

Shadow economy interconnection with maritime sector development in coastal European countries

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Abstract. In this article, the authors analyze the interconnection between shadow economy and maritime sector development in coastal European countries. The article provides scientific analysis review of shadow economy and maritime sector, their importance and interconnection; and also examines the current trends of shadow economy and maritime sector in the selected countries. Additionally, the authors raise the hypothesis about the interconnectivity of shadow economy and maritime sector development, which are later tested using the regression model (based on the MIMIC methodology). Models aim to distinguish the relationship between shadow economy and the factors which impacts maritime sector development. The research results show that there is a significant relationship between shadow economy and main maritime sector impacts factors. During the research, the authors have identified that an increase of production value (operating profit), personnel costs and the number of employees in the companies operating in the maritime industry, will lead to decrease of shadow economy in coastal European countries. Furthermore, shadow economy decreases as weight handled in these countries' ports increases. On the other hand, the research findings show that as the number of companies

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operating in the maritime industry and their turnover increase, the shadow economy could increase as well.

Keywords: shadow economy, maritime sector, European coastal countries, MIMIC methodology.

JEL Classification: B41, C12, O10, O17

1. INTRODUCTION

In scientific literature shadow economy is widely discussed, however, very often, it is treated differently, as scientists tend to use various definitions. However, in general case shadow economy is referred to as multiple effects of various phenomena (Krumplytė, 2009), which are a part of unofficial country economy. In this article, the authors use underground economy definition, as unregistered economy at a given period of time, which would increase official economy size if registered (Schneider & Williams, 2013). Shadow economy exists in all of the countries and all sectors where economic activities are taxed and regulated, but its size differs significantly. Underground economy decreases economic development potential of geographic regions, countries and particular sectors, distorts competition in these countries and sectors, corrupts statistical data and damages various economic factors. Shadow economy can also create a cycle, when country's tax income is decreasing; therefore, governments increase tax rates, which in turn leads to more people moving to shadow economy, thus further decreasing the total tax revenues of a country (Schneider & Enste, 2002).

At the same time, shadow economy is constantly changing and adapting. In particular, recent changes in the ways of working and in business models, digital economy growth, wider social changes and globalization are causing new shadow economy activities to emerge and some existing ones to expand in both scale and scope (OECD, 2017). During the recent decades, with globalization expanding and becoming more and more important, maritime sector has started playing a major part in this trend, as shipping is one of the most important elements of the world economy. Shipping is prevalent in the most of supply chains and cycles, such as supplying raw materials, industrial goods and processed goods to end consumers (Demirel, 2019). Shipping impacts on the economy overall continue to increase, as maritime industry represents 90% of the commercial trade exchanges carried out worldwide, whereas the key supply chains of the main production sectors depend on it (Alcaide & Garcia-Llave, 2020). Maritime industry is no exception in terms of shadow economy presence (Mahajan, 2019). Therefore, it is important to understand the impact of shadow economy on maritime sector development and its interconnection, as better knowledge of these impacts will help developing the mitigation strategy. In this article, the authors are analyzing shadow economy in coastal countries and its trends and also reveal the underground economy in coastal countries in its interconnection with the maritime industry development by raising hypotheses how economic development impact factors interconnect with shadow economy levels in coastal European countries.

The novelty of the study: almost all sectors of every economy are impacted by shadow economy, while its influence on the country overall might be different. Maritime sector is no exception in this regard, as it is heavily impacted by shadow economy, especially in coastal countries, where maritime sector accounts for a significant share of GDP. In these countries, it also affects economic development and competitiveness at the global markets. Research carried out by the authors of this article suggests that it is difficult for public authorities to control the maritime sector due to the specific nature of its activities. As a result, shadow businesses (economy) tends to spread in this industry quite actively.

The research conducted by the authors determines the main reasons for shadow economy spread in the maritime sector while the developed methodology (model) suggests the actions needed to mitigate the shadow economy effects. The novelty of this study stems from these factors, and the practical part of this study can be used to minimize the activities of shadow business (economy).

2. THEORETICAL BACKGROUND

In this article, the authors are identifying shadow economy impact on the maritime sector development in coastal European countries; therefore, it is essential to understand both shadow economy and the maritime sector in-depth.

