Economic Determinants of Maritime Shipping in 21st Century

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Abstract

The usual growth trend of maritime transport deviated from its usual growth pattern since the second half of 21st century. This shows the importance of investigating main factors of maritime shipping during this period. The paper analyzes short-run and long-run dynamics deploying panel Autoregressive Distributed Lag (ARDL) model based on specification and model examination. Two models estimated for 13 countries in MENA region from 2000 till 2019 then re-estimated for upper-income countries and middle-income countries to specify main determinants in each country sub-group. Results found that main factors affecting maritime in 21st century is GDP which found to be statistical positive significant at both short run and long at all estimations. Merchandize trade, exports and oil prices found to be statistically positive significant at long run. Demand of maritime transport found to be more elastic in long run, exchange rate found to be negatively significant at long run.

Keywords: world economy, oil prices, panel ARDL, freight rate, trade, maritime shipping.

المحددات الاقتصادية للنقل البحري بالقرن الواحد والعشرين

مستخلص

تبحث الدراسة من خلال بناء وتقدير نماذج قياسية لدراسة المحددات الاقتصادية للنقل البحري ومحدداته في عينة من دول منطقة الشرق الاوسط وشمال افريقيا باستخدام بيانات سنوية للفترة من ٢٠٠٠ الى ٢٠١٩ بتطبيق نموذج الانحدار الذاتي للإبطاء الموزع ثم دمج نموذج تصحيح الخطأ لتحديد العلاقة قصيرالاجل والعلاقة طويلة الاجل بين المتغيرات محل الدراسة. تم تقدير نموذجين على ثلاث مستويات اولا تقديره لجميع الدول محل الدراسة ثم تقديره لمجموعة الدول ذات الدخل المرتفع واخيرا تقديره لمجموعة الدول ذات الدخل المتوسط. اختبر تأثير الدخل القومي الاجمالي واسعار البترول والتجارة السلعية على النقل البحري. اشارت نتائج تقديرات النموذجين للتأثير المعنوي الايجابي للدخل القومي الاجمالي، والصادرات والتجارة السلعية في الاجل الطويل، والتاثير المعنوي السلبي لسعر الصرف في الاجل الطويل.

الكلمات الدالة: محددات، النقل البحري، الدخل القومي الاجمالي، الانحدار الذاتي لفترات الإبطاء الموزع، التجارة الدولية.

1. Introduction

Maritime transport importance has been discussed since early stages of economic thoughts. Adam Smith mentioned importance of maritime shipping in The Wealth of Nations, in 18th century "As by means of water-carriage a more extensive market is opened to every sort of industry than what land-carriage alone can afford it, so it is upon the sea-coast, and along the banks of navigable rivers, that industry of every kind naturally begins to subdivide and improve itself" (Smith, 1982).

Based on Stopford (1988), “Maritime trade covers the movements of commodities through vessels between the ports of origin, where merchandise is received or loaded from the exporter, and the port of destination where the merchandise is collected by the importer”. According to Maritime Transport review (2005) maritime trade known as "the anchor for international trade". Maritime transport trade links economies, and enhance economic and social development. According to UNCTAD (2019) maritime shipping is the backbone of international trade and global supply chain; carrying 80% of trade volume.

Problem of study that data shows a decline in maritime trade internationally deviated from the usual trend. Container transport increased from 2001 to 2008 by 10.8% average per year, in comparison to growth rate of 3.9% in the period from 2011 to 2016.

The importance of the study is examining the main determinants of maritime shipping especially in twenty first century, as there is a gap in literature studying demand factors regionally and internationally.

The paper uses deductive approach deriving economic hypotheses using logical deduction, then empirically testing them through econometric methods deploying panel ARDL model. The study will estimate two Panel ARDL models investigating main determinants of maritime shipping. Main hypotheses based on martin Stopford and economic literature that the main determinants of demand are world economy, international trade, transport cost, exchange rate and prices.

The remaining of paper planned as follows second section is briefly discussing maritime shipping in twenty first century, then third section discussing theoretical and literature background. The fourth section covers data description, and explanation of methodology, followed by results of empirical analysis at fifth section, and then ending with conclusion and recommendations.

2. Maritime Industry in the 21st Century

Based on Rodrigue (2020), maritime transport played important role in trade over centuries, as it brings maritime shipping users and providers, together with all global supply chain parties for increasing benefits and profits of international trade.

Product life cycle (PLC) model, proposed by Raymond Vernon (1966) divided PLC into four stages (introduction, growth, maturity and decline) (Lv & Wang, 2011). Scholars believe that changes of markets need caused PLC (Wang et al., 2010).

Innovations (new product or service) go first through the phase of introducing the new product to the market at which, there are low profits and few competitors. By increasing sales, it goes directly to growth stage at which demand increases sales, which reduce production costs according to economies of scale and raise profits. The product will be well known and new versions will be introduced to the market by

competitors. Increasing number of customers moves the innovation to maturity phase; at which the product becomes standardized and the profit start to decrease. Decline phase; is the final stage at which the original innovation disappears from the market as it isn't profitable enough to continue production due to high competition worldwide and production of cheaper versions by competitors which reduce the demand on the original invented product (Cai & Gong, 1999).

Stopford (1997) stated that during 1960s maritime transport started on an international scale, and used large containers for large cargo, as a cost-effective mean of transportation over long distance. Over 21st century maritime industry went through innovation, and changes in industry structure and technology, as well as, geographical changes due to changes in sources of raw materials and production plants. That supported going from introduction phase towards growth, and maturity phases, integrating distribution system and production with logistics services in international markets (Rodrigue, 2016).

