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SHIPPING ACTIVITIES AND INTRODUCTION OF NON-INDIGENOUS SPECIES IN THE MEDITERRANEAN

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AIM OF THE STUDY

Fig.1. A total of 1479 introduction events recorded in these 4 countries.

CUMULATIVE NUMBER OF NIS INTRODUCTION

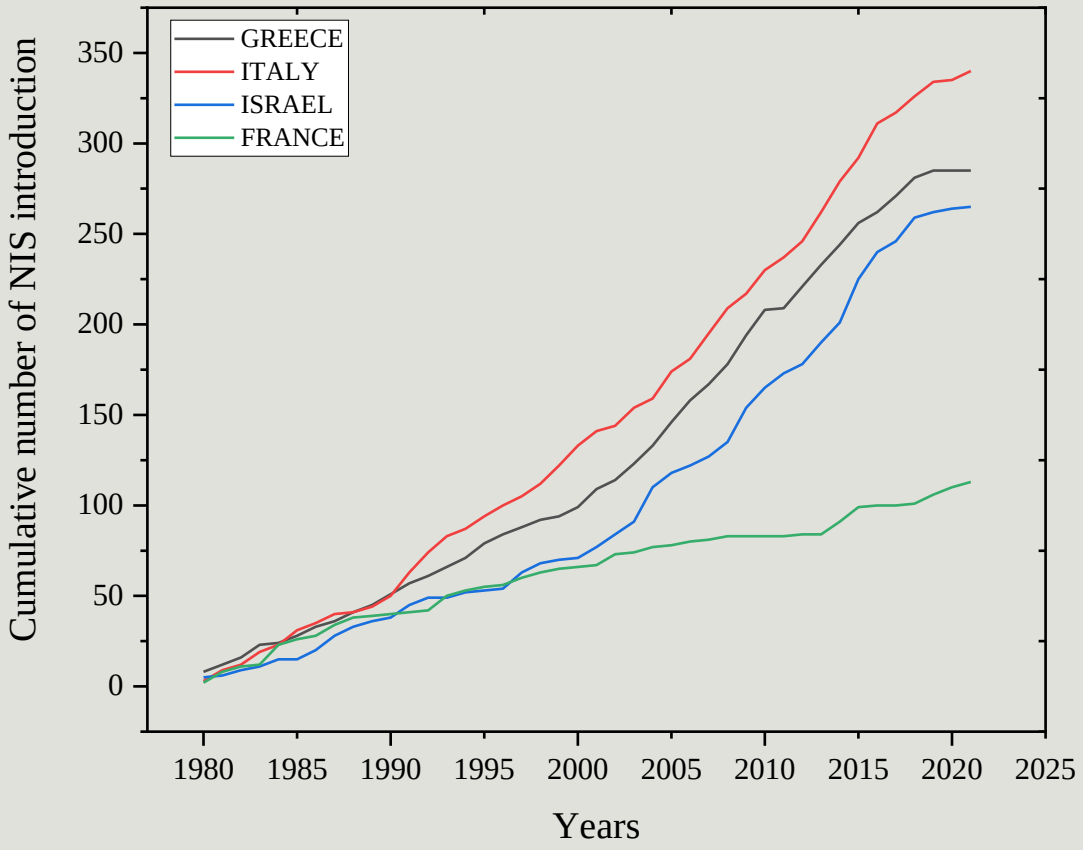
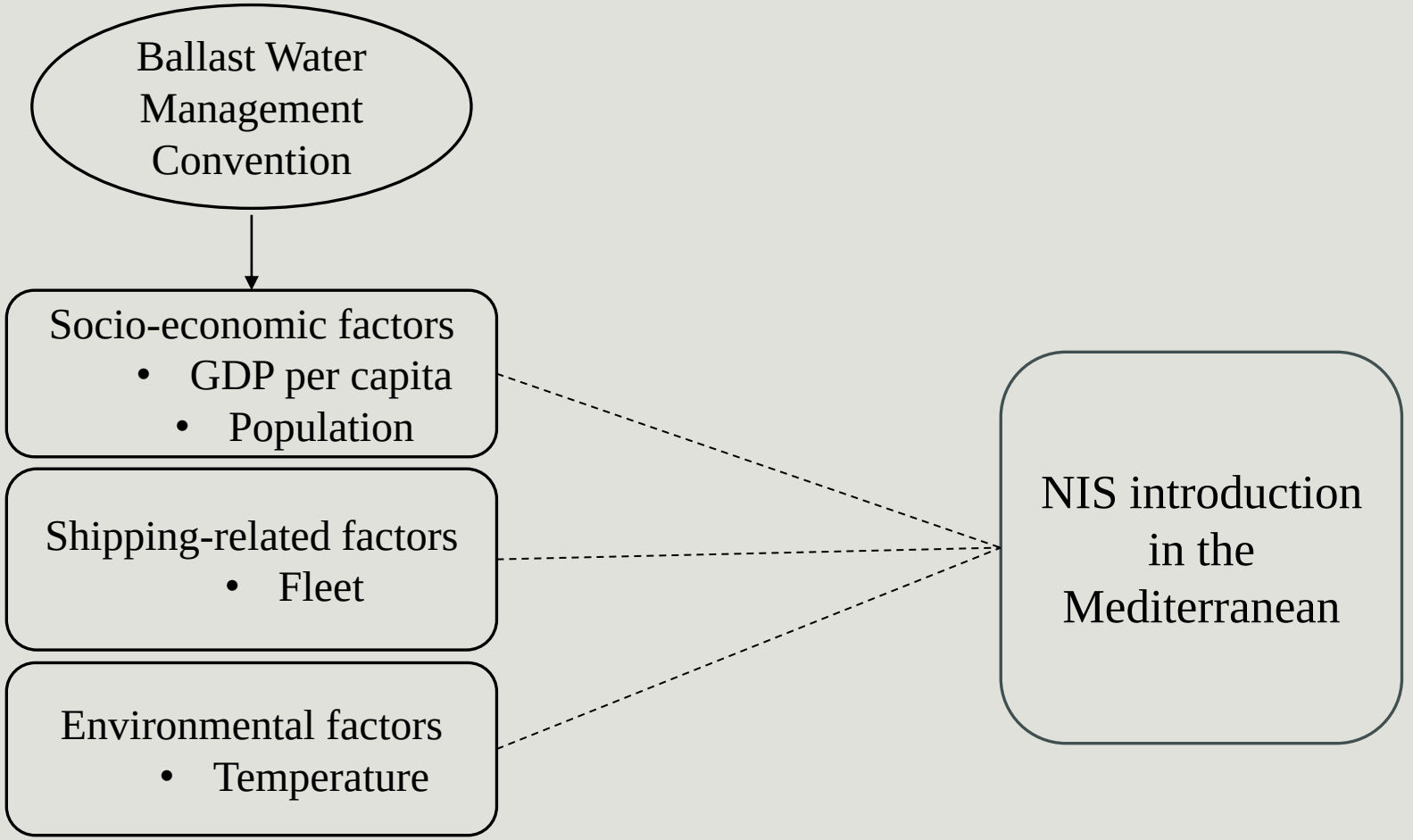


