long-term data. Additionally, the collected data were converted to logarithmic form for computational purposes.

The foundational econometric framework employed for investigating the nexus between financial development and economic growth is the model formulated by R. Levin, R.G. King, and R. Barro, known as the Economic Growth Regression Model. This particular model lays the groundwork for the construction of customized models aimed at exploring the interplay between capital markets and economic growth (Filipowicz, 2019, p. 18-35). For the computational aspects of this research, the GRETL software was utilized, a choice driven by its robustness in econometric analysis. The model specifically developed for this study focuses on assessing the influence of capital markets on Luxembourg's economic progression. In this model, the dependent variable is represented by the natural logarithm of real GDP, a standard approach in economic modeling that allows for a more nuanced understanding of economic growth patterns. This choice is underpinned by the log-linear model's ability to transform non-linear relationships into linear ones, making it easier to interpret the impact of independent variables on economic growth.

Equation 2: Author's econometric model examining the influence of the capital market on economic growth in Luxembourg

 $lnGDP_t = a_0 + a_1 lnCAPINV_t + a_2 lnKAP_t + a_3 lnPOP_t + u_t$

Where:

InGDPt – stands for the natural logarithm of the real Gross Domestic Product. InCAPINVt – is the natural logarithm of capital investments. InKAPt – is the natural logarithm of real stock market capitalization. InPOPt – is the natural logarithm of the number of population.

In the construction of the model, the method of stepwise backward regression was employed. The estimation of structural parameters utilizing the least squares method is contingent on the advantageous characteristics of the estimators derived from the Classical Linear Regression Model (CLRM). Consequently, the Ordinary Least Squares (OLS) model was employed for estimation, with the outcomes presented in Table 1.
Table 1. The results of the OLS model estimation

OLS, using of	bservations 197	5-2020 (T = 46)				
Dependent va	ariable: I_GDP	· · ·				
HAC standar	d errors, bandwi	dth 2 (Bartlett ke	ernel)			
name	coefficient	std. error	t-ratio	p-value	significance level	
const	2.82591	0.118185	23.91	4.40e-26	***	
I_CAPINV	0.661781	0.0454424	14.56	5.11e-18	***	
I_KAP	0.131661	0.0259702	5.070	8.49e-06	***	
I_POP	1.48904	0.140666	10.59	2.00e-13	***	
Mean dependent var		2.539320	S.D. depe	ndent var	1.390739	
Sum squared resid		0.144504	S.E. of reg	gression	0.058656	
R-squared		0.998340	Adjusted	R-squared	0.998221	
F(3, 41)		7290.274	P-value(F)	4.51e-57	
Log-likelihood		67.27990	Akaike cr	iterion	-126.5598	
Schwarz criterion		-119.2452	Hannan-C	Juinn	-123.8197	
rho		0.423550	Durbin-W	atson	1.116825	
White's test f	or botoroskodos	ticity				

White's test for heteroskedasticity -Null hypothesis: heteroskedasticity not present Test statistic: LM = 9.10819 with p-value = P(Chi-square(9) > 9.10819) = 0.427348

Test for normality of residual -Null hypothesis: error is normally distributed Test statistic: Chi-square(2) = 0.161883 with p-value = 0.922248

Test for ARCH of order 1 -Null hypothesis: no ARCH effect is present Test statistic: LM = 0.948393 with p-value = P(Chi-square(1) > 0.948393) = 0.330129

*** - the variable is significant at the significance level of 0.01,

** - the variable is significant at the significance level of 0.05,

* - the variable is significant at the significance level of 0.1.

Source: Own study based on the GRETL program.=

The analysis conducted indicates that the estimated model exhibits heteroscedasticity, characterized by the Autoregressive Conditional Heteroskedasticity (ARCH) effect. Additionally, the p-value for the normality test of the residuals exceeds 0.1, suggesting an abnormal distribution of residuals, evidenced by a pronounced 'long tail' in the empirical distribution. This implies that models relying on this estimation method do not conform to the conventional assumptions of classical regression.

Efforts to estimate the model using alternative methods like the Cochran-Orcutt, Prais, and Generalized Least Squares (GLS) approaches were unsuccessful in yielding satisfactory results during testing. These findings underscore that the random component in the model, particularly for financial series estimation, might not adhere to the normal distribution assumption, rendering the least squares estimate inaccurate. In most instances, the variance estimates proved to be flawed, leading to a weakened efficacy of commonly employed statistical tests. Consequently, it becomes imperative to identify an alternative estimation method that is more suited for the problem being studied (Maciejewska, 2008, 534-536).

