PANEL ANALYSIS OF WAREHOUSING ECONOMIC PERFORMANCE IN 13 NEW EU MEMBER STATES

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Abstract

Warehousing and transportation support activities are an important part of the overall transportation sector. COVID-19 outbreak requires a prediction of future risks contingent in the overall economic predicament. The purpose of this paper is to contribute to the analysis of possible adverse effects of this crisis on the Warehousing activity. We analysed a 10-year panel from 2008 to 2017 of 13 latest European Union member countries: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, and Slovakia, and their data representing the "Warehousing and support activities for transportation" of the overall "Transportation and storage sector". We differenced the data to achieve stationarity and to lose the idiosyncratic effects present in the coefficients. We regressed the variables representing the overall economy on warehousing and transportation support activities. The null hypothesis of no-causation may be rejected for most causal conjectures with three successive test methods: Panel Pairwise Granger Causality test, Panel Estimated Generalized Least Squares with Fixed Effects, and Panel Generalized Method of Moments with First Differences. We conclude the changes in the overall economy have an impact on warehousing and transportation support activities in terms of its value added.

Key words: warehousing, transportation support activities, panel analysis.

1. INTRODUCTION

The modes of transportation are air transportation, railway transportation, waterway transportation including sea and land waterways, land transportation including road and pipeline. The transportation and warehousing activities include transportation of passengers and cargo, warehousing and storage for goods, as well as support activities related to modes of transportation. Warehousing and transportation support activities are an important constituent part of the overall transportation sector. Not disregarding the importance of other transportation and warehousing activities, we concentrate on warehousing and transportation support activities (H52) and try to conjecture its relationship with other component parts of transportation and total economic value added.

We tentatively test the hypothesis of Granger causation as well as correlation between overall value added and the value added of the warehousing and transportation support activities. This is the consequence of our conjecture that the changes in the overall economy have an impact on warehousing and transportation support activities in terms of its value added. We were primarily motivated by the assumption of the downward trend in economic prospective caused by COVID-19.

Economic predicament caused by the COVID-19 outbreak indicates possible adverse changes in the time series of Transportation sector data. The data for the present year (2020) are still not available, but by testing the impact of changes from the overall economy (all economic sectors) to the Warehousing and support activities for transportation (H52) we might be able to predict the adverse effects of the COVID-19. We analysed a 10-year panel from 2008 to 2017 of 13 Central and Eastern European Countries: Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovenia, and Slovakia. We specifically targeted the new EU member states as they represent a homogenous group from the economic perspective. We used available data that was statistically commensurable.

We specifically put under scrutiny the data representing the H52: Warehousing and support activities for transportation as part of the overall H: Transportation and storage sector. We analysed the 10-year time series data of transportation and storage industry activities as well as their mutual correlation and correlation with the overall economic activity. The activities of the transportation and storage sector (H) according to the Nomenclature of Economic Activities (NACE) are: land transport and transport via pipelines (H49), water transport (H50), air transport (H51), warehousing and support activities for transportation (H52), and postal and courier activities (H53). We put under scrutiny also the warehousing and support activities' employment classified in micro, small, medium and large enterprises according to the number of employees (less than 10, 10-49, 50-250, and more than 250). Longitudinal datasets dictate a panel analysis. The review of the literature describing the panel analysis is found at the beginning of the next chapter, and the description of the dataset as well as the choice of specific methods that were used is described in chapter 3 Data and Methods.