In 2016, commodity trading was below worldwide GDP annual growth rate by 1.3% for the first time since 2001. Container transport increased from 2001 to 2008 by 10.8% average per year, in comparison to growth rate of 3.9% in the period from 2011 to 2016 (Saxon & Stone, 2017), showing deviation from the usual trend.

According to UNCTAD (2019) report, growth in international maritime trade stagnated in 2019, showing the lowest level since 2008 global financial crisis, as volume of maritime trade increased by 0.5 % in 2019, in comparison to 2.8% in 2018.

Based on Rodrigue (2010) there are six main groups of motivators caused this change (politics, society and

demography, environment and energy, economics, finance and technology) (Esmer, 2018). Economic factors motivating this change in maritime industry need to be further studied.

3. Maritime Shipping Determinants in Literature

Based on Stopford (1988) shipping market supply and demand model stated that the main shipping demand factors are world economy, seaborne commodity trades, average haul, political events, and transport costs. World economy, determine goods amounts shipped by sea, changes in growth trends of a commodity can modify trade growth trends. Also, stated main supply factors as: world fleet, freight rates, shipbuilding deliveries and scrapping.

Stopford (1997) studied the relationship between growth rates of industrial production and seaborne trade in OECD, since industrial production is the main parameter affect sea transport demand through world trade. The study found that OECD economic cycles invariably mirror sea trade cycles during the period from 1963 to 1995. Based on Stopford, demand curve is almost vertical showing inelastic demand for most bulk commodities as there is no other alternative transport means. Shippers need to deliver the cargo regardless of transportation cost, as they need time to find alternative arrangements. Also, lower shipping cost doesn't attract shippers to raise their demand. In real world, price that buyers and sellers accept depends on time available for adjustment. At momentary equilibrium transport deal has to be carried immediately as there is no time for adjustment. At short run, there is time for adjustment actions as reactivation of ships and containers or switching markets or changing operating ships speed. At long run, ship-owners have long adjustment time of changing supply to respond to changing demand, or changing commodities supply sources (Stopford, 1997).

Regarding the adjustment, Zannetos (1966) stated that at short run, laid-up containers or ships considers an important response of disequilibrium in shipping industry. In recession, ships are laid up due to reduction of demand on shipping at lower equilibrium freight rate. At expansion, while demand on shipping increases there is little or no laid up vessels responding to increasing demand and equilibrium freight rate sustained at higher level (Grammeno & Arkoulis, 2002).

In addition, to Stopford demand function there are number of related factors discussed in economic literature as follows:

First: since Bretton Woods's early 1970s exchange rate was of great concern for shipping industry. McConville (1999) found direct and indirect impacts of exchange rate on maritime shipping. Leggate (1999) quantifying exchange rate impact on shipping industry, found that movement of exchange rate affect expenditure which in return affect profits, and consequently affect maritime shipping.

Grammeno & Arkoulis (2002), mentioned the importance of macroeconomic factors include; exchange rate, inflation, oil prices, and growth in industrial production. Any raise of American dollar will raise freight rates, as it’s quoted in American dollar. From a macro-economic perspective, exchange rate affects demand on shipping industry indirectly, through its impact on international trade, in case of lower exchange rate exports from trading partners will be cheaper and consequently increase demand on shipping (Grammeno & Arkoulis, 2002).

Second: global inflation has an important impact on international trade, which affects world economy and consequently affects maritime shipping. Ferson & Harvey (1994) stated that higher inflation levels raise economic uncertainty which reduces aggregate demand and affect GDP

and maritime shipping. Millan *et al.* (2005) found significant impact of maritime shipping services prices as well (Millan et al., 2005).

Third: economic literature supports the concept of macroeconomic factors influence on demand in maritime industry. Esmer (2018) stated that world economy has positive significance on logistics industry. Yin & Shi (2018) discussed impact of demand variables on shipping market. Bai & Lam (2019) stated that global economy has great impact on demand on maritime shipping since its demand driven. If world economy facing expansion, trade volume increase which will raise the demand on shipping. Akbulaev *et al.* (2020) studying five countries discussed positive linkage among maritime shipping and economic growth. Michail (2020) investigated relationship between economic factors and seaborne transportation, found significant impact of world GDP on seaborne transportation at long run.

Fourth: Based on UNCTAD (2005) Maritime Transport review; freight rates contribute by almost 5% of total global trade which has positive impact on world economy. This means that freight rate returns might have positive impact on demand of shipping indirectly through raising world economy (Osadume & Blessing, 2020). Bai & Lam (2019) stated that freight rate is main factor affecting shipping companies' profits and prices of second-hand ships and capacity utilization.

Fifth: oil prices consider important for maritime shipping because of its impact on world economy, then consequently on seaborne trade supply and demand. This illustrated by oil crisis of 1973 and 1979 as rising of oil prices reduced oil imports demand and deteriorated economic status which in return reduced demand of maritime shipping and freight rates. Also, fuel represent almost 47% of voyage cost then

rise of oil prices will increase maritime transport cost which decrease demand and shipping industry profits (Grammeno & Arkoulis, 2002). Michail (2020) ranking countries according to income level found that oil prices have positive significance at high and middle-income economies and negative impact on low-income economies due to inelasticity of demand.

4. Data Analysis and Model Specification

4.1 Data Description

The estimation based on panel data of 13 Middle East and North Africa (MENA) countries from 2000 till 2019. The period selected according to the paper objective studying maritime shipping at the 21st century. Variables definitions shown in table (2) the data obtained from World Bank indicators, except oil prices obtained from bp's Statistical Review of World Energy.