Scientists define underground economy differently, as there are multiple definitions of the underground economy in common use, however, it is usually serving different objectives. For example, governments and other public authorities usually define it as sales or other types of income, which are not reported for tax or regulatory purposes. While statisticians, usually define it as economic activities belonging, but not captured, in the official GDP estimates (Smith, 1994). Other scientists structure shadow economy definition by defining whether in itself it is legal economic activity, which would increase official economy if were legal (Schneider & Williams, 2013). In this article, the authors follow such underground economy definition. Based on it, shadow economy is usually separated to legal and illegal activities, as well as, splitting it by financial transaction and defining whether it is monetary or non-monetary transaction (Lipper & Walker, 1997; Schneider, 2005, 2017). Analysis of the scientific literature and statistical data shows that shadow economy has a tendency to decrease with time, but it also influences well-being of the state (Bilan et al., 2020) due to direct relationship with countries economic development, corruption levels, tax morale and other factors (Navickas et al., 2019). At the same time, it is an obvious fact that shadow economy cannot be completely eradicated in any society and can shift its social safety significantly (Mishchuk et al., 2020; Onwuegbuchunam, 2018).

The maritime sector is no exception, as various types of illegal activities take place, such as unreported industrial fishing, illicit trade of goods and other activities, which would increase countries economy, if were officially reported. In this article, the authors, same as most of other scientists, do not include criminal activities to shadow economy definition, because such activities cannot increase country GDP.

Shipping is one of the most important elements of the world economy and it is one of the main elements of the maritime industry. Shipping is prevalent in most of the supply chain cycles, such as supplying of raw materials, industrial goods and processed goods to the consumer. Total volumes of trade through the maritime sector has reached almost 11 billion tons in recent years and it continues to expand (Demirel, 2019). Furthermore, the maritime industry represents 90% of the commercial trade exchanges carried out worldwide, where the supply chains of the main production sectors depend on it (Alcaide & Garcia-Llave, 2020). Scientific analysis shows clear relationship of the maritime sector and its impact on the economic development (Frankel, 1989); (Syamsuri et al., 2018) and others. Therefore, when shadow economy affects maritime sector and its development, it also makes negative impact on the total economy of particular region or country, distorts its competitiveness and overall well-being of its society.

Thus, with maritime sector being one of the essential world economy components, it is important to understand its relation with shadow economy and how such interconnection might impact the development of the maritime industry and total countries' economies.

Figure below provides how various types of economic and other factors drive economic activities in the maritime industry.

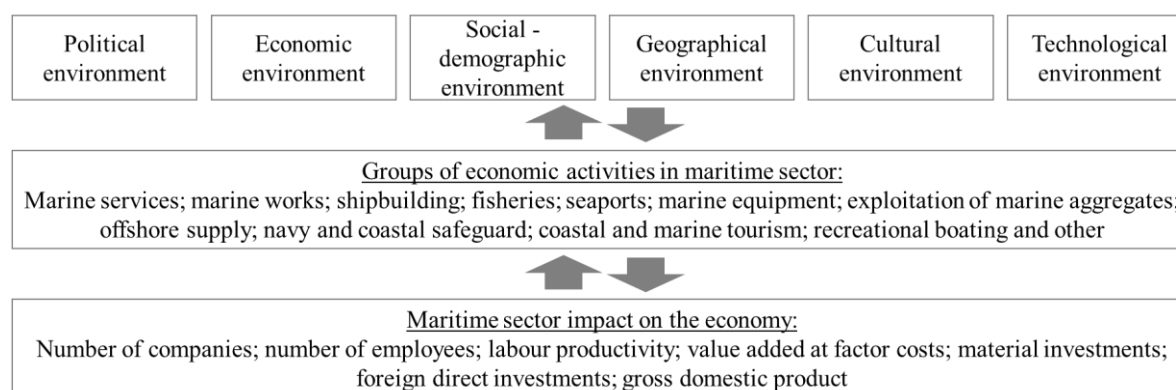


Figure 1. Maritime sector interconnection with total economy

Source: (Viederytė, 2014), amended by the authors

As identified by Viederytė, R. (2014), maritime sector is impacted by political, economic and other types of environments, but the maritime industry also makes a significant impact on the total economy, as it provides many workplaces in coastal regions and also supports multiple other industries. However, maritime sector relation with the total economy is reciprocal and as shadow economy accounts to significant part of the total economy, therefore, it is important to understand shadow economy interconnection with development of the maritime industry.

