Importance of VAT digitization for income disclosure in section F-construction – a case for Poland

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Abstract. The ongoing digital transformation is visible in the tax world. In Poland, the process that began in 2016 is defined by the authors as the VAT digitization process. The solutions introduced by the legislator have primarily been aimed at curbing tax evasion and at authorizing efficient audit and as a result, tightening of VAT tax system. The purpose of the paper is, thus, to highlight the importance of VAT digitization in disclosing income in section-F of the economy – construction and in section-G – wholesale and retail trade; repair of motor vehicles, including motorcycles. There are several reasons these sectors were chosen. In 2016, the Ministry of Finance indicated that the construction industry was characterized by a high risk of tax fraud (making it a so-called sensitive industry). The same year, construction, along with trade, became the sectors affected most by the shadow economy. The conclusion was based on the observation of the construction sector value added in the period of 2017-2019 set against the previous period of 1995-2016 and compared with the trade value added in 1995-2016 and 2017-2019 respectively. The study has found a visible value-added increase, which was reasonably greater than what would have resulted from the economic boom, proving that the income which has so far been subject to tax fraud has been duly demonstrated. Research hypothesis, VAT digitization has a greater impact on disclosing income in section F than in section G, has been positively verified.

1. INTRODUCTION

The ongoing digital transformation brings on the new reality. Artificial intelligence elicits both quick and effective work along with fewer financial resources involved, as well as forms of control which were previously unknown (Gupta et al., 2017). The digital revolution and the new technologies it offers open up opportunities for improving work comfort and results, and running a business, or even everyday life (Śledziewska & Włoch, 2020). Recent years have also shown a clear improvement in the use of technology in the areas of government administration in Poland - this phenomenon is also visible in tax world (Kowal & Lichota, 2020). The use of new, developing technologies will redefine the world of tax systems, with tax authorities becoming increasingly dependent on the storage and analysis of digital tax data (Deloitte, 2018).

Basic information on the analyzed sections of the Polish economy in terms of the impact of VAT digitization is presented in Table 1.

Table 1

Basic information on the analyzed sections of the Polish economy

Economy section	Classification of activities by divisions	Number of enterprises in the section in 2016 and 2019		Gross domestic product generated in a given section in PLN (million)		
		2016	2019	2015	2016	2019
F	41 - Construction work relating to the erection of buildings 42 - Works relating to the construction of civil engineering structures 43 - Specialized construction work	494 724	584 275	127 853	115 457	144 108
G	45 - Wholesale and retail trade in motor vehicles; repair of motor vehicles 46 - Wholesale trade, except of motor vehicles 47 - Retail trade, except retail trade of motor vehicles	1 044 727	986 789	282 859	289 624	355 305

Source: Own study based on Statistics Poland (GUS) data (www 1).

The analyzed sections - construction and trade, were not selected randomly. In the 2016 annual report, the Ministry of Finance indicated construction sector as an industry with high risk of tax fraud[1] (Ministry of Finance [Ministerstwo Finansów], 2017). Construction is a branch highly saturated with the gray economy, including both the workers employed illegally at construction sites, especially in construction of residential buildings, and providing private individuals with many construction and renovation services. It can be seen that the current system itself supports activities that create a gray area in construction. The main criterion for selecting a contractor for construction works or finishing services is the price. To obtain the contract, the best price offer should be quoted. Neither the quality nor the method the contractor uses to settle accounts with employees, subcontractors or the state budget matter (Network Poland, 2016). The shadow economy in this section constituted 35.2% and 37.1% of GDP in 2015 and 2016, respectively (own calculations based on IPAG and Statistics Poland data). Trade, along with construction, are the sectors which have become the most affected by the activities of the gray economy. The gray area in trade consists

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[1] The term tax evasion is used as a synonym for tax fraud in this work. The authors mean: illegal (knowing and unconscious) action or failure to act in order to reduce the tax burden and / or obtain other benefits.

of numerous and unrelated activities. The identified commercial activities include: tax-free street trade, peddling of beverages at train stations and beaches, trafficking in smuggled and illegally manufactured cigarettes, unregistered sales at mass events, including concerts of light music, commission services, repair and service of vehicles in workshops cars, etc. The shadow economy in the sector constituted 31.8% and 33.46% of GDP, in 2015 and 2016, respectively (own calculations based on IPAG and GUS data). What is disturbing is the fact that over 1/3 of GDP is generated in these two sections (with the predominance of section F) in the shadow economy. In order to prevent tax evasion in value added tax, i.e. to build an effective control and management system, a series of measures have been systematically being taken (since 2016). Solutions, classified by the authors as part of the digitization process, have been introduced to bring change to the method of tax settlements and the communication between the state and the taxpayer. Such reforms are expected to reduce tax fraud, which would result in the increase in tax revenue. From the statistical point of view, this should also simultaneously raise the added value of this section.

The considerations estimate the impact of VAT digitization process on disclosing income in section F - construction. To put it into perspective data from section G - wholesale and retail trade; repair of motor vehicles, including motorcycles is complied. For the purposes of the considerations, a research hypothesis is formulated as follows: [H1]: *Digitization of VAT has a greater impact on the disclosed income in section F than in section G.*

The composition begins with a review of Polish and foreign literature in the field of VAT emphasizing its significant share in the Polish budget, as well as in other EU Member States. Despite its fiscal efficiency, it has been proven that VAT is vulnerable to tax fraud, especially in intra-Community transactions. Solutions which potentially may eliminate or reduce unfair practices have been characterized as part of the digitization of VAT. Further, the paper focuses on empirical research in order to determine the effectiveness of the solutions with regard to adequate income disclosure in sections F and G. The following data has been used for empirical research: total gross value added, value added in construction, value added in trade, employment and investment outlays in both construction and trade. Value indicators in a year-on-year mode, are used to analyze 1995-2019 data provided by Statistics Poland, along with the data acquired from the Ministry of Finance concerning information on VAT revenues in the construction sector. The authors emphasize that the topic is new, but also significant pertaining to VAT functioning in the entire EU. Progressive digitization may be a tool to fight the VAT gap in the EU.

2. LITERATURE REVIEW

The VAT tax, which is discussed in this article, is a consumption, indirect, state tax (Gomułowicz & Małecki, 2002). According to RM Bird, the introduction of VAT *is unquestionably the most successful fiscal innovation of the last half-century (...), perhaps the most economically efficient way in which countries can raise significant tax revenues* (Mirrlees, 2011). What should be emphasized as an extremely important in terms of VAT system is its efficiency, its neutrality for entrepreneurs (including economic neutrality) (Talik, 2019), manageable service (Bełdzikowski & Kuzińska, 2018) and its resistance to tax evasion. Tax on goods and services should not trigger entrepreneurs or consumers to take actions which could be justified mainly on tax grounds, as this would prove that the tax is not economically neutral (Bełdzikowski & Kuzińska, 2018).