2. LITERATURE REVIEW

Panel analysis comprises a set of statistical methods that is speedily developing during the last two decades (Arellano, 2003, Baltagi, 2005, and Wooldridge, 2010), but also improving on past time-series analysis methods such as Granger non-causality (Granger, 1969). These methods are widely used to test conjectures of strictly social phenomena (Mance and Pečarić 2016, Mance et al. 2020,) as well as strictly natural phenomena (Mance at al. 2018a and 2018b). The methods we used are static such as Panel Estimated Generalized Least Squares (Panel EGLS) with Fixed Effects Panel EGLS as well as dynamic GMM (Mance at al. 2018b, Mance et al. 2020). Some of the methods were already used on a smaller data subset when researching the determinants of maritime passenger transport to Croatian islands (Debelić et al. 2019). Transportation and transportation support activities have been analysed in the context of the European common market by Pantazi and Vlachos (2019). Pantazi and Vlachos (2019) analysed how the global financial and economic crisis of late 2000s had affected the economic activity of European transport. Their conclusion is that these activities are indispensable for the functioning of the internal market. As far as we know, there are no detailed analyses of warehousing and support activities for transportation in Central and Eastern Europe except for a paper by Zawieja-Żurowska and Zimny A. (2014). They estimated that the costs of transportation and warehousing constitute about 10-15% of the cost of finished products. If that is the case, there are at least two reasons we need a thorough study of the warehousing and transportation support activities. Firstly, we need an analysis of the causal mechanics of the industry, and secondly, we need an estimate of the consequences for the industry. For a comprehensive overview of the importance of warehousing in the global supply chain see Manzini (2012). As for specific country based case studies Jurgelane-Kaldava et al. (2019) conclude that transportation and warehousing industry plays an important role in Latvian economy. Not only it generates significant share of the value added (9.2% in 2017), but it also ensures exports of transport services (12.7% of the total exports of goods and services in 2017). Bazaras & Palšaitis (2017) performed surveys of the situation of logistics in Lithuania, providing a comprehensive analysis across transportation activities (from H49 to H53). The purpose of the research is to estimate potential consequences of an economic downturn caused by COVID-19 or similar contingencies with adverse effects on a set of countries with similar economic origins. A relatively small number of studies are present at the time (Deloitte, 2020). Their study concludes that the pressure on organizations during this coronavirus pandemic has shifted from moving citizens to keeping a core transportation system operational, thus changing the source of revenue from persons to goods. Deloitte (2020) warns of a potential substitution effect between persons and goods. Organizations will need to increase their planning activities to ensure that transportation resumes its activities. We analyse the relations of the transportation sector with the warehousing and transportation support activities, as well as possible effects of a downfall in overall value added.

3. DATA AND METHODS

We analysed a 10-year panel from 2008 to 2017 of 13 newest European Union member states: Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovenia, and Slovakia. We used sectorial data for the non-financial business economy according to the NACE nomenclature from B-J and L-N (European Commission, 2019). We specifically put under scrutiny the data representing the warehousing and support activities for transportation (H52) part of the overall transportation and storage sector (H). We differenced the data to achieve stationarity, and regressed variables of the overall economy sectors as well as components of the transportation and storage sector (value added, employment, and number of enterprises) on warehousing and transportation support activities. By differencing the data, we actually ask the most common empirical question in economics: how a change in one variable, causes a change in another variable, whereby the hypotheses are falsified (Popper, 2002). The causal relationship between warehousing and support activities for transportation (H52) and other components of the overall transportation and storage sector (H) as well as the overall economy could be in either or both directions, or without any relation. Thus, we wanted to start with the simplest of tests specifically thought of to falsify temporal causalities: the "Granger causality" test. Granger causality is a statistical intertemporal concept of correlation with lagged variables (Granger, 1969). The test cannot confirm an actual causal relation as no test actually is able to master such a thing, but it is able to falsify an actual intertemporal correlation since the cause precedes the effect. If an independent variable X Granger causes a dependent variable Y, then past values of X $(X_{t-1}, X_{t-2}, \ldots, X_{t-n})$, as well as past values of Y $(Y_{t-1}, Y_{t-2}, \ldots, Y_{t-n})$ should contain information that could help predict Y_{t+1}. A Granger-causality test has several limitations. It depends entirely on linear relationships between variables. Variables need to be stationary in level and trend to avoid spurious regressions. Thus, in most cases, the data needs to be differenced, what destroys valuable information. Granger causality depends entirely on the appropriate selection of observable variables: no factor (latent variable) analysis is possible. Granger-causality test is designed to handle pairs of variables, and not for co-integrated relationships involving three or more variables. Firstly, we performed a Panel Pairwise Granger Causality test between all relevant variables (table 1). Secondly, we ran a Panel Estimated Generalized Least Squares (EGLS) test between differenced variables of the transportation and storage sector (H) and warehousing and support activities (H52) and the value added of the overall economy (table 2). Panel Estimated Generalized Least Squares (EGLS) is a technique for estimating the unknown parameters in a linear regression model when there is a certain degree of correlation between the residuals in a regression model. In these cases, ordinary least squares and weighted least squares can be statistically inefficient, or even give misleading inferences.