Most prevalent types of shadow economy in maritime sector include unreported fishing (Okafor-Yarwood, 2017), smuggling and trafficking of illicit goods (Bruwer, 2020), but other types of underground economy are also common, such as illegal, unreported workforce, hiding revenues to avoid taxes and other.

Underground economy in maritime sector is partially driven by the fact that public institutions lack potential control mechanisms. It is difficult for governments to ensure control due to the specific nature of the maritime industry activities. As a result, illicit economy tends to spread in the maritime sector in a form of illegal fishing, moving illegal goods and various other types of activities. However, maritime security and control mechanisms are extremely important in order to control the spread of shadow economy in the maritime industry (Bueger, 2015).

In Table 1 below, the authors provide a framework of shadow economy and its examples in the maritime sector.

Table 1

Shadow economy examples in maritime sector

Shadow economy drivers in maritime sector	Shadow economy types in maritime sector
Economic impacts	Income / taxes Transporting goods Unreported workforce Competition (vs others)
Political impacts	Avoiding regulation
Cultural impacts	Low tax morale; low support by government, other
Other impacts	Administrative procedures

Source: prepared by the authors

To better understand the potential interconnection between shadow economy and the maritime sector, in this analysis, the authors made six hypotheses about different impact factors, which are closely related with the maritime sector and its development and are interconnected with shadow economy size in coastal European countries. It was assumed that as number of companies or its employees in maritime sector rises or as weight handled in ports increase, shadow economy as percentage of GDP might increase as well. Such

assumptions were made because typically increased number of maritime sector participants and overall higher quantities of goods transported through ports leads to more difficult control for governmental agencies, which usually are trying to insure that these companies and employees do not engage in shadow economy. Other hypothesis include turnover of maritime companies, their production value, personnel costs paid for employees. It was assumed, as these impact factors increase, shadow economy percentage of GDP should decrease, because companies in maritime sector with higher turnover or profits should have less incentives to engage in shadow economy, as their economic situation is already stable enough. Summary of these hypotheses is provided below, while regression model later tests these hypotheses.

Table 2

Summary of hypothesis of shadow economy and maritime sector interconnecting factors

Impact factor	Hypothesis
Number of companies	Number of companies in maritime sector: increasing Shadow economy % of GDP: will increase
Turnover	Turnover of companies in maritime sector: increasing Shadow economy % of GDP: will decrease
Production value	Production value (operating income of maritime sector): increasing Shadow economy % of GDP: will decrease
Personnel costs	Personnel costs (salaries paid to maritime sector employees): increasing Shadow economy % of GDP: will decrease
Number of employees	Number of employees in maritime sector: increasing Shadow economy % of GDP: will increase
Weight handled in all ports	Gross weight of goods handled in all ports: increasing Shadow economy % of GDP: will increase

Source: prepared by the authors

3. METHODOLOGY AND RESEARCH FINDINGS

In 2018, 3.6 billion tons of freight were handled in EU ports in 2018, as all European countries has ports, except Czech Republic, Luxembourg, Hungary, Austria and Slovakia. However, some of the countries with ports, has relatively small part of the maritime industry from its total GDP, therefore, ten European coastal countries were selected for the analysis with highest gross weight of goods handled in its ports, measured in tons per capita, them being: Belgium, Denmark, Estonia, Finland, Greece, Latvia, Lithuania, Netherlands, Norway and Sweden. Graph below shows that is has tendency to increase in all analyzed countries over last decade with minor exceptions.

In literature, scientists usually define three main shadow economy evaluation methods: direct, indirect and the model approach (Schneider, 2017, 2019); (Schneider & Buehn, 2018); (Medina & Schneider, 2019) and other scientists. Direct shadow economy evaluation includes micro level analysis, which tries to identify the size of underground economy in the particular country / industry at the time of the analysis. Most common direct methods are surveys, which is also great method to identify approximate shadow market size in the maritime industry. However, surveys should be complex to understand the full picture of underground market in maritime sector, as it would include illegally working employees, seaports authorities and many other stakeholders. Indirect approach includes various macroeconomic analytical approaches and usually evaluates shadow economy historical and potential future changes. Few examples include The Physical Input (Electricity Consumption) method, (Kaufmann & Kaliberda, 1996), where researches tries

to calculate underground economy size by evaluating electric energy consumption changes, also, the discrepancy between the official and actual labor force model (Schneider, 2014). Later model evaluates what are the income and expenditure in a particular country and tries to measure the unexplained gap, thus defying it as shadow economy. However, such models application to maritime sector analysis is difficult and not used by the researchers. Model approach applies statistical models and is the most used, when analyzing shadow economy and its' interconnection with particular industries and is named MIMIC (Multiple indicators multiple causes).

