Do Islands trade more or less? A Meta-Analysis

A Research Paper presented by:

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Nigeria

in partial fulfilment of the requirements for obtaining the degree of
MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Economics for Development

ECD

Full Name of Specialization

Econometric Analysis of Development Policies and Global Economy

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The Hague, The Netherlands
December 2020

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This document represents part of the author's study programme while at the International Institute of Social Studies. The views stated therein are those of the author and not necessarily those of the Institute.

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List of Acronyms

CDA	Cluseterd Data Analysis
ESF	Eigenvector Spatial filter
FE	Fixed Effects
GDP	Gross Domestic Product
GLS	Generalised Least Square
GMM	Generalised Methods of Moments
HMR	Helpman Melitz Rubeinstein
MLE	Maximum Likelihood Estimator
MRT	Multilateral Resistance Term
NEG	New Economic Geography
NPR	Non-Peer Reviewed
NTT	New Trade Theory
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Square
PPML	Poisson pseudo maximum likelihood
PR	Peer Reviewed
SEM	Structural Equation Model
SIDS	Small Island Developing Countries
SLS	Two Stage Linear Square
SSA	Sub Saharan Africa
UNCTAD	United Nations Conference for Trade and Development

Details of Variables as used in the Study

Precision	Precision of estimated island effect sizes
orige	Estimated island effect sizes
se	Standard error of estimated island effect sizes
t	T-value of estimated island effect sizes
panel	Panel studies
cs	Cross sectional
lnobs	The logarithm of no of observation
lnyears	The logarithm of time span/years covered by the study
disagg	Disaggregated
Noimporter	No of importing countries
Noofexporter	No of exporting countries
Nocount	No of trading countries
exports	Exports specification
Imports	Imports specification
trade	Trade specification
OLS	Ordinary Least Square
Tobit	Tobit or censored regression
Heckman-2S	2nd stage Heckman

PPML/ZIP	Poisson pseudo maximum likelihood/Zero inflated possion regressions
SLS/SEM	Two Stage Linear Square/Structural Equation Model
GLS/MLE	Generalised Least Square/Maximum Likelihood Estimator
Random	Random effects
Fixed	Fixed effect
Yeartimefe	Year/Time fixed effect
Countfe	country fixed effect
Pair_countfe	Pair country fixed effect
Exporteryrfe	Exporter year fixed effect
Importyrfe	Importer year fixed effect
AvWMRT	MRT accounted with Anderson & van Wincoop(2003)
BBMRT	MRT is accounted with Baier and Bergstrand(2009)
CtryTFEMRT	MRT is accounted with country and time fixed effect
DyadicFEMRT	MRT is accounted with Dyadic fixed effect
ESFMRT	MRT is accounted with Eigenvector Spatial Filter
HMRZeros	Zeros treated with an HMR specification
Zeros1	Zeros treated with the additon of 1
PPMLZeros	Zeros treated with a PPML specification
TobitZeros	Zeros treated with a Tobit specification
ESF	Zeros treated with an Eigenvector Spatial filter
nozeros	Study does not account for zero flows
distance_od	Specification controls for distance
border_od	Specification controls for border
currency_od	Specification controls for currency
language	Specification controls for language
landlock	Specification controls for landlock
P-reviewed	Specification controls for peer reviewed studies

Abstract

This study investigates the island-trade literature in order to examine two things. One is to examine the underlying effect of islands on trade. Two is to investigate to see if publication bias influences the direction of reported effect sizes in the literature. The study uses the methodology of meta-regression analysis as its empirical workhorse and examined 52 studies with 1,433 estimated effect sizes, and over a period of 10 years (2010-2019). Contrary to the study's hypothesis, results estimated using a mixed-effects method (MEM) indicates the underlying effect to be positive. From the same approach, the study found the presence of a moderate publication bias that is negative, and from all included studies. However, robustness check on this result using outliers and controlling for an important study (ID 17) shows these results to be inconsistent. Hence, we cannot on the basis of this study conclude that the underlying effect of island on trade is positive; and that a moderate publication bias that is negative exists in the literature.