Fig.2. Introduction events of NIS in the Mediterranean between the years of 1980 and 2022.

CONCEPTUAL FRAMEWORK OF THE MODEL

POLICY IMPLEMENTED

MEASURED VARIABLES



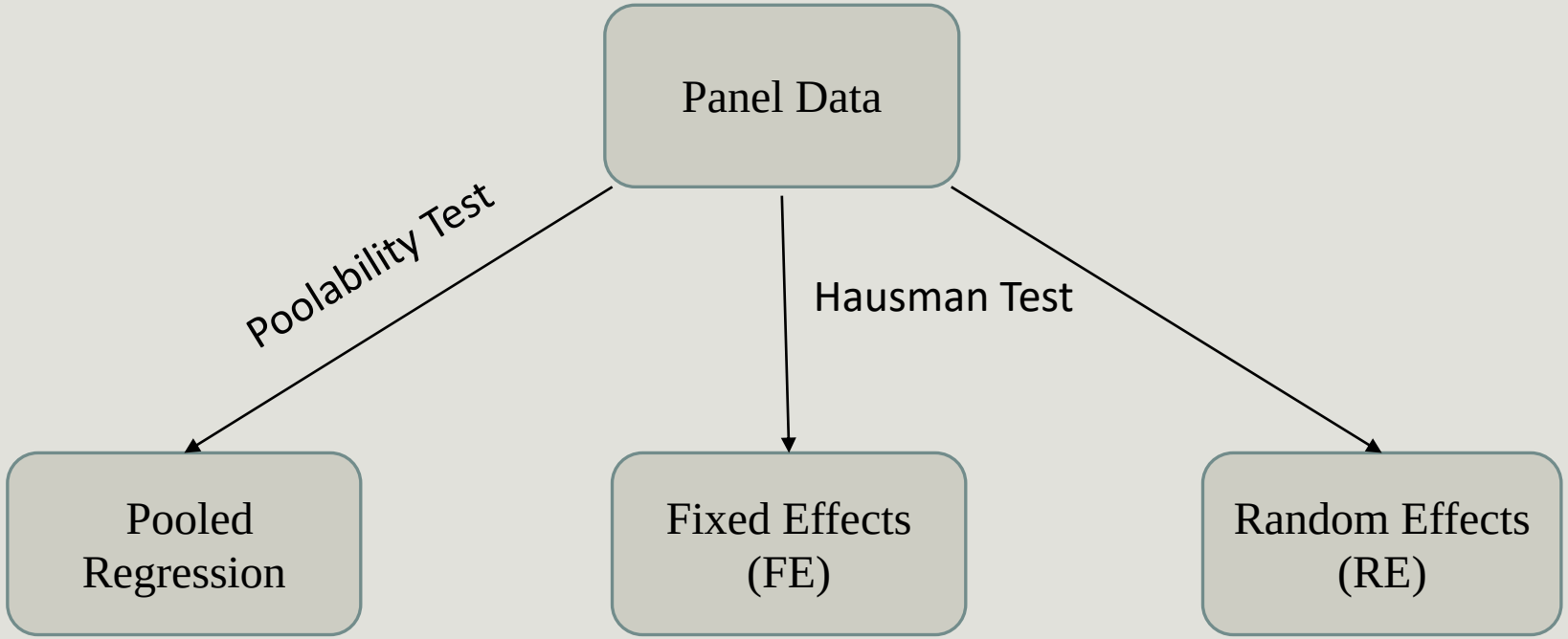
VARIABLES USED

Codes	Definition	References	Data Sources
NIS	Non-Indigenous Species	Seebens et al. 2016, Tidbury et al. 2016, Gren et al. 2022, Sardain et al. 2022, Zenetos et al., 2022	EASIN, AQUANIS
Ship	Port of call, arrival and departure dates, ship attributes	Seebens et al. 2016, Tidbury et al. 2016, Gren et al. 2022, Sardain et al. 2022	IHS Seaweb, AIS
Pop	Population	Gren et al. 2022, Sardain et al. 2022	World Bank
CB	Common border	Sardain et al. 2022	Centre d'Études Prospectives et d'Informations Internationales research centre
CCH	Common colonial history	Sardain et al. 2022	Centre d'Études Prospectives et d'Informations Internationales research centre
CL	Common official language	Sardain et al. 2022	Centre d'Études Prospectives et d'Informations Internationales research centre
GDP	Gross Domestic Product	Gren et al. 2022, Sardain et al. 2022	World Bank
Dist	Inter-country distance	Sardain et al. 2022	Centre d'Études Prospectives et d'Informations Internationales research centre
RTA	Trade agreements	Sardain et al. 2022	Centre d'Études Prospectives et d'Informations Internationales research centre
S	Salinity	Gren et al. 2022	Aqua Maps Environmental Dataset/Copernicus
T	Temperature	Gren et al. 2022	AquaMaps Environmental Dataset/Copernicus
N/P	Nitrogen load/Phosphorus loads	Gren et al. 2022	NA