VAT (*Value Added Tax,* in Polish statutory nomenclature - *goods and services tax*) was first introduced in France in 1954 (*Tax sur la valeur ajoutée, TVA*) (Polish Economic Institute [PIE], 2019). Since 1993 VAT has become an important income source for the Polish state budget (Kowal, 2019). In 2017, 2018 and 2019, VAT was accounted for: 42.3%, 42.4%, 41.2% respectively, of all taxes received by the Polish state (Kowal & Lichota, 2020). The tax is also an essential part of income in other European Union countries (Krzikallová & Tošenovský, 2020).

After 1993, Polish solutions were being gradually adjusted to the EU directives (Karolak, 2011). In 2004 new law on value added tax was passed (the Act [Ustawa] of 11 March 2004...) and came into force on the day of Poland's accession to the European Union (Olkowska, 2008). VAT mechanism takes the tax out of the business entity and passes it onto the consumer (OECD, 2017). VAT is tax deductible for any entrepreneur, who is receiving goods or services (with VAT included in their price). An individual, being the consumer, has no such right (Nykiel & Sęk, 2018). Though based on taxpayers' self-control VAT system turned out to be susceptible to fraud (including carousels) (ZPP, 2014), with one of the causes being the complexity of the mechanism of settling taxpayers with tax authorities, which significantly limits its efficiency (Neal, 2007). The benefits of tax fraud are greater in areas of economic activity where VAT system offers preferences: 0% (within the EU) or reduced rates. Intra-Community transactions carried out in various countries, and thus also jurisdictions, limit tax authority's effectiveness (Negrescu & Comănescu, 2007). Although there is a variety of cooperation methods in this matter, their effectiveness is limited essentially by crime rate being higher than that of fiscal inspections. (Bełdzikowski & Kuzińska, 2018). In this context, it is extremely significant for the fiscal institution to verify the transaction in real-time.

The PWC organization indicates two important factors reducing budget revenues from taxes (PWC, 2014):

− grey area, i.e. economic activity not disclosed to state authorities in order to evade tax,

− strictly criminal activity aimed at extorting financial gains by abusing the construction elements of VAT (the so-called tax carousels) (Buszko, 2017).

Taking into accountthe analysis of the subject literature, it is possible to distinguish typical causes of the grey area. V. Tanzi (Tanzi, 2002) lists:

- a complex, contradictory legal system (the company is not able to properly interpret legislation and is somewhat naturally incorporated into the grey area),
- too many financial strains related to running a business, e.g. taxes,
- tax liabilities - the level of tax morality,
- a high level of organized crime.

In a survey conducted in the first half of 2017 among 200 Polish entrepreneurs almost 1/4 of the surveyed clearly agreed that VAT regulations stimulate activities in the grey area, while the answer 'rather yes' was indicated by 27% of respondents. A smaller part of the surveyed enterprises replied that the regulations did not cause the escape to the unobservable economy (Furman, 2019).

Since 2016, due to a growing VAT gap, which in 2013, 2014, 2015, 2016 amounted for: 27.0%, 24.4%, 24.7%, 20.4% of potential proceeds respectively (VVTL) (Poniatowski et al., 2019), (Poniatowski et al., 2020) Polish Ministry of Finance has been systematically introducing solutions, regarded as a part of the VAT digitization process.. In the analyzed period 2017-2019 a Unified Control File (JPK, Polish equivalent to SAF-T) (Macudziński, 2018b), STIR tele informatic system (Macudziński, 2018a), split payment (SP) mechanism (Bielawska & Pauch, 2016), *white list* and online cash registers were introduced (Table 2).

Most Polish enterprises were required to prepare SAF-T in 2017 and 2018 (PWC, 2017). The advantage of the solution is a quick identification of errors and inconsistencies in the reports filed by the entrepreneurs. Currently, algorithms and advanced so-called 'hard analytics' are being used to analyze the data conveyed in VAT registers, which provide thorough verification of the delivered information without engaging any officials. The process allows to immediately capture discrepancies and abnormalities occurring in tax settlements (Zychowicz, 2017).

Table 2

VAT digitization tools (2017-2019) – synthetic perspective

Tool	Aim of introduction	Date of introduction
JPK_VAT	Eliminating the nuisance of controls, the number of random controls, the cost of meeting tax obligations, tax gap and the time spent on data analysis.	Since July 1st, 2016 - for big enterprises; Since January 1st, 2017 – for small and medium enterprises; Since January 1st, 2018 – for micro enterprises; In 2020 a new JPK_VAT – including VAT registers and declaration.
STIR	Counteracting using the financial sector for fiscal fraud. Limiting VAT gap and fighting VAT carousels.	January 13th, 2018
SP	Sealing the system and reducing VAT gap, ensuring entrepreneurs' security during transaction.	Since July 1st, 2018 – voluntary; Since November 1st, 2019 r. – obligatory for 150 products and service groups.
White list	Tightening VAT collection system and minimizing a possible risk of participation of honest taxpayers in VAT carousels.	September 1st, 2019
Online cash registers	The ability to monitor sales remotely, fight the shadow economy and strengthen fair competition among entrepreneurs.	Since May 1st, 2019 – voluntary; Since January 1st, 2020 - obligatory for individual industries.

Source: Original study based on: (Polish Economic Institute [PIE], 2018), (Kobiela & Nesterak, 2018), (Kowal, 2020), (Macudziński, 2018a), (www 2).

Since January 2018 there has been a real-time 'early warning system', which is based on big data analysis: STIR, warning of VAT extortion (Hoza & Żabka, 2018). The system has been introduced to counteract using financial sector for fiscal fraud (including 'VAT carousels') (Macudziński, 2018a). If any irregularities are found the bank informs the fiscal authorities, which in turn may obligate the bank to block the account in question for 72 hours [PIE, 2018]. In 2018 STIR received over 8 billion reports about such transactions, with over 29 000 subjects with increased risk of exploiting financial sector for tax fraud were classified. (Ministry of Finance data – unpublished).

In the explanatory memorandum to the law concerning split-payment mechanism the legislator enumerated the following aims:

- protecting consumers – improving their legal and tax situation.
- transparency of tax settlements, greater tax safety, maintaining competition rules and security of running a business (Government project… [Rządowy Projekt…], 2017).