Lastly, we performed a Panel Generalized Method of Moments (GMM) First Differences (FD) test on the H52: Warehousing and the overall H: Transportation and storage sector value added variables. Panel GMM FD has several advantages over other tests. By differencing, the fixed effect, the possible autocorrelation, and any unit-root processes are removed from the data. In this way we control for unobserved

heterogeneity among observed countries when this heterogeneity is constant over time. Since lags of the dependent variable are necessarily correlated with the idiosyncratic error we test the residuals with the Arellano-Bond GMM estimator (Arellano and Bond, 1991).

4. RESULTS AND DISCUSSION

We analysed a panel of a 10-year time series data in 13 new European Union member countries for various transportation activities. We tested the data for stationarity as most tests require inputs without unit root effects (table 1).

Table 1. Panel unit root test of total employment in warehousing (H52)

Method	Statistic	Prob.	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.64429	0.0000	13	104
Breitung t-stat	0.03431	0.5137	13	91
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.22248	0.1108	13	104
ADF - Fisher Chi-square	51.0998	0.0023	13	104
PP - Fisher Chi-square	46.5232	0.0080	13	117

Data source: European Commission (2019); Calculation: Eviews 9.

According to the panel unit root test statistics' summary, we cannot reject the null-hypothesis of our data assuming common root processes, ie non-stationarity. We get similar results with other variables too: value added of the overall transportation and storage sector (H) and its component activities from H49 to H53, as well as overall economic value added and employment. After differencing, the data assumed stationarity, whereby we show an example of the stationary data test statistics in table 2. One of the direct consequences of data differentiation is that we end up working with changes of the primary variables by asking a typical economic question of how a change in variable X correlates with the change in variable Y.

After differencing, we achieved stationarity of the analysed variables. Table 2 shows an example of the panel unit root test after differencing. We can reject the null hypothesis of both common and individual unit-root processes with a confidence of $p<0.001$ (table 2).

Table 2. Panel unit root test of total employment in warehousing (H52)

Method	Statistic	Prob.	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6.78574	0.0000	13	104
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.21568	0.0007	13	91
ADF - Fisher Chi-square	60.1327	0.0004	13	91
PP - Fisher Chi-square	91.8026	0.0000	13	104

Data source: European Commission (2019); Calculation: Eviews.

We regressed the changes in the value added of various "Transportation and storage sector" (H) of the European Union's Nomenclature of Economic Activities (NACE) component variables as well as variables representing the value added of the overall economy against warehousing and transportation support activities (H52). The results of Panel Pairwise Granger Causality tests are shown in table 3.

Table 3. Results of Panel Pairwise Granger Causality tests (104 observations, lag 1)