The study is investigating the main determinants of maritime shipping using container port traffic as dependent variable. The explanatory variables are investigated in two different models; the first model includes factors of demand of shipping market based on Stopford demand factors (GDP as proxy of world economy, merchandize trade as proxy of seaborne trade, and oil prices as proxy of transport cost). Second model, investigating the impact of exchange rate based on literature as McConville (1999) and impact of trade using exports and inflation using deflator based on Grammeno & Arkoulis (2002).

Both models estimated for all studied countries, then divided the countries into two subgroups according to income level using World Bank country classification. First group include high-income level countries (HI) while second group include middle-income countries (MI), as shown in

table (1). According to World Bank countries' income groups based on gross national income (GNI) per capita.

As shown from table (3), analyzing growth of container port traffic at the studied 13 MENA countries as proxy of maritime shipping found that its minimum value was at Bahrain year 2000 and maximum value at United Arab of Emirates year 2015. Also, as shown from figure (1) and (2) growth of container port traffic from 2000 to 2019 showing the highest growth rate of 25% at Saudi Arabia and the lowest growth rate of 1% at Tunisia.

Table (1) Countries Ranked According to Income Level

Bahrain	High income
Israel	High income
KSA	High income
Malta	High income
Oman	High income
UAE	High income
Algeria	Lower middle income
Egypt	Lower middle income
Iran	Lower middle income
Morocco	Lower middle income
Tunisia	Lower middle income
Jordan	Upper middle income
Lebanon	Upper middle income

Sources: Collected by author based on World Bank data

Table (2) Variables Definitions

Variable	Label
LNCONT	Container port traffic (TEU: 20 foot)
LNOILP	Oil prices
LNGDP	GDP (constant 2015 US$)
LNMERCH	Merchandise trade (% of GDP)
LNEXP	Exports of goods and services (constant 2015 US$)
LNEXCH	Official exchange rate (LCU per US$)
LNDEF	GDP deflator

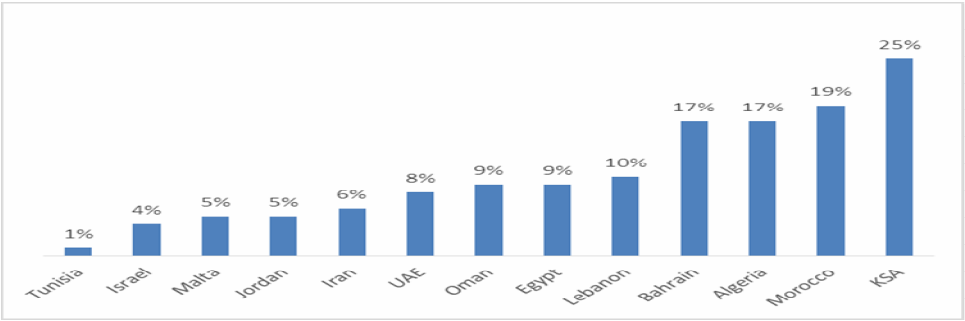
Sources: Collected by author

Table (3) Descriptive Statistics

Variable	Mean	Median	Max.	Min.	Std. Dev.	Jarque-Bera P value	Obs.
CONTAINER	3010354	1511057	21233200	200000	4052613	0.000	260
LNCONT	14.235	14.228	16.871	12.206	1.185	0.017	260
LNOILP	4.008	4.116	4.692	3.126	0.507	0.000	260
LNGDP	25.214	25.149	27.243	22.614	1.214	0.002	260
LNMERCH	4.187	4.205	5.108	2.935	0.430	0.264	260
LNEXP	24.305	24.175	26.730	22.303	1.046	0.001	260
LNEXCH	2.027	1.322	10.645	-1.166	3.121	0.000	260
LNDEF	4.376	4.497	5.962	2.743	0.442	0.000	260