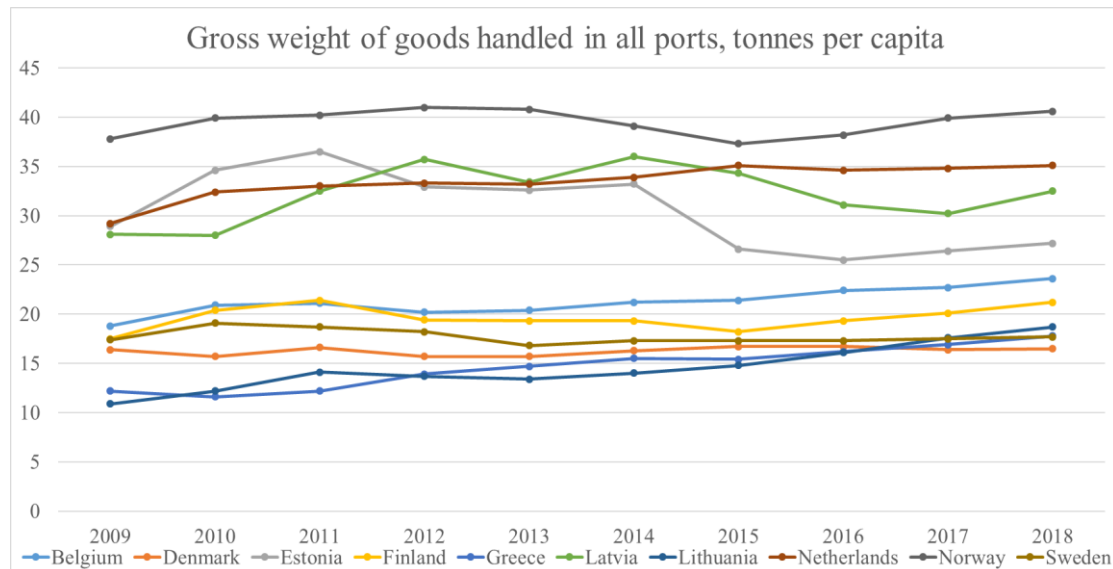


Figure 2. Gross weight handled in ports per capita in European coastal countries

Source: prepared by authors, according to Eurostat data (2019)

First method is very complex and second rarely used for the maritime industry analysis, therefore in this article the authors base their research on MIMIC methodology, as it is the most common. However, it should be noted that shadow economy and the maritime industry analytic models are usually seen as ambiguous, as all of them have both pros and cons.

Hypothesis raised in the previous section of the article are tested by using panel data regression analysis, where dependent variable – size of shadow economy, calculated by using MIMIC methodology. It is calculated as percentage from gross domestic product in particular country. Regression model equation is provided below (aforementioned model, MIMIC approach):

Shadow economy

$$\begin{aligned}
 &= \beta_0 + \beta_1 \text{Number of companies in maritime sector} \\
 &+ \beta_2 \text{Turnover of companies in maritime sector} \\
 &+ \beta_3 \text{Production value of maritime companies} \\
 &+ \beta_4 \text{Personnel costs of maritime companies} \\
 &+ \beta_5 \text{Number of employees in maritime sector} \\
 &+ \beta_6 \text{weight handled in coast countries ports} + \varepsilon
 \end{aligned}$$

In regression analysis, Beta (β) is a coefficient, which shows the effect of the independent variable to the dependent variable. The closer this coefficient is to one, the greater is its' influence. ε is the random error of the regression analysis, which shows how much the observed value of the dependent variable differs from the value obtained by predicting according to the regression equation.

Analysis conducted by the authors is based on 2005-2018 years data, as 2019 data was not released at the time of analysis. Data was gathered from (Eurostat, 2019) and (Schneider, 2019). Some of maritime sector data for 2018 and shadow economy size of Norway for 2018 was missing, therefore forecasted by the authors, using statistical modelling. Authors believe that such forecast of the data does not make negative impact on the analysis and analysis results do not change due to this factor.