Nr.	Null Hypothesis	F-Stat.	Prob.
1	D(VA ALL TOTAL) doesn't Granger Cause D(VA **H52** TOTAL)	29.6401	$4 \cdot 10^{-7}$
2	D(VA **H52** TOTAL) doesn't Granger Cause D(VA ALL TOTAL)	3.8801	0.0516
3	D(VA H TOTAL) doesn't Granger Cause D(VA **H52** TOTAL)	30.7623	$2 \cdot 10^{-7}$
4	D(VA **H52** TOTAL) doesn't Granger Cause D(VA H TOTAL)	7.2429	0.0083
5	D(VA H53 TOTAL) doesn't Granger Cause D(VA **H52** TOTAL)	19.8065	$2 \cdot 10^{-5}$
6	D(VA H49 TOTAL) doesn't Granger Cause D(VA **H52** TOTAL)	26.8401	$1 \cdot 10^{-6}$
7	D(VA ALL TOTAL) doesn't Granger Cause D(VA **H52** 250+)	50.0109	$2 \cdot 10^{-10}$
8	D(VA H TOTAL) doesn't Granger Cause D(VA **H52** 250+)	53.4879	$6 \cdot 10^{-11}$
9	D(VA H49 TOTAL) doesn't Granger Cause D(VA **H52** 250+)	43.5011	$2 \cdot 10^{-9}$
10	D(VA H53 TOTAL) doesn't Granger Cause D(VA **H52** 250+)	32.7917	$1 \cdot 10^{-7}$
11	D(VA H49 ALL SME) doesn't Granger Cause D(VA **H52** TOTAL)	8.9072	0.0036
12	D(VA **H52** ALL SME) doesn't Granger Cause D(VA H49 ALL SME)	8.4970	0.0044
13	D(VA **H52** ALL SME) doesn't Granger Cause D(VA H53 ALL SME)	13.1731	0.0004
14	D(VA **H52** TOTAL) doesn't Granger Cause D(VA H50 TOTAL)	10.3119	0.0018
15	D(VA **H52** TOTAL) doesn't Granger Cause D(VA H50 ALL SME)	7.2871	0.0081
16	D(VA **H52** ALL SME) doesn't Granger Cause D(VA ALL TOTAL)	5.2387	0.0242
17	D(VA **H52** ALL SME) doesn't Granger Cause D(ENT ALL SME)	4.0793	0.0461
18	D(VA H51 TOTAL) doesn't Granger Cause D(VA **H52** TOTAL)	5.5311	0.0206
19	D(VA H51 ALL SME) doesn't Granger Cause D(VA **H52** TOTAL)	4.3306	0.0400

Data source: European Commission (2019); Calculation: Eviews. D – First difference, VA – Value Added, SMEs – Small and Medium Enterprises. H49 – Land transport and transport via pipelines, H50 – Water transport, H51 – Air transport,
H52 – Warehousing and support activities for transportation, H53 – Postal and courier activities.

The results of the Pairwise Granger Causality Tests show the null hypothesis of no-causation may be rejected for most causal conjectures with relatively high F-Statistics (strength of the effect) and relatively low values of probability ($p<0.01$). In row 1 of Table 3 we see that the conjecture of a causal effect going from the overall economy represented by the value added of all economic sectors to the value added of the warehousing and support activities of the transportation sector (H52) cannot be rejected. In row 2 we may observe that the inverse effect is much lower and is not statistically significant at the 0.05 level. In row 3 we see that the conjecture of a causal effect going from the overall Transportation and storage sector (total H) to the Warehousing activities also cannot be rejected. The much weaker inverse relationship is observable in row 4 considering the fact that H52: Warehousing and support activities of the transportation sector are an integral part of the overall H: Transportation and storage sector. In row 5 of table 3 the Granger (non-)causality between changes in the value added of postal and courier services (H53) and warehousing and support activities of the transportation sector (H52) is tested. The F-statistic of 19.8065 shows a strong relationship, and a probability value of $2 \cdot 10^{-5}$

indicates a strong statistical significance. In row 6, we may observe the results of the Granger causality test between land transport (H49) and warehousing (H52) also showing a very high F-statistic of 26.8401 with $p=1\cdot10^{-6}$. The fact that the vice versa relationship is statistically insignificant means that the land transport activity (H49) is leading the warehousing activity (H52).

Rows 7 to 10 of table 3 show the conjectures of Granger causality between the value added of the overall transportation and storage sector (H), land transport and transport via pipelines (H49), and warehousing and support activities for transportation (H52) against the value added of large enterprises with more than 250 employees. The conjectures 7 to 10 from table 3 have the highest measured statistical probability of success. This means that changes in overall economic activity, in overall transportation and storage sector, and in land transportation and warehousing is strongly correlated and precedes changes in the value added of the warehousing and support activities for transportation (H52), but only in large enterprises with more than 250 employees. The rest of the table 1 shows other Granger causality test results with somewhat weaker F-statistics and p-values. Nevertheless, these relationships are also statistically significant at the $p<0.05$ level.