DATA COLLECTION

VARIABLE	DESCRIPTION	DATA SOURCE
NIS	Introduction events' accounts	AquaNIS
FLEET	Merchant fleet by flag of registration and by type of ship, annual	UNCTAD
GDP per capita	GDP per capita (constant 2015 US$)	World Bank
POP	Population density (people per sq. km of land area)	World Bank
TEMP	Decadal average observed sea surface temperature anomalies, highest (°C)	European Environment agency

METHODOLOGY



PROPOSED REGRESSION FRAMEWORK

$$NIS_{it} = \alpha + \beta \log(X_{it}) + \varepsilon_{it}$$

$$NIS_{it} = \alpha_i + \beta \log(X_{it}) + \varepsilon_{it}$$

$$NIS_{it} = \alpha + \beta \log(X_{it}) + \vartheta_i + \varepsilon_{it}$$

X_{it} = (Fleet, Pop, GDP, Temp)

Where NIS denotes introduction events of NIS; Fleet measures merchant fleet by flag of registration; Pop denotes population density; GDP denotes GDP per capita; Temp represents sea surface temperature ; subscript i of each variable denotes the cross-sectional unit; α and ε are the constant and residual terms, respectively; and β denotes parameters to be estimated.

RESULTS

	1980-2017			1980-2022		
Variables	OLS	Fixed Effects	Random Effects	OLS	Fixed Effects	Random Effects
Constant	-45.3894***		-73.68470 ***	-40.3773***		-55.86303 ***
Log(FLEET)	2.1617***	1.4975	1.74075 .	2.0426***	1.4759	1.76409 *
Log(GDP)	-1.0598	-2.6109	-0.16300	-1.2496	-0.8923	0.54286
Log(POP)	8.3296***	19.0683**	13.05007*	7.8391***	11.3349.	7.88328 *
Log(Temp)	-2.2502***	-1.4726	-1.19222	-2.7713**	-2.2823*	-2.0981*
Diagnostics	Statistics					
Poolability	4.5991***			3.6734***		
R Square	0.2706***	0.1982***	0.1892***	0.2530***	0.1463***	0.2035***
Hausman test			1.8208			1.1585

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1

According to Hausmann test results, it is seen that the H0 hypothesis cannot be rejected according to the 5% significance level (0.7687 < 0.05 (Before), 0.8849 < 0.05). It means, the random effect model has been seen consistent in present study.

DISCUSSION

The preliminary results of the study show that shipping activities have a significant impact on the introduction of NIS in the Mediterranean.

One per cent increase in shipping activities is associated with a 1.76% increase in NIS introduction. Similarly, an increase in the population density by 1% raises the introduction of NIS by 7.88 %.

However, the sea surface temperature anomaly has a negative and statistically significant effect on NIS introduction.

In addition, the economic factor of GDP does not have a statistically significant impact on NIS introduction.

Our estimations with the data before the ballast water management convention (BWM) lead to a similar model. This research serves as an initial step for BWM to demonstrate its impact in the Mediterranean region and be utilized in policy effect analysis.

FUTURE WORK

This research serves as an initial step to demonstrate impact of BWM Convention in the Mediterranean. This study is limited to socio-economic development indicators, which restricts its generalizability. Future studies could broaden the scope by incorporating other factors such as shipping traffic, socio-economic, and cultural influences. Additionally, a future study could focus on predicting the likelihood of future NIS introductions.

For the NIS data, only AQUANIS database has been used, other sources, such as EASIN, may also be included in the future work.

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THANK YOU FOR YOUR ATTENTION!

For further discussion

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RESULTS FROM THE EARLIER STUDIES

Gren et al. (2022) specified 1% increase in fleet causes 5.9% increase in the reported NIS introduction. They also reported GDP, population and temperature have significant effects on the NIS introduction.

Galil et al. (2018) showed that the global trend of increasing numbers of NIS is magnified in the Mediterranean Sea.

IF ASKED

The robustness of the findings can only be determined with panel-data-framework empirical research. Specifically, the study makes the following hypotheses:

Hypothesis 1 : *Pooled OLS is stable.*

Alternative Hypothesis : *Pooled OLS is not stable.*

Since $p < 0.05$ the alternative