Furthermore, it should be noted that collected shadow economy data represents shadow economy size in total economy and not only in maritime sector, due to lack of such data. However, the authors believe that underground economy part in maritime sector is similar to shadow economy part in total economy. Therefore, such numbers can be used in the analysis.

In this article, the authors have used most common regression analysis types of Pooled OLS, fixed, random effect and WLS analysis. Furthermore, the authors have determined the most appropriate model from aforementioned four types by using multiple statistical theory tests: multicollinearity, normal residual distribution, data homoscedasticity and autocorrelation tests. The aim of these tests is to answer whether dataset is reliable for the analysis. Multicollinearity test answers whether correlation between independent variables is present, as in such case, one of the variables could not be used. Normal residual distribution shows whether residual are distributed normally, meaning there are no significant externalities, which may falsify the model results. Data homoscedasticity tests whether different samples have the same variance (even if they came from different populations). Autocorrelation test identifies similarity between observations as a function of the time lag between them in order to answer whether data does not follow repeating patterns. After running these tests, the authors have identified WLS model as the most applicable for further results evaluation. Summary of the regression analysis is provided in the table below.

Table 3

Results of made regression analysis

Dependent variable: Shadow economy, size as % from GDP				
	Pooled OLS	Fixed effect	Random effect	WLS
Constant	29.6488***	29.6488***	29.829***	29.8553***
Number of companies	0.0060***	0.0060***	0.0061***	0.0059***
Turnover	0.0011*	0.0011*	0.0009	0.0010*
Production value	-0.0011**	-0.0011**	-0.0009	-0.0011**
Personnel costs	-0.0057***	-0.0057***	-0.0057***	-0.0064***
Number of employees	-0.0006***	-0.0006***	-0.0006***	-0.00059***
Weight handled in all ports	-6.6e-05***	-6.6e-05***	-6.7e-05***	-6.7e-05***
Observations	140 (10 countries; 14 years)			
Adjusted R^2	0.832	-	0.829	0.844

* significance with 90 % likelihood; ** significance with 95 % likelihood; *** significance with 99 % likelihood.

Source: prepared by the authors

The results of the regression analysis shows that all chosen six impact factors, analyzed by the authors makes a significant impact on shadow economy. Due to aforementioned reasons, article analyzes results of WLS model.

First hypothesis state that increasing number of companies in the maritime sector will lead to increased shadow economy, as government institutions will have harder time to control increased number of

companies. This relation is seen in all four regression models with 99% significance, therefore hypothesis cannot be rejected and model results show that when new company in maritime sector is established in chosen European coastal countries, on average it will lead to increased shadow economy size of 0.0060. Such results show that it takes around 167 new companies in maritime sector to increase particular countries shadow economy by 1 percentage point.

Second variable analyzed is turnover of the maritime sector companies; hypothesis was raised that, when turnover of the maritime sector companies increases, shadow economy should decrease. However, results of the regression analysis show otherwise, meaning that increasing revenues of the maritime sector companies does not lead to decreasing shadow economy. Results show that when turnover of these companies increase by 914 million euros, shadow economy increases by 1 percentage point. The authors believe that this does not necessarily mean that increasing revenues in itself increase shadow economy size in the country, but rather could be a result of other impacts. One of these could be harder control of such companies by governmental institutions, as increased revenues usually means larger size of operations, potentially more employees, etc., thus harder to control for responsible parties. It could be argued that as the time goes and the maritime sector companies see weaker control by mentioned responsible parties their motivation to engage in illegal activities increases, due to decreased probability of being caught. Therefore, increasing revenues might not lead to increased shadow economy by itself, but rather by influencing other variables, which cannot be tested in the scope of this particular analysis.

Third hypothesis argue that increasing production value of maritime companies will lead to decrease of shadow economy as percentage of GDP. Regression analysis results show that such hypothesis cannot be rejected with 95% likelihood and results show that when maritime sector companies production value increase by 853 million euros, shadow economy will decrease by 1 percentage point. The authors understand that such number for maritime companies in coastal European countries is very high, therefore, it is reasonable to expect that in reality maritime sector companies' production value make low impact on efforts to decrease shadow economy. However, it is still valuable to point out that increasing production values (operating profits) of maritime sector companies might lead to decreasing levels of shadow economy. The authors believe that this might be driven by the fact that as profits increase, companies have lower motivation to hide illegal activities, since risk-reward ratio is becoming lower.