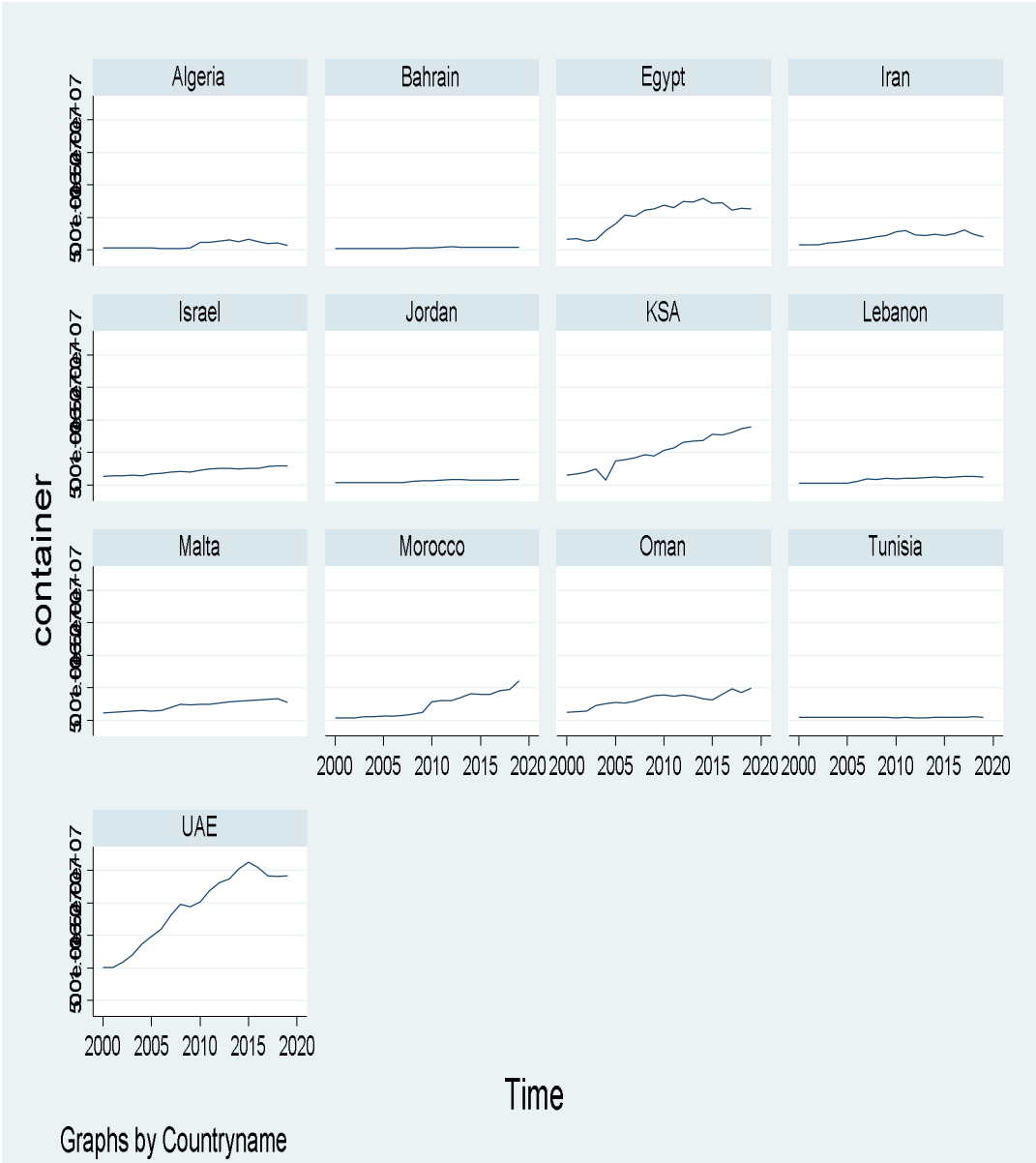
Source: Estimated by Author. "Ln" at the beginning of abbreviations stands for logarithm

Figure (1): Average annual growth Rate (2000-2019)



Source: Estimated by Author

Figure (2) Container Port Traffic from 2000 to 2019



Source: Estimated by Author based on World Bank data

4.2 Empirical Analysis Methodology

4.2.1 Pre-Estimation tests

Before estimating ARDL model, data should be tested for CD (cross-section dependency) which could emerge due to macroeconomic linkages. The study employing Pesaran (2004) CD_{LM} and Pesaran (2015) tests of cross section dependence to identify the existence of CD dependency among studied variables. If the CD problem doesn't exist, then first generation unit root test should be employed which don't consider CD problem. If the variables have CD problem second generation unit root test should be employed (Rafindadi, 2013).

Unit root test should be carried to identify order of integration to ensure that studied variables integrated of order zero or one at most to be able to use ARDL model, any second order integrated variables should be excluded. Based on Pesaran and Smith (1995); Pesaran (1997); Pesaran *et al.* (1999) unit root tests carried to confirm that the integration order of all variables doesn't exceed I(1) (Rafindadi, 2013).

Then testing for long run Co-integration among the dependent variable and the independent variables using panel co-integration tests as Pedroni (1999, 2004), Kao (1999) and Westerlund (2007). The three tests testing null hypothesis of no co-integration. If variables co-integrated then ARDL model can be estimated.

Also, bias adjusted test LM_{adj} of Pesaran *et al.* (2008) employed. In Addition, Pesaran & Yamagata (2008) slopes homogeneity test Δ_{adj} employed testing null hypothesis "slope coefficients are homogenous" (Dahmani et al., 2021).

4.2.2 Estimation Technique

Pesaran and Smith (1995) suggested employing panel ARDL model if studied varaiables stationary at level or at first difference, and if panel sample number of years more than countries (Khan et al., 2020). The main advantage of panel ARDL over other methods as GMM and instrumental variables, that they may produce inconsistent estimate of average value of paramenters unless coeffecient are identical across countries (da Silva et al., 2018).

Since the panel sample investigated includes 13 countries and 19 years and the variables might not be stationary at level then panel ARDL model is appropriate.

ARDL model estimated at the current study has the following form:

$$\mathrm{LNCONT}_{it} = \sum_{j=1}^{p} \alpha_{ij}\ LNCONT_{i,t-j} + \sum_{j=0}^{q} \beta'_{ij} \mathrm{X}_{i,t-j} + \mu_i + \varepsilon_{it} \quad \text{(Equ.1)}$$

Reparametrize the ARDL - ECM (Error Correction Model) turns into:

$$\Delta\,\mathrm{LNCONT}_{it} = \emptyset_i\ (\mathrm{LNCONT}_{i,t-1} - \lambda'_i\, X_{i,t}) + \sum_{j=1}^{p-1} \alpha_{ij}\,\Delta\mathrm{LNCONT}_{i,t-j} + \sum_{j=0}^{q-1} \beta'_{ij}\Delta\mathrm{X}_{i,t-j} + \mu_i + \varepsilon_{it} \quad \text{(Equ.2)}$$

LNCONT is dependent variable which is used for both models. X is explanatory variables vector (LNGDP, LNMERCH, LNEXP, LNEXCH, LNOILP, LNDEF) examining their impact on LNCONT in both models.