Relevance to Development Studies

Variables such area, border, contiguity, "landlockness", and "islandness" or insularity are major geography variables that feature regularly in modelling of bilateral trade flow. When present in trade models, they indicate the effect of the variable on trade flows. For nations surrounded by water, the island variable , often modelled as a dummy estimates the sheer effect of being surrounded and separated from trading partners by water. Across the globe, many countries qualify as an island, and whose gross insularity condition is worthy of investigation, but this study is conducted with the view of small islands developing countries (SIDS) in mind. Islands in this category are faced by the same geographical conditions like other island countries, but unlike other islands countries, SIDS has further peculiar conditions (i.e. smallness and remoteness) which can amplify the effects of their insularity. Hence, it is important to investigate the underlying effect of islands on trade. Knowledge of the underlying effect of islands on trade will help leaders from SIDS design a more nuanced trade policies that can help guide their development aspirations. In this respect, this study is a potential contribution to development studies.

NB: This study is part of a research paper project. Students (first and second coder) collaborated at the early stage, which required collecting and coding of data from which a common data set is pooled for this study. The study's analysis cover different periods. This is for supervision and grading purposes.

Keywords

Key words: Trade, Islands, Gravity Model and Meta-Regression Analysis (MRA)

Chapter 1 : Introduction

1.1 Background

Trade is one of the major means of global economic integration that dates back to long distance barter exchanges between countries and civilisations in ancient times (Mussa 2000). This means that global economic integration through trade is not a new phenomenon. Over the last two centuries, global trade has increased tremendously and now accounts for about a quarter of global production (Beltekian and Ortiz-Ospina 2018). Trade is influenced by a number of factors. On a broad term, these factors can be categorised as being economic, cultural and geographic in nature, and are easily seen in recent modelling of trade flows involving the use of gravity model. From a vector variable perspective of trade modelling, geography includes all variables that encourage or impede trade flows as a result of the geographical conditions of trading partners and proximity or distance. This includes conditions of being an island, landlocked, sharing a common border etc. This study is concerned with the condition of being an island on trade or the condition of insularity as tagged in some studies (i.e. De Benedictis and Pinna 2015 and Deidda 2015).

When any of these mentioned variables is highlighted in trade analysis, it is usually from the consideration of its impacts on trade flow. One major impact of geography variables that can be inferred easily from trade models is "transportation cost". This is because the geographic proximity of trading partners determine the distance between them, and which in turn determines the transportation cost (for island countries, particularly the small island developing countries-SID-one might add the cost of ferry from islands to mainlands). This is one of the rationales and novelties of the gravity model as pioneered by Jan Tinbergen in Tinbergen (1962). Basically, the gravity model equates trade flows between any two trading partners as being proportional to the interaction between the countries' economic mass and distance. Seen from another angle, one can also infer that islands geography enhances trade flows. This is because some islands are located along shipping routes. Some good example are island clusters of Alderney, Sark and Herm that is located around the English channel and the Island city state of Singapore that lies in the strait of Malacca (Stewart 2018). Following Stewart (2018), the English Channel is the busiest shipping route in the world, while the strait of Malacca links major trading countries in Asia, including China, Japan, India, Indonesia and South Korea. This highlights the importance of geography on trade. To buttress further on its importance, Frankel and Romer (1996) has submitted that the features of a country's geographic territory has a unique effect on trade. This is distinct from other determinants of income.

On a broad scale of economic development process, studies such as Gallup et al. (1995) and Sachs (2003), has argued that geography explains the better part of long term cross-country differences in economic performance which persist till date. Basically, these studies believe that geographic characteristics such as climatic condition, location, and proximity to the sea, shape and determine long term patterns growth. However, studies such as Acegmolu et al. (2001) and Rodrik et al. (2004) think otherwise. These studies believe geographical factors become less important when institutions are controlled for. In any case. the general sense in the literature is that geography is an important influencer of long term patterns of development. This study, even though. it agrees that from a historical perspective, that geography is an important influencer of long term patterns of development, its focus is not in the geographical determinants of long term growth. Instead, it is interested in how geography factors that feature constantly in the modelling of trade flows explain the direction of bilateral trade flows.