Further results show that, shadow economy has a tendency to decrease as more salaries are paid for maritime companies employees, as 1 million more personnel costs paid leads to decrease of shadow economy by 0,0057%. The authors believe that such results reflects reality rather well, as increased level of wages to employees might not only mean that salaries for regular employees were increased, but also, some of employees, who were previously working illegally or partially illegally, might have switched to legal workforce. Furthermore, as employees receive legal salary and full social insurance levels, they might find less value coming back to illegal workforce, thus leading to decreased shadow economy in the long-term. It is worth noting that the authors believe that further analysis is needed to identify which impact causes each other, meaning whether decreasing shadow economy leads to increased legally paid personnel costs, or otherwise.

Hypothesis was raised that when number of employees in maritime companies increase, shadow economy should increase as well. However, regression analysis results show otherwise: increasing number of employees leads to decreasing shadow economy levels and on average 1687 new employees in the maritime sector companies will lead to decrease of shadow economy by 1 percentage point. The authors believe that increasing number of employees might lead to more visibility of maritime companies activities, thus increased exposure might lead to more controlling institutions interest, which in turn could lead to decrease of shadow economy in those companies and overall economy.

Last hypothesis claims that when weight handled in ports of coastal European countries increases, shadow economy tends to increase, as it is getting harder to control activities, which happen in ports. However, regression analysis shows opposite results, meaning that shadow economy tends to decrease as weight handled in ports increase. Reasons for rejecting initial hypothesis could be various. One of the more possible ones, potentially, is that companies, who are legally conducting all of their operations, are more willing to expand, as there are no fears of being caught, since there are no illegal activities on their side. While, companies, who are doing some of their business illegally, might be more hesitant to expand and increase their operations (and in turn weight in handled ports), because in such case in might be more difficult to hide illegal activities from controlling government agencies. Therefore, it could be speculated that in the long-term countries with more legally conducted businesses (meaning lower shadow economy share from total economy), has more potential to grow, expand and outperform their neighboring countries, where shadow economy might be more prevalent.

CONCLUSIONS

This article has analyzed the interconnection of shadow economy and maritime sector development in coastal European countries in 2005-2018. Article analyzes why maritime sector and its development are important and how it interconnects with shadow economy. Based on scientific literature as well as logical deduction, the authors have identified key potential shadow economy determinants arising from maritime sector. After performing regression analysis, the authors were able to identify their influence and significance.

Analysis of scientific literature showed that shadow economy is usually defined as non-registered, but in itself legal economic activity, which would increase official economy if were legal and such definition is used when analyzing maritime sector as well. When analyzing shadow economy, scientists usually use direct, indirect and model approaches to evaluate its size, impact or interconnection with other industries. Therefore, in this article the authors use model approach (MIMIC) in order to identify maritime sector and its development interconnection with shadow economy.

Research results show that there is a significant relationship between shadow economy and main maritime sector impacts factors. During the research the authors identified that increase of production value (operating profit), personnel costs and number of employees in companies operating in the maritime industry, will lead to decrease of shadow economy in coastal European countries. The findings of the research suggest that as companies' profits increase, they could shift from shadow activities, as incentives for participating in underground economy decrease. In addition, shadow economy decreases as weight handled in these countries ports increase.

Furthermore, research shows that as number of companies operating in the maritime industry and their turnover increase, shadow economy could increase as well. The authors believe that such results could be treated ambiguously, as it might be a drawback of a model and such results are determined by other dependent variables; or, as companies' number and their size increase, government and controlling institutions will face more difficulties when trying to control such companies, thus it might lead to increased shadow economy. However, the authors would like to note that this do not mean that number of companies or their revenue in maritime sector should be decreased, however it is an indication that stricter controlling measures are needed to diminish the size of shadow economy.

The authors understand the complexity of the maritime industry and its relation with shadow economy, and believe that in order to better understand the main drivers of shadow economy in the maritime sector further analysis is needed. Also, further discussion with experts and scientists would be beneficial, as surveys might provide more insights why shadow economy participants have incentives to join informal economy

in the maritime sector and what may help to move from it to the legal economy. In addition, further analysis is needed to understand the cause and effect between maritime sector and shadow economy, as it might help to understand whether increased production value, personnel costs and other impact factors leads to decreased shadow economy or vice versa.

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