The core of the mechanism is that the invoice is paid by the consumer onto the provider's account, or it is settled in any other possible way. While the rest of the payment, the amount corresponding to VAT value, is transferred onto a VAT account (a sub-account) (Kowal, 2019). Split-payment mechanism is targeted at minimizing the phenomenon of a disappearing taxpayer – the subjects cannot disappear while making a transaction aimed at extorting VAT, therefore they cannot keep the tax for their own benefit (Ochman, 2019). This mechanism is designed to limit illegal activities in the form of tax carousels, which have become notorious in intra-community transactions. The advantage of using the SP mechanism is the

non-application of the provisions on joint and several liability for tax liabilities of a dishonest contractor (Palej, 2018).

The VAT digitization process continued in 2019 when the white list and online cash registers were implemented in Polish business practice. The white list, a list of entities registered as VAT taxpayers, enabling quick access to up-to-date data on contractors should contribute to increasing safety and certainty of business transactions. As a result, this tool ought to minimize the risk of a taxpayer's unaware participation in VAT fraud.

The main benefits of online cash registers include: reducing the shadow economy, increasing the transparency and competitiveness of the economy, and real-time data analysis. The experience of other countries (Hungary, Croatia or Bulgaria) shows that the implementation of online cash registers increases VAT revenues permanently, thus reduces the level of VAT gap. The effectiveness of online cash registers in Bulgaria is demonstrated by the fact that in the first year after their introduction, the declared turnover increased by 20%. According to the data of the Croatian Ministry of Finance, after the first year of operation, Croatian entrepreneurs revealed a turnover which was 17.88% (over EUR 1 billion) higher than in the previous year. There were also a few occasions where some restaurants reported a turnover higher by 900% In 2014 and 2015 in Hungary, VAT revenues increased by 8% and 7%, respectively, and online cash registers played their significant role in this achievement - they generated approximately HUF 60 billion in tax revenues (approx. EUR 190 million) (KPMG, 2020).

The digitization process in Poland is continued, as shown by the elimination of paper VAT returns in 2020, the planned elimination of paper invoices and their replacement with structured e-invoices in the near future.

Evading taxes carries a great number of negative social consequences, just a few being: a decrease in budget revenues, unfair competition and injustice, lack of motivation to lawfully obey obligations (Pauch, 2015). Information constraints determine the opportunities for tax avoidance and evasion (Gupta et al., 2017). The tools introduced as part of the digitization of VAT should reduce tax evasion, which will not only be reflected in the increase in tax revenues, but also in the added value of individual industries (sections), especially those with a high level of tax gap.

3. METHODOLOGY

The main objective of the empirical research is to determine the effectiveness of decisions regarding the changes in the organization of VAT collection for the purpose of disclosing income information. In practice, it is extremely difficult to estimate the size of the grey economy, therefore, sometimes research of this kind has to be conducted on the basis of circumstantial evidence or observation of the subjects like the assessed one. The convention has been used in the study. Conclusions have been formed after the observation of the value added in construction in 2017-2019 in comparison with the previous period 1995-2016, as well as with the value added in trade in 1995-2016 and 2017-2019.

Descriptive statistics have been determined for the series of indicators of the dynamics of the total value added and the value added in the construction and trade section (Table 3). This is the real data. In 1995-2016, the development of both construction and trade was slightly slower than the overall economy. The average growth of the total economy constituted 3.90% annually, while construction industry grew by 2.89% per annum, and trade sector - by 3.74%. On average, the dynamics of construction and trade happens to be strongly related to the dynamics of total value added – with correlation coefficients slightly below 0.5. These are not high values, but given that they relate to the series of dynamic changes, they can be considered as indicative of an relevant impact of the entire economy on construction and trade.

Table 3

Descriptive statistics for the dynamics indicators 1995-2016

Added value	Statistics		
	Average	Standard deviation	Correlation coefficient
Overall	103.90	1.55	-
Construction	102.89	6.68	0.4837
Trade	103.74	2.97	0.4525

Explanations: correlation coefficients between the value added of the construction and trade sections and the total value added.

Source: own study based on the data of Statistics Poland.

Table 4

Dynamics indicators for 2017-2019

Added value	Year		
	2017	2018	2019
Overall	104.7	105.3	104.6
Construction	106.5	111.8	99.7
Trade	105.7	105.2	104.7

Source: own study based on the data of Statistics Poland

2017-2018 brought a clear improvement in the economic situation in construction and a slight improvement in trade (Table 4). Worth noting is the fact that, in general, the period 2017-2018 was good for the economy, as the increase in the value of a given total amounted to around 5% a year, much more than the average in the years 1995-2016. The basic problem, however, is how, in theory, the overall economic situation should affect gross value added in 2017-2018, and what is the empirical impact.

Another issue requiring clarification is the 2019 situation, when the growth dynamics of the added value of construction was negative. Comparing the theoretical and empirical repercussions should allow us to determine the effectiveness of tax digitization in terms of income disclosure. Empirical research has been divided into several stages:

1. General presentation of the dynamics of total value added and value added in Sector F - construction and sector G - trade. The part focuses on the dynamics of the value added in the selected sectors in 2017-2019 set against the period from 1995 to 2016.

2. Determining the co-integration between the value added in both construction and trade sectors and the total gross value added. This part aims to validate the conclusion by means of a regression model. A cointegration study has been conducted allowing to distinguish between real and apparent correlations (Engle & Granger, 1987).

3. Determining a regression model between the value added in construction and trade sectors as well as the total gross value added for the years 1995-2016:

$$i'_{construction} = a_0 + a_1 i_{GVA}$$

$$i'_{trade} = a_0 + a_1 i_{GVA}$$

$i_{construction}$, i_{trade} – dynamics indices in construction and trade section

i_{GVA} – gross value added dynamics indices;

a_0; a_1 – structural parameters of the model.