Testing for the existence of cross-section (individual) and time effects is important in panel data analysis since the presence of these effects could lead to an incorrect specification of the regression and consequently to an improper inference. The primary choice of a test statistic in a panel analysis is between Random Effects (RE), Fixed Effects (FE), and First Differences (FD) dynamic methods. The Correlated Random Effects - Hausman Test statistics compares two sets of estimates, one that is consistent under both the null and the alternative, and another consistent solely under the null hypothesis. If the idiosyncratic effects are random, then the RE estimator is more efficient. If the idiosyncratic effects of the RE and FE estimators converge to different values, the FE estimator is solely consistent. A large statistical difference between the two sets of estimates is taken as evidence in favour of the alternative FE hypothesis. The FD dynamic method by differencing the variables eliminates any idiosyncratic effects, held in cross-section data, but unfortunately, differencing also destroys valuable information held in raw data (Arellano, 2003, Baltagi, 2005, and Wooldridge, 2010). Table 4 shows a simple Panel Ordinary Least Squares (OLS) between employment in the warehousing and its supporting activities and overall activities.

Table 4. Panel OLS between employment in the warehousing and overall economy

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	2942.038	1351.858	2.176292	0.0316
EMPLOYMENT H TOTAL	0.037306	0.008604	4.336016	0.0000

Data source: European Commission (2019); Calculation: Eviews. Total panel (balanced) observations: 117.

Table 5 provides a Hausman test statistics for the regression in Table 4.

Table 5. Correlated Cross-section Random Effects - Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.187102	1	0.1392

Data source: European Commission (2019); Calculation: Eviews. Total panel (balanced) observations: 117.

Table 5 shows an example of a correlated cross-section RE test: the Hausman test (Hausman et al. 2005), between the total employment of the warehousing and support activities for transportation as a dependent variable and total employment of all economic sectors. The statistic provides little evidence against the null hypothesis that there is no misspecification of the RE hypothesis. The p-value of 0.1392 is not enough to reject the null hypothesis of a cross-section random effects estimate being well specified.

In continuation, we show the same test statistics for the change in the value added of the warehousing and support activities for transportation (H52) as a dependent variable, and change in the value added of all economic sectors (table 6).

Panel data models can have heteroscedasticity and autocorrelation between errors both contemporaneously and over time. In such cases it is advised to use the Panel EGLS method. Table 6 shows the dependence of the changes in total value added of the warehousing and support activities for transportation (H52) from changes in the total value added of the overall economy. For purposes of data stationarity, all variables are first differenced. Also, because of first differences, we speak of changes in variables and not of their nominal values.

Table 6. Results of the Panel EGLS test

Dependent Variable: D(VA H52 TOTAL)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CONSTANT	13.46404	4.174893	3.225002	0.0017
D(VA ALL TOTAL)	0.02078	0.002279	9.116857	0.0000
R-squared	0.484833	Mean dependent var		42.56758
Adjusted R-squared	0.419811	S.D. dependent var		141.6007
S.E. of regression	106.6106	Sum squared resid		1170679.
F-statistic	7.456538	Durbin-Watson stat		1.902425
Prob(F-statistic)	0.000000			

Data source: European Commission (2019); Calculation: Eviews. Total panel (balanced) observations: 117.

The equation results are statistically significant at the $p<0.01$ level and show a relatively high R^2 of 0.48, although having a weak coefficient value of only 0.02078 related to the independent variable of the changes in the overall economy value added D(VA ALL TOTAL). On the basis of the Panel EGLS test results we may conclude that there is high probability of H52: Warehousing and support activities of the transportation sector being influenced by the H: Transportation and storage sector in the 13 new EU member states between 2008 and 2017.