$\emptyset_i$ is group specific speed of adjustment coefficient

λ'_i Is vector of long run relationships

Error correction term; ECT = ($Y_{i,t-1} - \lambda'_i\, X_{i,t}$)

α_{ij} , β'_{ij} short run dynamic coefficients

i represents country and t represents time, p is lag of dependent variable, while q is lags of independent variables.

The models estimated using Panel ARDL model distinguishes between short-term and long-term impacts, estimating (MG, PMG and DFE) then using Hausman test to check the appropriate estimators.

MG (Mean Group) model suggested by Pesaran, Shin & Smith (1995) to solve the bias happen because of heterogeneous slopes in dynamic panels. MG estimator provides long run parameters by calculating average of long run parameters of ARDL models of individual countries. Pooled Mean Group (PMG) developed by Pesaran *et al.* (1997, 1999) estimate non stationary dynamic panels based on averaging of coefficients detects short and long run association among studied variables, with investigating the possibility of heterogonous dynamics across countries (Rafindadi, 2013). MG technique allow intercepts, slope and errors to differ along the groups, while PMG allows the same but in short run parameters only but restrains long run coefficients to be equivalent (Asghar et al., 2015).

Dynamic Fixed Effect (DFE) is similar to PMG, coefficient of co-integrating vector equal across all panels in long-run and it restricts speed of adjustment coefficient to be equal (Rafindadi, 2013).

ARDL models estimated three times; first including the thirteen studied countries then re-estimating the models for two countries subgroups divided according to income level using World Bank country classification. First subgroup includes six high income level countries and second subgroup includes seven middle-income countries.

5. Estimation Results

5.1 Pre- Estimation Tests Results

The variables were tested for CD cross sectional dependence using Pesaran (2004) CD_{LM} test, and Pesaran (2015) test which found that both models at all estimations are free of CD which means first generation unit root test should be applied. The study employed IPS and LLC first-generation unit root tests for testing studied variables for stationarity. Test results as shown in table (4) shows that all studied variables are integrated of first order I (1) so the variables can be used to estimate ARDL technique. Also, panels don't have bias estimators and the slopes are homogenous in panel data at all estimations.

Table (4) Unit Root Test Results

Variable	IPS	First difference	LLC	First difference
LNCONT	0.2449	0.000	0.2324	0.0000
LNOILP	0.9918	0.000	0.1611	0.0000
LNGDP	1	0.000	0.9971	0.0000
LNMERCH	0.5132	0.000	0.5132	0.0000
LNEXCH	0.2548	0.000	0.2548	0.0000
LNEXP	0.7227	0.000	0.2409	0.0009
LNDEF	1	0.000	0.8136	0.0004

Source: Estimated by Author

5.2 Estimation Results

5.2.1 Estimation of All Studied Countries

As shown from table (5) both models are free of CD using both Pesaran (2004) CD_{LM}, and Pesaran (2015) tests. Also found that panels don't have bias estimators using bias adjusted test of Pesaran *et al.* (2008), as well as, slopes are homogenous in panel data using Pesaran & Yamagata (2008) test.

Based on the results of stationary tests, the co-integration test carried to confirm that there is co-integration between dependent and independent variables in each model to confirm of the employability of ARDL model. Pedroni, Kao and Westerlund cointegration tests are employed to test the co-integration in both models. The three used cointegration tests reject the null hypothesis of no cointegration in all studied panels. As shown from table (6), there is evidence of a long-run cointegration between the dependent and explanatory variables for all studied panels. This suggests that an estimation of ARDL models will provide reliable short and long-run results.

Table (5) Pre-Estimations Tests Results

Test	Model 1		Model 2	
	Stat.	**P. Value**	**Stat.**	**P. Value**
Pesaran CD	0.668	0.325	0.942	0.378
CD_{LM}	1.493	0.135	0.565	0.571
LM_{adj}	12.04	0.676	0.147	0.140
Δ	-0.176	0.860	1.362	0.173
Δ_{adj}	-0.205	0.838	1.587	0.112

Source: Estimated by Author

Table (6) Cointegration Tests Results

Test	Model 1	Model 2
Pedroni test for co-integration		
Modified PP "Phillips-Perron"	0.2301	0.2979
PP "Phillips-Perron"	0.0001	0.0287
ADF "Unadjusted Dickey-Fuller"	0.0002	0.0478
Kao test for co-integration		
“Modified Dickey-Fuller”	0.3571	0.0867
“Dickey-Fuller”	0.2224	0.0065
“Augmented Dickey-Fuller”	0.2658	0.0236
“Unadjusted Modified Dickey-Fuller”	0.0191	0.4867
“Unadjusted Dickey-Fuller”	0.0362	0.4656
Westerlund	0.0105	0.0411

Source: Estimated by Author

Table (7) shows models estimation results for 13 MENA countries of short-run dynamic estimates associated with long-run relationship derived from the error correction model (ECM). The table shows estimation results of MG, PMG and DFE estimators. Both models found to be well fitted at first lag (1, 1, 1, 1) using PMG as found by result of Hausman test.

First model ARDL – PMG estimation shows that ECM model is well fitted as the coefficient of the error correction term (ECT) is -0.3471 (0.000) which is statistically significant at 1% level with negative sign as expected which means that disequilibrium from previous periods shock will bounce back to equilibrium. ECT presents speed of adjustment towards long run equilibrium of 34.7% annual correction rate; divergence from equilibrium will be corrected in almost 3 years.

At long run, all investigated variables are significant; GDP as proxy of world economy and merchandize trade as proxy of seaborne trade are positive significant at 1% confidence level which goes with Stopford (1988). At short run, GDP is positive statistically significant which also goes with Stopford (1988).

Oil prices found to be positive statistically significant at long run only at 1% confidence level which goes with Michail (2020).