Generalized Conditional The Autoregressive Heteroskedasticity (GARCH) model emerges as a viable alternative for predicting the volatility of financial time series, especially in scenarios marked by fat tails or variance clustering in rate-of-change distributions. This phenomenon is often attributable to the presence of outliers in financial time series. One-time anomalies are particularly critical as they represent significant, isolated deviations in the predicted value of the phenomenon being studied within a single period, without influencing the values in subsequent periods (Domańska, 2020, p. 122-128). The results derived from the GARCH model estimations are detailed in Table 2.

Table 2. Model: GARCH estimation, observations used 1975-2020 (T=46). Dependent variable (Y): InGDP. Standard errors of Quasi-Maximum l ikelihood

Elkelmood											
GARCH, using ob	servatio	ons 197	'5-2019	(T = 45)						
Dependent variab	le: I_GE)P									
QML standard err	ors										
name	coefficient		std. error		z	p-value		significance level			
const	2.81582		0.124681		22.58	6.20e-113		***			
L_CAPINV	0.642165		0.0644467		9.964	2.18e-23		***			
I_KAP	0.144600		0.0374041		3.866	0.0001		***			
I_POP	1.48705		0.155694		9.551	1.28e-21		***			
alpha (0)	0.00226544		0.00102692		2.206	0.0274		**			
Alpha (1)	0.294209		0.4083	20	0.7205	0.47	12				
Mean dependent var		2.539320		S.D. dependent var		r	1.3907	739			
Log-likelihood 6		67.879	37.87982		Akaike criterion		-121.7	7596			
Schwarz criterion -10		-108.9	9592	Hannan-Quinn			-116.9	9645			
Unconditional erro	or variar	1ce = 0.	.003209	979							
Test for normality	of resid	ual -	/ distrib	uted							

lull hypothesis: error is normally distributed

Test statistic: Chi-square (2) = 0.175263

with p-value = 0.916098

*** - the variable is significant at the significance level of 0.01,

** - the variable is significant at the significance level of 0.05,

* - the variable is significant at the significance level of 0.1.

Source: Own study based on the GRETL program

The estimation of model parameters can effectively be performed using the maximum likelihood estimation method. This technique enables the derivation of asymptotically efficient parameter estimates, provided the distribution's normality assumptions are met. For estimating GARCH models, the Quasi-maximum-likelihood (QML) methods are typically the standard. What's advantageous about this approach is its ability to yield consistent parameter estimates, even in instances where the distribution deviates from normality (Fiszeder, 2009, p. 21-24). This contrasts with the outcomes of normality tests for distributions in model estimations utilizing Ordinary Least Squares (OLS), where GARCH models distinctly address the characteristic "fat tail" phenomenon often observed in financial data time series analysis.

Upon examining the data presented in Table 2, it's evident that all the explanatory variables hold statistical significance. Notably, variations in capital investment exhibit a substantial positive influence on the fluctuations of the economic growth rate. Additionally, alterations in market capitalization demonstrate nuanced positive impacts on the economic growth rate's variability. From these observations, it is plausible to infer that the necessary conditions for affirming the capital market's positive influence on Luxembourg's economic growth are established. This conclusion is underpinned by the statistical significance and nature of the impacts observed from the capital market variables in the analysis.

Conclusion

The empirical analysis conducted provides clear evidence of a correlation between the evolution of capital markets and the economic growth of Luxembourg. In the interpretation of the developed model, it is observed that under the condition of constancy in other variables, an incremental rise of one percentage point in capital investment is associated with an approximate 0.64 percentage point increase in the GDP's value. This indicates a notable and direct impact of capital investments on the country's economic output.

Similarly, with other factors held constant, a one percentage point escalation in market capitalization is linked to an estimated 0.15 percentage point growth in GDP. This relationship underscores the significant role that market capitalization plays in bolstering the national economy, albeit with a less pronounced effect compared to direct capital investments.

Moreover, the analysis reveals that a one percentage point rise in the population correlates with an approximate 1.49 percentage point increase in GDP. This suggests that population growth in Luxembourg has a substantial and positive impact on economic expansion, potentially due to increased labor force participation, consumer spending, and demand for goods and services.

The assumption of stability in other variables is crucial for isolating the specific impacts of capital investment, market capitalization, and population growth on GDP. However, it's important to recognize that in real-world scenarios, these variables often interact with each other and with other economic factors, potentially leading to complex and multifaceted impacts on economic growth.

Overall, these findings contribute valuable insights into the dynamics of Luxembourg's economy, particularly highlighting the influential role of capital market development and demographic changes in shaping the country's economic trajectory. The results underscore the importance of fostering a robust capital market and managing demographic trends as key strategies for economic development.

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