The model provides means to determine the impact of the total gross value added dynamics on the dynamics of value added in the construction and trade sectors. Based on the obtained models, theoretical dynamics of value added in construction and trade are estimated. The other projection concerns the 95% confidence interval of the estimate for 2017-2019, as based on the assumption of the dynamics of the realized total gross value added:

$$i'_{construction}(2017, 2018, 2019) = a_0 + a_1 i_{GVA}(2017, 2018, 2019)$$

$$i'_{trade}(2017, 2018, 2019) = a_0 + a_1 i_{GVA}(2017, 2018, 2019)$$

Then, the actual dynamics of value added in the construction and trade sectors is compared with the estimated values basing on regression models. These values are treated as evidence for the potential effectiveness of tax system changes introduced since 2017.

$$tax\ efficency\ for\ construction = i_{construction}(2017,2018,2019) - i'_{construction}(2017,2018,2019)$$

$$tax\ efficency\ for\ trade = i_{trade}(2017,2018,2019) - i'_{trade}(2017,2018,2019)$$

4. After observing significant differences between the value added dynamics in construction sector and the expected dynamics, as based on the regression model, the attempt to explain the discrepancy is made. To do so, the authors analyze the connection between employment and investment outlays and the value added in construction. Quite differently, trade sector presents itself with what is determined as a comparative relationship between the employment and investment outlays and the value added in the sector.
5. The last point of the research is to examine the relationship between the dynamics of value added in construction and VAT revenue from the sector.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Dynamics of the increase in the value added in construction and trade

Years 1995-2019 were terrific for the Polish economy. It developed steadily; the total value added grew at an average rate of 4.01% per year with a standard deviation of 1.49 pp. The fastest improvement took place in 2006 and 2007, when it amounted to 6.1% and 7.1%, respectively. Even the subsequent global crisis did not result in a negative growth rate, as in 2013, the worst year in case of Poland, when the economic growth amounted to 1.2%.

Against this background, the growth of the value added in trade looks slightly worse. In the assessed period the sector experienced an average growth of 3.91% per annum, with the standard deviation of 2.84 pp. In the best year for trade, which was an exceptional one, 1996, there was an increase to 11.1%. 2006-2010 brought a quite high growth rate which oscillated around 5-6% annually. The worst year for trade was 2011, when it recorded a decline in value by 2.4%. In the entire analyzed period, a total decrease in the value added in trade was recorded 4 times.

Construction is characterized by much more volatile growth than trade. The average growth rate of value added in construction was 2.90% with a standard deviation of 6.70 pp. Thus, with a clearly weaker growth in the value added in construction as compared to trade. Construction is characterized by over 2 times greater differentiation in growth than trade and more than 4 times greater fluctuation than the entire economy. The span of growth indexes of value added in construction was very wide, as in 2016, the worst year for the sector, there was a decrease of 8.1%, and in the best year 2011 – an increase of 14.0%.
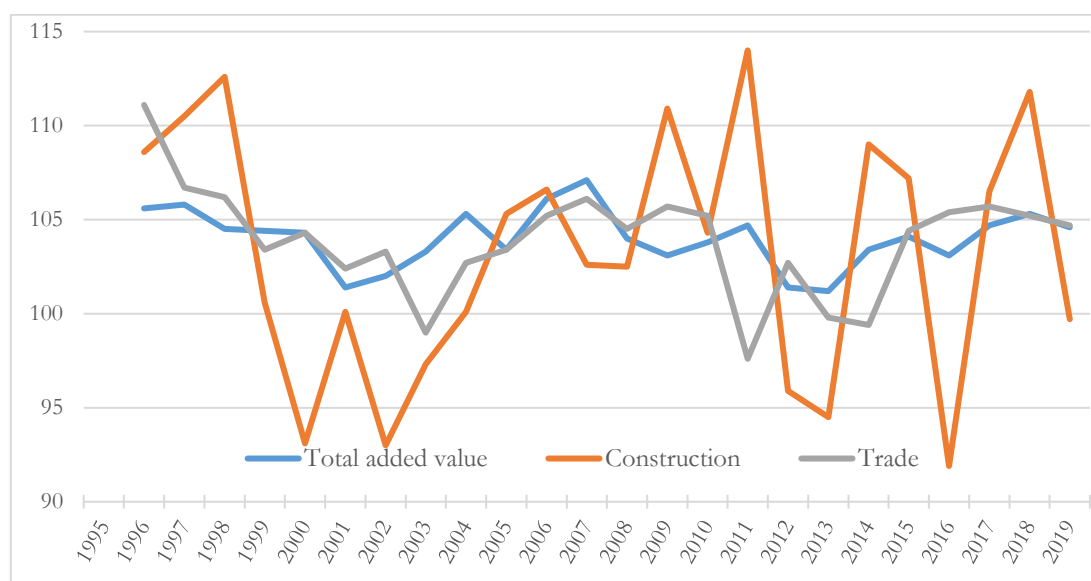
Figure 1. Total value added, construction and trade indices, constant prices, previous year = 100%
Source: original study based on data from Statistics Poland.

Figure 1 shows clearly the high volatility of the value added in construction, where systematically a very poor year follows a very good year, and vice versa, a very poor year follows a very good year. The value added in trade is characterized by significantly smaller fluctuations. On the other hand, minor fluctuations in total value added are the most expected here, as they show the total result for the entire economy. From the paper's point of view, it is important to observe the economic situation in 2017 and 2018. It turns out that the period presents itself with an above-average growth rate. Total value added increased by 4.7% and 5.3%, respectively, while in trade - 5.7% and 5.2%, and in construction - 6.5% and 11.8%. Moreover, the following year, 2019, which was a very good one for the economy, brought an improvement in total added value of 4.6% in construction and 4.7% in trade. At this point, it is clear that the results for construction sector are worse, with a 0.3% drop in value.

4.2. Modelled perspective of value added in construction and trade depending on total value added

Time series of the levels of gross value added in general and the time series of the value added in both trade and construction turn out to be not stationary. Even though, their first differences are (table 5).

Table 5

Stationarity and cointegration tests

Series	I (0)		I (1)		Cointegration test	
	t-stat	p level	t-stat	l level	t-stat	p level
GVA in total	-0.6144	0.8441	-3.8032	0.0112		
Trade	-2.0063	0.2822	-3.8045	0.0093	-3.7831	0.0006
Construction	-0.6258	0.8462	-3.5798	0.0151	-1.7716	0.0729

Source: original study.

This is a classic situation observed in the economic time series. Additionally, the time series of value added in trade and total gross value added constitute a cointegrated series (p=0.0006). On the other hand,