Second model found to be well fitted using PMG method as result of Hausman test. ARDL – PMG estimation shows that ECM model is well fitted as the coefficient of ECT is -0.374 (0.000) which is statistically significant at 1% confidence level with negative sign as expected which means that disequilibrium from previous periods shock will bounce back to equilibrium at 37.4 % annual correction rate, or divergence from equilibrium will be corrected in 2.6 years.

Exports at long run found to be positive statistically significant at 1% confidence level which goes with literature as higher trade will raise demand on maritime shipping. Exchange rate found to be negative statistically significant at long run which goes with economic literature as a change in exchange rate would affect shipping directly as freight rates calculated in US dollar and can affect shipping indirectly, through its effect on international trade, consequently, affecting demand for shipping.

Deflator at short run, found to be negative statistically significant showing indirect inflation impact on maritime shipping industry because of its impact on international trade, and world economy which affect shipping demand that goes with literature as (Millan et al., 2005, Harvey, Ferson and Harvey, 1994). At long run, deflator is positive statistically significant which doesn't go with literature that can be explained, that higher local inflation rates reduce demand on country's exports but increase demand on imports which will be relatively cheaper than local prices that will increase demand on maritime shipping of that countries.

Table (7) ARDL Models Estimation Results

	MG		PMG		DFE	
Variable	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
Model 1						
Long Run						
L.LNOILP	1.1107	0.079	0.2768	0.000	0.3230	0.098
L.LNGDP	0.6791	0.404	0.7791	0.000	1.1221	0.011
L.LNMERCH	-1.9943	0.105	0.1879	0.004	0.3850	0.384
Short run						
ECT	-0.7441	0.000	-0.3471	0.003	-0.2186	0.000
LD.LNCONT	0.1355	0.035	-0.0013	0.409	-0.0879	0.180
LD.LNOILP	-0.1191	0.184	0.1079	0.428	0.0306	0.636
LD.LNGDP	0.2344	0.818	1.2380	0.059	0.3600	0.330
LD.LNMERCH	0.4415	0.106	-0.7683	0.152	-0.0712	0.653
C	-13.597	0.012	-0.8696	0.018	-3.6691	0.195
Model 2						
Long Run						
L.LNEXP	-0.4877	0.547	0.4821	0.000	0.4530	0.248
L.LNEXCH	12.843	0.323	-0.7216	0.001	-1.2866	0.032
L.LNDEF	2.0913	0.410	0.5531	0.000	0.6430	0.151
Short run						
ECT	-0.5811	0.000	-0.3748	0.000	-0.1525	0.000
LD.LNCONT	0.0466	0.425	0.5870	0.202	-0.1154	0.076
LD.LNEXP	0.2766	0.352	-0.1231	0.117	0.2644	0.038
LD.LNEXCH	3.0801	0.285	-11.946	0.322	-0.1201	0.355
LD.LNDEF	0.2412	0.749	-0.427	0.078	-0.0350	0.833
C	9.5878	0.377	0.2772	0.430	0.0017	0.702

Source: Estimated by Author

5.2.2 Estimation of Upper Income Subgroup Countries

As shown from table (8), both models are free of CD using both Pesaran (2004)CD_{LM}, and Pesaran (2015) tests. Also, bias adjusted test of Pesaran *et al.* (2008) found that panels don't have bias estimators, and slopes are homogenous. As shown from table (9) Pedroni, Kao and Westerlund co-integration tests are employed to test the co-integration in both models. The three tests' results show evidence of a long-run cointegration among the dependent and explanatory variables for all studied panels.

Table (8) Pre-Estimation Test Results

Test	Model 1		Model 2	
	Stat.	**P. Value**	**Stat.**	**P. Value**
Pesaran CD	1.5143	0.278	1.1438	0.264
CD_{LM}	1.501	0.1334	0.1748	0.8612
LM_{adj}	2.422	0.1155	-2.436	0.1491
Δ	-0.418	0.676	0.141	0.888
Δ_{adj}	-0.482	0.630	0.163	0.871

Source: Estimated by Author

Table (9) Cointegration Tests Results

Test	Model 1	Model 2
Pedroni test for co-integration		
Modified PP "Phillips-Perron"	0.3683	0.3178
PP "Phillips-Perron"	0.0000	0.0016
ADF "Unadjusted Dickey-Fuller"	0.0000	0.0034
Kao test for co-integration		
"Modified Dickey-Fuller"	0.2525	0.4301
"Dickey-Fuller"	0.0457	0.3333
"Augmented Dickey-Fuller"	0.4759	0.0000
"Unadjusted Modified Dickey-Fuller"	0.0000	0.0000
"Unadjusted Dickey-Fuller"	0.0000	0.4656
Westerlund	0.0501	0.0869

Source: Estimated by Author

Table (10) shows models estimation results of short-run dynamic estimates associated with long-run relationship derived from ECM for seven upper income countries. The table shows estimation results of MG, PMG and DFE estimators, both models found to be well fitted using PMG as result of Hausman test.

First model, ARDL – PMG - ECM model is well fitted at proper lag length (1, 0, 0, 1). ECT coefficient is statistically significant -0.3727 (0.000) at 1% level with negative sign as expected which means that disequilibrium from previous periods shock will bounce back to equilibrium, with speed of adjustment 37.2% annual correction rate, or divergence from equilibrium will be corrected in almost 2.7 years. GDP is positive significant at both short and long run which goes with economic literature as Stopford (1988). Oil prices is positive statistically significant at 1% at long run which goes with Michail (2020). Merchandise trade is insignificant at both short run and long run which doesn't go with literature.