Table 7. Panel EGLS (Cross-section weights) test results

Nr.	Depend.	Independ.	Coeff.	S. E.	p	Const.	S. E.	p	R2
1	D(VA H52)	D(VA ALL)	0.020775	0.00228	0.000	13.4640	4.17489	0.002	0.48
2	D(VA H52)	D(VA H49)	0.312116	0.04886	0.000	13.2466	4.90746	0.008	0.33
3	D(VA H52)	D(VA H50)	0.728990	0.17393	0.000	33.6002	3.82339	0.000	0.21
4	D(VA H52)	D(VA H51)	0.311171	0.31295	0.322	28.5927	5.31728	0.000	0.08
5	D(VA H52)	D(VA H53)	1.684451	0.44062	0.000	27.4162	5.04891	0.000	0.18

Data source: European Commission (2019); Calculation: Eviews. Total panel (balanced) observations: 117.

The above results are statistically significant at $p<0.01$ level except for the relationship between the changes in the value added of the air transport (H51) and the changes in the value added of the warehousing and support activities for transportation (H52) as the p-value=0.322. It seems the warehousing activities are not under the influence of air freight since air transported cargo is not warehoused for any longer period of time.

We proceed with the Panel Generalized Method of Moments First Differences model test between value-added of the warehousing and support activities for transportation (H52) as a dependent variable, its autoregressive instrument and the value added of the overall economic activity as the independent variable (table 8).

Table 8. Results of the Panel GMM (FD) test

Dependent Variable: VA H52 TOTAL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
VA H52 TOTAL(-1)	0.345359	0.098600	3.502636	0.0007
VA ALL TOTAL	0.013113	0.003293	3.981702	0.0001
Mean dependent var	50.24592	S.D. dependent var		138.5642
S.E. of regression	139.6062	Sum squared resid		1987970.
J-statistic	24.90488	Instrument rank		28
Prob(J-statistic)	0.524365			

Data source: European Commission (2019); Calculation: Eviews. Total panel (balanced) observations: 104.
Period SUR (PCSE) standard errors & covariance (d.f. corrected).

The J-statistic states that the instruments are uncorrelated with the error term and the Prob(J-statistic) significantly different from zero (0.52) gives us the confidence that our instrument set is appropriate. In continuation we use the Arellano-Bond test (Arellano and Bond, 1991) to test the residuals for their serial correlation with the variables.

Table 9. Results of the Arellano-Bond residuals' serial correlation test

Test order	m-Statistic	rho	SE(rho)	Prob.
AR(1)	-2.691188	-598975.368624	222569.098459	0.0071
AR(2)	0.548028	120168.707102	219274.727651	0.5837

Data source: European Commission (2019); Calculation: Eviews.

The Arellano-Bond serial correlation test statistic (shows the AR(1) statistic is significant, while the AR(2) statistic is not, pointing to the residuals being serially

uncorrelated in levels (Arellano and Bond, 1991). Thus, the post-hoc statistics makes us confident of the primary result. In continuation, we show the summary statistics of other relationships tested with the Panel General Method of Moments (GMM) First Differences (FD), whereby the warehousing and support activities of the transportation sector is the primary dependent variable (table 10).

Table 10. Results of the Panel Generalized Method of Moments First Differences tests

Nr.	Depend.	Coef.(-1)	S. E.	p	Independent	Coef.	S. E.	p	J-Stat
1	VA H52	0.16234	0.0030	0.000	D(VA ALL)	0.24735	0.0002	0.000	11.663
2	VA H52	0.28890	0.0040	0.000	D(VA H49)	0.31194	0.0005	0.000	11.362
3	VA H52	0.40345	0.0188	0.000	D(VA H50)	-4.60744	0.0736	0.000	10.836
4	VA H52	0.68929	0.0107	0.000	D(VA H51)	0.59255	0.0048	0.000	12.008
5	VA H52	0.78621	0.0061	0.000	D(VA H53)	1.63344	0.0161	0.000	11.650
6	VA H52 250+	0.30439	0.1333	0.025	D(VA ALL)	0.01290	0.0031	0.000	66.463
7	VA H52 250+	0.35258	0.1297	0.008	D(VA H49)	0.19098	0.0516	0.000	65.710
8	VA H52 250+	0.47930	0.0671	0.000	D(VA H50)	-2.35158	0.6351	0.000	59.706
9	VA H52 250+	0.66960	0.1248	0.000	D(VA H51)	0.33591	0.3012	0.267	66.508
10	VA H52 250+	0.73894	0.1049	0.000	D(VA H53)	0.78543	0.4242	0.067	58.612