the time series of the value added in construction and the total gross value added can be considered as cointegrated, but the significance level is not as categorical (p = 0.0729). The results for construction are a consequence of a less stable growth pace in this sector of economy. Such results may be considered as expected. Generally, it can be assumed that the series cointegration allows for the credibility of the correlation analysis, an unlikely fact which is used in the following part of the study.
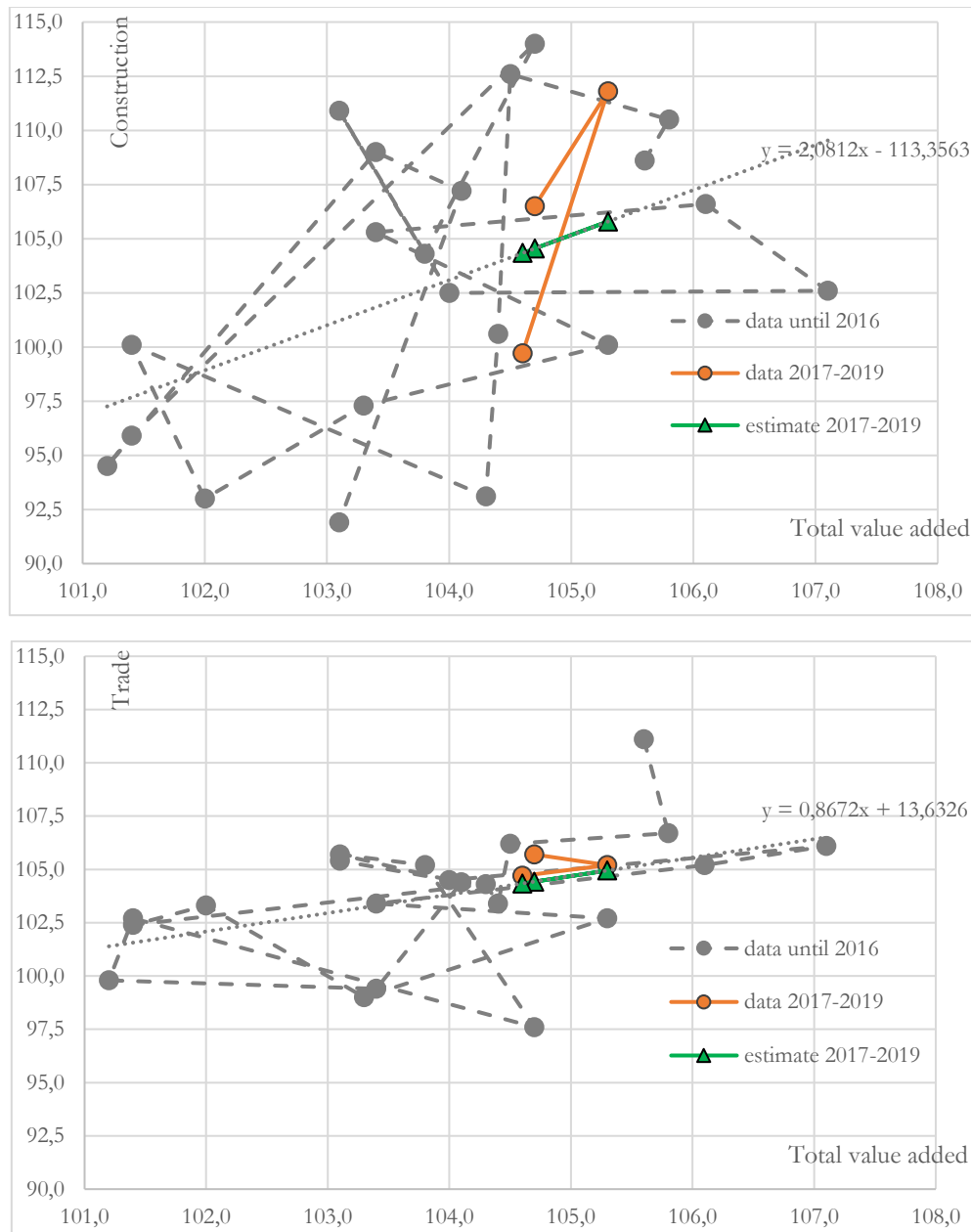

Figure 2. Relationship between the value added in construction and trade and total value added
Source: original study based on data from Statistics Poland.

For the data from 1995 to 2016, regression models have been determined to assess the value added in construction, depending on the total value added and the value added in trade, depending on the total value added (Table 6). The obtained regression models are statistically significant, which means that the total value added has a statistically significant influence on the value added in both construction (p=0.0263) and trade

(p=0.0394). Based on these, the theoretical value added in construction and trade is estimated, with a value added total increase of 104.7,105.3 and 104.6, corresponding to the total gains in value added in 2017-2019. These values are then contrasted with the actual increase in value added in the sectors.

Table 6

Regression models of construction and trade value added depending on the total value added

	a_0	a_1	y'(x=104.7)	y'(x=105.3)	y'(x=104.6)
Construction	-113.36	2.08	104.55	105.79	104.33
	0.2220	0.0263	±3.00	±3.59	±2.92
Trade	13.63	0.87	104.43	104.95	104.34
	0.7416	0.0394	±1.36	±1.63	±1.33

Explanation: a_0, a_1 - the first number in the cell structural parameters of the models, the second number in the cell significance level; y'(104.7), y'(105.3), y'(104.6) – estimated value of construction / trade with a total value added of 104.7, 105.3 and 104.6 (the first number in the cell) together with the 95% confidence interval (the second number in the cell).
Source: original calculations.

As mentioned above, construction and trade have been doing well economically in recent years. Moreover, taking into account the changes in the entire economy, the situation in construction becomes highly interesting. The regression model linking the indicators of the construction value added with the ones of total value added shows that the estimated value of the construction growth index for 2017 had been amounted to 104.55±3.00, which in fact was 106.5, and for 2018 - 105.79±3.59, in fact being 111.8.

The above-average increase in the value added for construction in 2017 and 2018 means that there were factors that had not been present previously, which contributed to an increase in production in these branches of the economy or resulted in disclosing a part of production that, so far, had been performed in the grey economy zone. This is especially true for 2018, when the actual increase in value added in construction exceeded 95% confidence interval of the estimated growth. A likely justification includes notions related to taxes digitization process. In 2019, however, construction industry recorded a value drop of 0.3%, while the regression model shows a theoretical value of + 4.33%. 2019 was quite a challenging year for the construction industry as it experienced 3 serious market slumps. Firstly, the heatwave in May and June caused the work to slow down. September emerged to be the second crisis point, when companies struggled with payment gridlocks. The third crisis period was the November cluster of holidays combined with heavy rains. In such conditions, it was difficult to improve the added value of construction, the more so because the benchmark was the very good previous year, 2018.

For the trade value added, there were no such significant differences between the estimated and realized values. The estimated values for 2017-2019 were 104.43±1.36, 104.95±1.63 and 104.34±1.33, respectively and the obtained ones - 105.7, 105.2 and 104.7. The actual increase is higher than estimated but still within the 95% confidence interval.