Second model, found to be well fitted at proper lag length (1, 0, 0, 0) using PMG as result of Hausman test. ARDL – PMG estimation shows that ECM model is well fitted as the coefficient of ECT -0.5062 (0.000) is statistically significant at 1% level, which means that disequilibrium from previous periods shock will bounce back to equilibrium at speed of adjustment 50.6 % annual correction towards long run equilibrium, divergence from equilibrium will be corrected in almost 2 years. Exports found to be positive statistically significant at 1% confidence level at long run which goes with literature as higher trade will raise demand on maritime shipping. Exchange rate is statistically negative significant at long run which goes with economic literature that coincide with first estimation of full list countries. Deflator found to be positive statistically significant at long run which also coincide with first estimation of full list countries.

Table (10) ARDL Upper Income Countries Level

	MG		PMG		DFE	
Variable	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
Model 1						
Long Run						
LNOILP	1.7814	0.192	0.2705	0.000	0.2826	0.019
LNGDP	-0.5915	0.684	0.8142	0.000	0.9607	0.001
L.LNMERCH	-2.5221	0.328	0.1422	0.484	0.0493	0.746
Short run						
ECT	-0.6036	0.023	-0.3727	0.000	-0.4589	0.000
LD.LNCONT	-0.0253	0.763	-0.0853	0.471	-0.2464	0.006
D.LNOILP	-0.0648	0.658	0.0715	0.183	0.0103	0.898
D.LNGDP	-1.0208	0.123	0.9998	0.045	-0.8623	0.121
LD.LNMERCH	0.2497	0.394	-0.1542	0.418	-0.0215	0.931
C	-8.2969	0.006	-2.6245	0.000	-4.9847	0.223
Model 2						
Long Run						
LNEXP	0.8136	0.001	0.4975	0.000	0.2555	0.308
LNEXCH	-0.2614	0.187	-0.7732	0.000	-0.9835	0.258
LNDEF	-0.6375	0.542	0.6133	0.000	0.8486	0.002
Short run						
ECT	-0.7438	0.001	-0.5062	0.000	-0.4013	0.000
LD.LNCONT	0.0520	0.530	0.0526	0.628	-0.258	0.005
D.LNEXP	-0.0690	0.699	0.1107	0.602	0.1354	0.573
D.LNEXCH	-0.0675	0.141	-0.0458	0.652	-0.0990	0.852
D.LNDEF	0.7736	0.376	0.3443	0.508	-0.1022	0.645
C	-6.4815	0.071	-0.0152	0.957	1.980	0.365

Source: Estimated by Author

5.2.3 Estimation of Middle-Income Subgroup Countries

As shown from table (11) the variables were tested for CD cross sectional dependence using Pesaran (2004) CD_{LM} test and Pesaran (2015) tests which found that both models are free of CD. Also results found that panels don't have bias estimators, and slopes are homogenous. Pedroni, Kao and Westerlund co-integration tests are employed to test the co-integration in both models. The three used co-integration tests show evidence of a long-run relationship between dependent and explanatory variables for all studied panels as shown at table (12).

Table (11) Pre-Estimations Tests Results

Test	Model1		Model 2	
	Stat.	**P. Value**	**Stat.**	**P. Value**
Pesaran CD	1.1180	0.357	1.8882	0.402
CD_{LM}	-0.1595	0.873	0.591	0.554
LM_{adj}	4.978	0.192	3.451	0.320
Δ	-0.090	0.928	1.077	0.281
Δ_{adj}	-0.104	0.917	1.244	0.214

Source: Estimated by Author

Table (12) Cointegration Tests Results

Test	Model 1	Model 2
Pedroni test for co-integration		
Modified PP "Phillips-Perron"	0.1477	0.0188
PP "Phillips-Perron"	0.1734	0.1356
ADF "Unadjusted Dickey-Fuller"	0.0024	0.1171
Kao test for co-integration		
"Modified Dickey-Fuller"	0.0370	0.0418
"Dickey-Fuller"	0.3162	0.0387
"Augmented Dickey-Fuller"	0.1038	0.1554
"Unadjusted Modified Dickey-Fuller"	0.0370	0.1940
"Unadjusted Dickey-Fuller"	0.0000	0.2656
Westerlund	0.0523	0.0869

Source: Estimated by Author

Table (13) shows models estimation results of short-run dynamic estimates associated with long-run relationship derived from ECM. The table shows estimation results of MG, PMG and DFE estimators. Both models found to be well fitted using PMG as result of Hausman test.

First model ARDL – PMG estimation shows that ECM model is well fitted at proper lag length of (1, 1, 0, 1). Coefficient of ECT is -.2324 (0.008) statistically significant at 1% level which means that disequilibrium from previous periods shock will bounce back to equilibrium, by speed of adjustment 23.2% annual correction rate towards long run equilibrium, divergence from equilibrium will be corrected in 4.3 years.

GDP as proxy of world economy found to be positive statistically significant at both short run and long run level which goes with Stopford (1988). Oil prices found to be positive statistically significant at long run only at 1% confidence level which goes with Michail (2020) changes in oil prices have positive impact on high and middle-income countries due to inelasticity of demand. Merchandize trade found to be positive at long run which goes with Stopford and economic literature as higher seaborne trade raise demand on maritime shipping.