Data source: European Commission (2019); Calculation: Eviews 9. Total balanced panel observations: 104. All variables are differenced. Glossary: land transport and transport via pipelines (H49), water transport (H50), air transport (H51), warehousing and support activities for transportation (H52), postal and courier (H53).

The results of Panel Generalized Method of Moments First Differences tests in table 10 show expected signs, p-values and Arellano-Bond residuals' serial correlation test results in case of overall economic value added but because of the results of the Arellano-Bond serial correlation test we cannot reject the null hypothesis of serial correlation in residuals in case of land transport and transport via pipelines (H49), water transport (H50), air transport (H51), and postal and courier (H53) since in all these cases the value of the AR(1) was significantly different from zero. From line 6 to line 9 of table 10, the dependent variable was changed to the value added of the enterprises with 250+ employees, as they bore the statistical brunt of the influence. This is shown by the very similar results to total H52. Some modifications to the test parameters where necessary though to be able to get residuals without any statistically significant serial correlation. In some cases (line 6, 7, 8, 9, and 10) GMM weights where set to Differenced Arellano-Bond 1-step, and the coefficient covariance method was set to period SUR (PCSE). This requires the shocks to have same time-series correlation structure for all cross sections. But in case of a broad world crisis such as the COVID-19 pandemic, this is to be expected. In all other cases the coefficient covariance method was set to a robust White period standard errors & covariance corrected for degrees of freedom. The seemingly unrelated regression (SUR) method, accounts for heteroscedasticity and contemporaneous correlation in errors across equations. Panel period Corrected Standard Error (PCSE) is robust to heteroscedasticity across periods, but not to general correlation of residuals.

We thus conclude that the changes in the value added of the overall economy are a good predictor of the changes in the value added of warehousing and support

activities for transportation (H52). The results are statistically significant at the $p<0.001$ level, and for every one percent of decrease in the overall economic activity, we may expect a quarter of a percentage decrease in the warehousing activities.

5. CONCLUSION

Our 10-year data-panel from 2008 to 2017 of 13 EU member states including 11 CEECs (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovenia, and Slovakia) but also two Mediterranean island countries (Cyprus and Malta) has given us a good basis to test the conjectured relationship between the changes in the value added of the overall economic activity within observed countries and the H52:Warehousing and support activities for transportation as part of the H: Transportation and storage sector of the European Union Nomenclature of Economic Activities. We achieved stationarity by differencing the data and regressed the variables representing the overall economy on warehousing and transportation support activities (H52). The null hypothesis of no-causation may be rejected for most causal conjectures with three successive test methods: a Panel Pairwise Granger Causality test, a Panel Estimated Generalized Least Squares (EGLS) with Fixed Effects (FE), and a Panel Generalized Method of Moments (GMM) with First Differences (FD). We conclude the changes in the overall economy have an impact on warehousing and transportation support activities (H52) in terms of its value added, employment, and number of enterprises.

We have had a number of limitations to our study. Although we were able to show many statistical outputs, many more were computed, but because of statistical insignificance, only a fraction was finally shown. Now, we would proceed probably differently, by jumping ahead of many statistical tests and analyses that were done without bearing any significant results. We hope to be able to continue this research after the COVID-19 pandemic settles down and to test the structural break in the panel data, as well as the recovery thereafter.

We conclude that the overall economy (value added and employment) has a statistically significant and measurably strong impact on Warehousing. Of all transportation activities, the land transportation activity (H49) has the strongest statistical impact on warehousing and support activities (H52).

Moreover, any change in the value added of the overall economy impacts the change of the Warehousing and support activities of the transportation and storage sector by the relative amount of approximately ¼ of the relative original amount.

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