4.3. Testing macroeconomic causes of the above-average increase in value added in construction

The problem of identifying the causes of the above-average increase of value added in construction in period 2017-2018 is not a simple one. This situation could have been caused by many factors. There may be issues related to the digitization of taxes, but also a few others, such as an above-average economic situation. An approximate unravelment of the causes may be provided by additional analysis of other

variables related to production. The primary focus should be put on the employment assessment (Figure 3). As previously indicated 2019 was a year of unfavorable weather conditions.
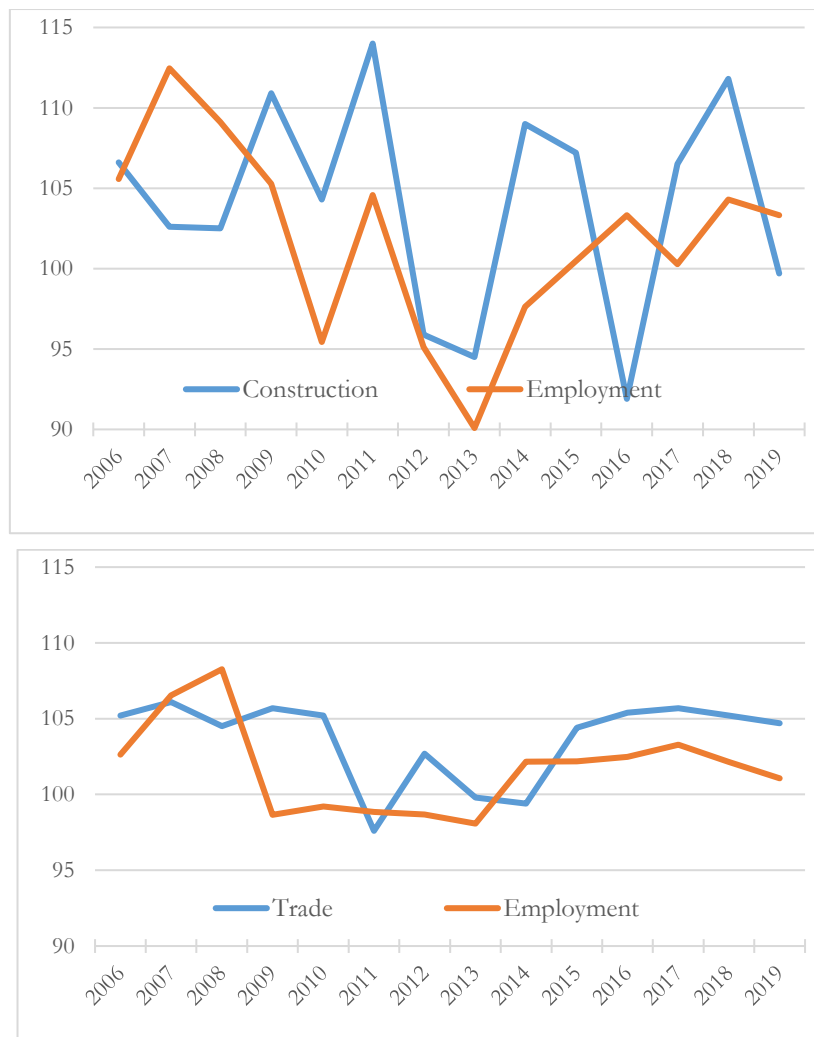

Figure 3. Value added indicators in construction and trade along with employment rates in both sectors
Source: original study based on data from Statistics Poland.

Based on the employment growth rates and the increase in value added, it has been established that in 2006-2016 the average annual increase in employment in construction amounted to 1.53% and the corresponding interim improvement in value added was on average of 3.36%. Meanwhile, in 2017-2018, the average annual employment increase amounted to 2.27%, clearly higher than before and corresponding to an interim average increase of 9.12% in value added (Table 7). This means that the 1% increase in employment in 2006-2016 corresponded to a 2.19% increase in value added, while in 2017-2018 it was 4.02%. Such a high result for 2017-2018 gives reasons to assume that the above-average increase in the value added of construction in this period was caused by administrative factors, including the most important change, VAT digitization.

Once again, it turns out that 2019 produced different results. Despite the 3.3% increase in employment, it was not possible to improve production. It is difficult to associate this result with the ineffectiveness of the tax system, since 2019 was extremely difficult for the construction industry for fundamental reasons.

Table 7

Average annual increase in employment and the corresponding average annual increase in the value added in the section

	2006-2016		2017-2018		2019	
	employment growth	section increment	employment growth	section increment	employment growth	section increment
Construction	101.53	103.36	102.27	109.12	103.3	99.7
Trade	101.56	102.72	103.23	105.45	101.1	104.7

Source: original calculations.

In case of trade sector, where no such reforms as in construction have been carried out, the situation looks completely different. As in 2006-2016 the average annual increase in employment amounted to 1.56% and it corresponded to an average gain in the value added of 3.23%.. Meanwhile, in 2017-2018, the average annual employment rise amounted to 2.72%, which was clearly higher than before and corresponded to an annual average increase in value added of 5.45%. This means that the 1% increase in employment in 2006-2016 corresponded to 2.07% increase in value added, while in 2017-2018 it was 2.00%, so the difference between the periods 2006-2016 and 2017-2018 is minor. Trade is not as sensitive to weather changes as construction, therefore 2019 can be considered a typical year for this section to operate, as both employment and value added increased (by 1.1% and 4.7% respectively)Another important variable related to economic development is investment expenditure (Figure 4). The changeability of the value of investment outlays is significant. It is especially visible in the construction industry, which is significantly volatile itself, and as it turns out, changes in the value of investment outlays in this section range from about -30% to over 60% annually.
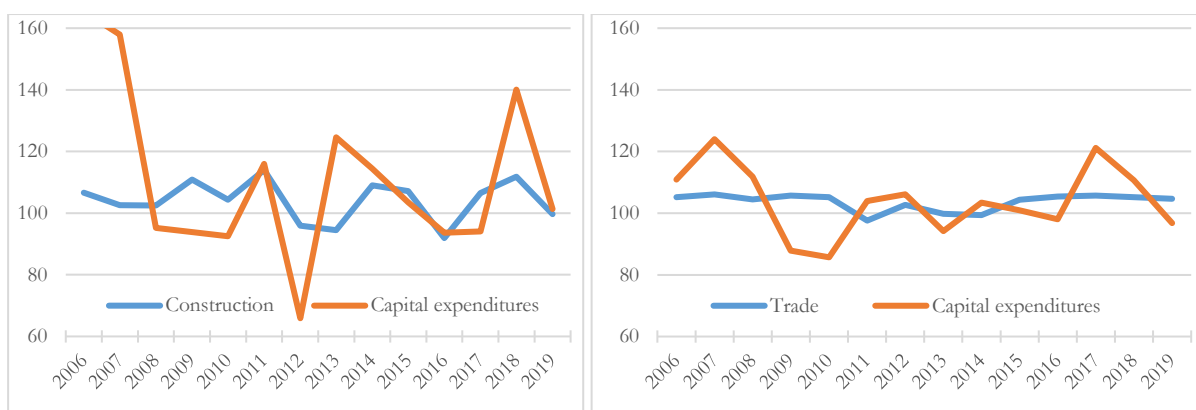