Second model found to be well fitted at proper lag length of (1, 1, 0, 0). ARDL – PMG estimation shows that ECM model is well fitted as the coefficient of the lagged ECT -0.2244 (0.000) is statistically significant at 1% level with negative sign as expected which means that disequilibrium from previous periods shock will bounce back to equilibrium. Error correction term presents speed of adjustment towards long run equilibrium of 22.4 % annual correction rate, divergence from equilibrium will be corrected in 4.4 years

Exports found to be positive statistically significant at 1% confidence level at long run, which goes with literature as higher trade will raise demand on maritime shipping. Exchange rate is statistically negative significant at long run which goes with economic literature, this relationship also found by a McConville (1999). This goes with Stopford (1997) of inelasticity of shipping demand in short run. Deflator found to be positive statistically significant at long run which coincide with full countries list estimation and upper income countries estimation.

Table (13) ARDL Models Estimation -Middle Income

	MG		PMG		DFE	
variable	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
Model 1						
Long Run						
L.LNOILP	0.5358	0.006	0.7085	0.000	0.4173	0.238
LNGDP	1.7684	0.014	1.0925	0.000	1.4150	0.066
L.LNMERCH	-1.5419	0.086	0.7886	0.072	0.2730	0.726
Short run						
ECT	-0.8646	0.000	-0.2324	0.008	-0.1738	0.001
LD.LNCONT	0.2733	0.000	0.0890	0.351	0.1150	0.214
LD.LNOILP	-0.1656	0.158	-0.0981	0.531	0.0150	0.872
D.LNGDP	1.3103	0.458	1.5930	0.026	0.9138	0.058
LD.LNMERCH	0.6059	0.181	-0.0452	0.631	-0.0713	0.724
C	-18.142	0.063	-4.6044	0.001	-4.2672	0.281
Model 2						
Long Run						
L.LNEXP	20.360	0.340	0.6504	0.023	1.2318	0.037
LNEXCH	-0.6710	0.989	-1.0118	0.000	-0.9314	0.258
LNDEF	24.860	0.286	0.8270	0.000	0.2980	0.665
Short run						
ECT	-0.406	0.000	-0.2244	0.000	-0.1353	0.001
LD.LNCONT	0.0422	0.649	0.0319	0.765	0.1181	0.194
LD.LNEXP	-0.6325	0.145	-0.9418	0.180	-0.1266	0.512
D.LNEXCH	-6.838	0.360	37.710	0.310	-0.0679	0.641
D.LNDEF	0.4905	0.615	0.3125	0.621	-0.3863	0.139
C	17.663	0.218	0.0627	0.865	-1.750	0.329

Source: Estimated by Author

6. Conclusion and Recommendations

During the 21st century maritime industry went through slow turn in comparison to its usual growth trend. In which it went through innovation, and changes in industry structure and technology, as well as, geographical changes due to changes in sources of raw materials and production plants. That supported the importance of investigating the main factors affecting maritime shipping in this period to avoid decline phase.

The paper analyzes short-run and long-run dynamics deploying panel ARDL technique estimating two panel ARDL models during the period from 2000 till 2019 for 13 countries in MENA region divided into upper-income and middle-income countries. The first model is investigating impact of GDP as proxy of world economy, merchandize trade as proxy of seaborne trade and oil prices as proxy of transport cost, on maritime shipping. Estimated first for the 13 studied countries then estimated for six upper income countries and finally estimated for seven middle income countries.

According to first model estimation, the main factors affecting maritime shipping in twenty first century is GDP which found to be statistical positive significant at both short run and long run for all countries in the three estimations, which goes with economic literature showing the importance of world economy on maritime shipping. Merchandize trade found to be statistical positive significant at long run level of all 13 countries and for middle income countries and insignificant for upper income countries. Oil prices found to be statistically positive significant at the three estimations at long run which goes with Michail (2020) stated that changes in oil prices have positive impact on high and middle-income countries.

Second model estimation found that exports is positive statistically significant at long run in the three estimations which goes with literature as higher trade will raise demand on maritime shipping.

Exchange rate is statistically negative significant at long run which goes with economic literature as a change in exchange rate would affect shipping directly as freight rates calculated in US dollar and can affect shipping indirectly, through its effect on international trade, consequently, affecting demand for shipping, this relation consistent with McConville (1999).

Deflator found to be negative statistically significant at short run at full list countries estimation showing inflation impact on maritime shipping because of its impact on international trade and consequently on world economy and shipping demand which goes with literature as (Millan et al., 2005, Harvey, Ferson and Harvey, 1994).

At long run, deflator is positive statistically significant which doesn't go with literature that can be explained that higher local inflation rates reduce demand on country's exports but increase demand on imports which will be relatively cheaper than local prices that will increase demand on maritime shipping of that countries.

Deflator found to be positive statistically significant at long run at upper and middle-income countries estimation which goes with Stopford that elasticity of shipping demand increase with time due to availability of enough time of adjustment as laying up tonnage or changing transport policies, raw materials sources and production locations which could have positive impact on shipping in long run with reallocation of production policies. Increasing elasticity of demand also confirmed by significance of oil prices in long run only.

Models' results highlighted the important factors that shipping industry should take inconsideration in their long run planning to avoid decline phase of maritime shipping.

The analysis offers guidance to policy maker based on the findings of the analytical evaluation of maritime determinants in MENA countries.

Policies and institutional factors for rising demand of maritime transport and government policies at MENA countries should plan to stabilize foreign exchange rates to stabilize demand on trade and maritime transport.

Based on the analysis maritime shipping in MENA countries affected by world economy which shows the importance of international transactions that depends on foreign exchange rate in finalizing the international commitments which stress on the importance of foreign exchange in attracting international trade, which as shown consider a significant prerequisite to raise maritime shipping. In the broader picture, it is important to take into account exchange rate, oil prices and exports that are critical aspects for policymaking based on investigation results.

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