Figure 4. Value added indicators of construction and trade and capital expenditure indicators in these sections
Source: original study based on data from Statistics Poland

The characteristics (Table 8) show that in the period of 2006-2016 the average annual increase in the value of investment outlays in construction amounted to 7.78%, with the average annual gain in the value added of 3.36%. This means that the dynamics of investment outlays was more than twice as high as the section development itself. Meanwhile, in 2017-2018, the average annual increase in the value of investment outlays amounted to 14.82%, with the average annual gain of 9.12% in value added. Thus, investment outlays in 2017-2018 grew significantly faster than in 2006-2016. However, in relation to the section's

growth, it was not a spectacular increase. The apathy in construction in 2019 can be observed not only in the negative dynamics of value added, but also in the changes in investment outlays, which amounted to only 1.3%. It was a much different value than the average from the previous periods.

Table 8

The average annual increase in investment outlays and the corresponding average annual increase in the value added of the section

	2006-2016		2017-2018		2019	
	increase in expenditure	section increment	increase in expenditure	section increment	increase in expenditure	section increment
Construction	107.78	103.36	114.82	109.12	101.3	99.7
Trade	101.90	103.23	115.83	105.45	96.8	104.7

Source: original calculations.

Having observed the situation in trade, it can be said that in the years 2006-2016 the average annual increase in the value of investment outlays amounted to 1.90%, with the average annual value added gain of 3.23%. Meanwhile, in 2017-2018, the average annual increase in the value of investment outlays amounted to 15.83%, with the average annual growth in value added by 5.45%. Thus, investment outlays in 2017-2018 grew significantly faster than in 2006-2016. Much faster than in construction, the sector which, after all, saw a significantly greater increase in value added. This is yet another proof that the growth in construction in 2017-2018 was caused by non-economic factors, and thus, potentially, may have been a result of tax digitization process. In terms of the relationship between the increase in investment outlays and the rise in value added, 2019 is unusual for trade. Despite the negative rate of investment outlays (-3.2%), a decent growth of the section was achieved (4.7%).

4.4. Evaluation of tax revenue

The effectiveness of the assumed goals of VAT digitization is indicated by the relationship between the dynamics of value added in construction and the dynamics of tax revenues (Figure 5).
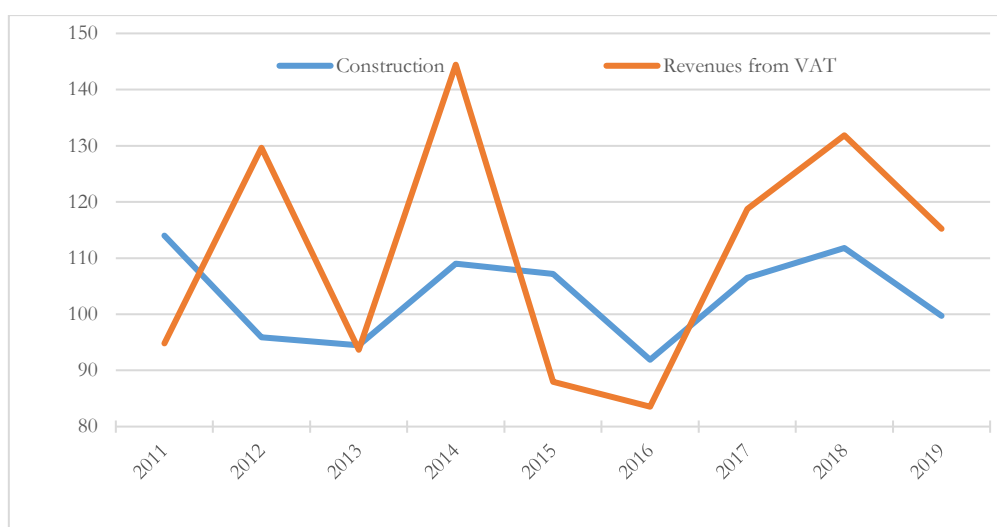

Figure 5. Dynamics of value added in construction and VAT revenues
Source: original study based on data from Statistics Poland and the Ministry of Finance.

VAT revenues from the construction sector in 2017-2018, in particular in 2018, were record-breaking. In 2017, revenues from VAT amounted to PLN 10.07 million and were higher than the 2016 revenues by 18.75%, and in 2018 - PLN 13.28 billion, higher by 31.88%. than in 2017. Additionally, the relationship between the dynamics of growth of the value added in construction and the dynamics of the VAT revenue increase is worth emphasizing. In fact, the relation is quite weak, as the 2011-2018 correlation coefficient is only 0.3313. Therefore, it can be stated that the increase (decrease) in the value added of the sector translated poorly onto the increase (decrease) in tax revenues. The 2017-2018 situation contradicts this tendency, with a clear growth in the value added of construction and an even stronger increase in VAT revenues. Even an unsteady year of 2019 did not cause a drop in tax revenues. On the contrary, the revenues increased by 15.2%. The result is in line with the idea of tax digitization, which has aimed, among others, at tightening the tax system.

4.5. Discussion

The factors determining the shadow economy are commonly discussed in the subject literature. The shadow economy has many negative economic consequences and does not offer much good in return. Hence, there have been many actions taken by the governments aimed at curbing it. In Poland, the construction industry is considered a section potentially susceptible to a variety of abuse. Research shows that the changes that took place in 2017, aiming at tightening the tax system, brought a positive effect. On the basis of the relation between the actually realized value added of construction and the theoretical value added, it can be concluded that the previously unrevealed income, thus generated in the shadow economy, has now been disclosed.

Bitzenis et al. (2016) drew attention to the importance of the tax system for companies leaving the shadow economy and disclosing income. Their conclusion is consistent with that obtained in this work. They recognized institutional factors, tax morale and the rule of law in particular, as the basis for leaving the shadow economy. On the other hand, rising unemployment boosts the shadow economy. A separate approach to estimating the size of the informal economy can be found in Artavanis et al. (2015), where the inference was based on the comparison of official income with household loans and the balance of bank accounts. This study identified medicine, law, education, engineering and the media as industries prone to the shadow economy. What is interesting about this particular research is that, similarly to the analyzes presented above, it is based on circumstantial evidence. The study also provides evidence that tax evasion recurs not because of the ignorance of tax authorities, but because it cannot be effectively controlled.

An important conclusion regarding the role of the tax system emerges from the work of Remeikiene et al. (2014), identifying that it is not only the tax system itself that is important, but also the amount of taxes and their types. In terms of macroeconomics, the work confirms that the main non-tax determinants influencing the scope of the shadow economy are the unemployment rate, GDP per capita, total workforce, and domestic credit for private individuals.

The problem concerning the repercussions of the shortcomings both in the design and the enforcement of the tax system with reference to the shadow economy was highlighted in the work of Kaplanoglou and Rapanos (2013). The paper argues that the shortcomings in the tax system, such as a malfunctioning administration, loose tax enforcement, and the lack of effective mechanisms for resolving tax dispute, result in low tax revenues. The authors additionally propose a number of specific measures, such as reorganization of tax institutions, simplification of tax law, rationalization of penalties, and improvement of tax audits, which will not only increase budget revenues, but also restore trust in public institutions. Similar conclusions are formulated by Katsios (2006), who additionally points to the need to fight bribery. Legal regulations, particularly the simplification of tax law, are indicated in the literature as the best way to reduce the shadow

economy. Poland followed a slightly different path, as the digitization of taxes cannot be called a simplification of the system, but rather a direction towards greater efficiency of tax control. The efficiency of the fiscal apparatus is also a direction recommended in the literature and, as the research shows, it can be an effective one.

5. CONCLUSION

Tax digitization is expected to reduce tax crimes and limit the grey zone as well as improve auditing, and as a result help seal tax revenue. According to the data of the European Commission, VAT gap was reduced to 9.7% in 2019 from 27% in 2013. Poland is among the European Union countries with one of the greatest reductions in VAT gap (Poniatowski, et.al, 2020).

The results of the research allow to conclude that digitization significantly contributes to disclosing income and moving enterprises out of the grey area. Construction, which has been recognized as a sensitive sector, is characterized by an above-average variability of development. An outstanding year was followed by a poor one, and conversely after a poor year, a good year would follow. High uncertainty of future results of operations may be the reason why some enterprises avoid legal activity. It is also a quite specific industry in which large construction projects are implemented by a contractor cooperating with many smaller entities, which often results in various types of payment holdups. Their occurrence, and thus the loss of liquidity and the inability to finance further operations, may push enterprises towards the grey area. Construction services performed on individual orders, where the scope of abuse is quite big, are a separate issue. All of the above contributed to defining construction as a sensitive sector. Therefore, in order to mend the situation and restore proper functioning of competition, it was necessary to implement appropriate measures at ministerial level.

The results of the 2017-2019 tax reform can be assessed as admirable. The value added of the construction section clearly increased at an above average level, greater than it would have resulted from the economic boom. Even in the weak, in terms of value added, construction sector VAT revenues improved significantly in 2019. This proves that the disclosure of income has so far been exposed to tax fraud, in particular the shadow economy. The observed changes in trade additionally strengthen the conclusions in terms of the effectiveness of activities related to the digitization of taxes. It is shown that in trade, which was not subject to tax reforms, the gain was at an average level. Certainly, there is less room for abuse in trade than in construction, and hence the different approach of the Ministry of Finance.

Statistical data related to employment and investment expenditure allow for the conclusion that the digitization of taxes, and thus the fact that some activities quit the grey area, has a positive impact on these figures. Years 2017-2019 are a period of growing employment and increasing investment outlays. All this creates good prospects for further development of the industry.

From the state budget's point of view, the expected effect of VAT digitization in the construction sector should be an increase in tax revenues. What also happened is that the increase in VAT revenues exceeded the gain in the value added of this sector. Improving tax system's transparency and the control over the functioning of enterprises forecasts further sector and tax revenues growth.

2020 seems to keep up the pace of changes imposed during previous years. The new JPK_VAT which replaced traditional declarations in 2020 has already been operating. The Ministry of Finance plans to make e-invoices available to entrepreneurs by 2022 at the latest (www 3). Therefore, standard paper invoices will be substituted. According to the Directive 2014/55/EU (European Commission, 2020), (Directive 2014/55/EU of the European Parliament…) since April 18th 2019, the units of public finances in Poland, which participate as contracting authority in public procurement are required to receive and process structured electronic invoices (www 4),. The precursors of this solution in the European Union were the

Italians, who have been using e-invoices for many years (FatturaPA – *Fatturazione elettronica verso la Pubblica amministrazione*) in B2G transactions, and since 2019 eInvoicing has been obligatory in B2B and B2C transactions (Ministero dell'Economia e delle Finanze, 2018). E-invoicing has been used by South American countries for many years: Brazil (NF-e – *Nota Fiscal Eletrônica*, NFS-e – *Nota Fiscal de Serviços Eletrônica*, CTe – *Conocimiento de Transporte Electrónico*), Chile (DTE – *Documentos. Tributarios Electrónicos*) (SOVOS, 2019) and Central America: Mexico (CFDI – *Comprobante Fiscal Digital por Internet*) (Deloitte, 2017b), the countries where the problem of VAT gap used to be significant. Electronic invoicing has many advantages, including increased transparency and control of taxable income, the preventing tax fraud and the security of data transmission (Abumohor, 2019). After the introduction of the generally applicable e-invoicing, the time of a possible crime (including VAT carousels) will be significantly shortened and the tax administration will be able to quickly track down possible irregularities (PWC, 2016).

Technical novelty, that should be considered substantial, and may possibly revolutionize the world of taxes is *blockchain* technology, which eliminates the need for centralization and mediation, allowing safe transmission of information and making transactions (Setyowati et al., 2020). At the 2016 World Economic Forum in Davos, more than 800 experts were asked when governments could be expected to levy taxes using *blockchain* technology. The average answer was 2023, while 73.1% of respondents claimed that the turning point would take place by 2025 (Rizzo, 2015). The technology would introduce a change in the method of tax settlement: the method of tax collection and refund, the method of settlement and verification of transactions and the invoicing mechanism (Sobiecki & Szwed-Ziemichód, 2019). The technology minimizes the risk of errors and fraud, which means that the space for tax carousels would be drastically reduced (Bulk, 2018). A system for settling VAT transactions, based on *blockchain,* would allow for multidimensional checks and control over transactions from both the legal and business perspective (Deloitte, 2017a).

It is important to remember that technology is evolving at a steady pace and some solutions that are currently in use may become useless in a year or two. Therefore, enterprises (taxpayers) are faceing the challenge of constantly adjusting to the changes introduced to limit tax fraud and to make the control over taxpayers' transactions easier (Wardyński & Wojdyło, 2017). In the modern world, only those who adapt to new conditions and mechanisms of operation in advance have a chance for success.

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