Specifically, this study is interested in the geographical condition of insularity and its effects on trade flow. Hence, the title of this study: "Do Islands trade more or less? A Meta-Analysis". In other words. this study wants to examine the underlying effect of islands on trade. Or to investigate whether the geographical condition of being surrounded by water actually inhibit or promote bilateral trade flows. The adverb qualifier "actually" is used on purpose. It is to drive home the point that island trade literature is uncertain as to the true effect of islands on bilateral trade. This is because extant studies on the subject is replete with studies with different directions (negative, zero effects and positive) of estimated effect sizes of island dummy on trade flow. This creates uncertainty and a gap in the island trade literature, which has necessitated the need for this study.

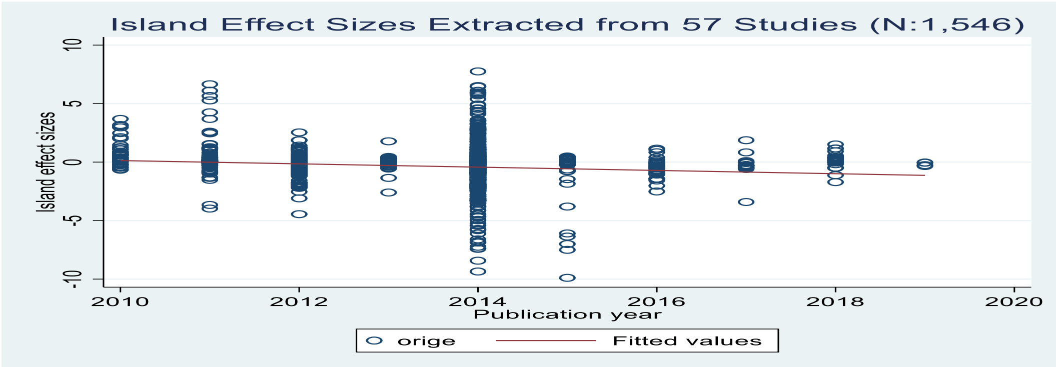
For instance studies such as Metulini et al. (2018) on the of use of "spatial-filtering zero inflated method" in the estimation of gravity model; Archaya (2018) on the "factors that promote trade integration in Asia"; and Matthee and Santana-Gallego (2017) on the factors that "determine South Africa's export growth", all returned effective sizes that are negative indirection. While studies such as Okafor et al.(2018) on the link between "common unofficial language and tourist flows"; Karkanis (2018) on the "roles of geography in EU-China trade", and Wong et al.(2017) on the "relationship between ASEAN regional free trade and intra-ASEAN manufacturing", returned positive effect sizes. For ones such as Miron and Cojocariu (2019) on "analysing Romanian trade flows with gravity model"; and Fiankor et al.(2016) on the relationship between EU/Africa trade agreement and the rejection of African exports at EU borders, returned effect sizes that have zero effects on trade. This mixed reports highlights the uncertainty in the literature and has provoked an interest which is at the core of this study's objective.

1.2 Motivation and Questions

From the foregoing, it is evident that the empirical literature on island status on bilateral trade is uncertain, despite the large ton of literature on the subject. This becomes quite obvious when the effect sizes from the consulted sample empirical studies are plotted against their publication years as in the graphs below (figures 1.1 and 1.2). From figure 1.1, one can see that the effect sizes are distributed randomly around a zero mean and between negative and positive effects across a 10 year period or publication years in which samples where extracted from. This can further be seen in figure 1.2 in which island effect sizes are categorized per direction and significance.

Figure 1.1

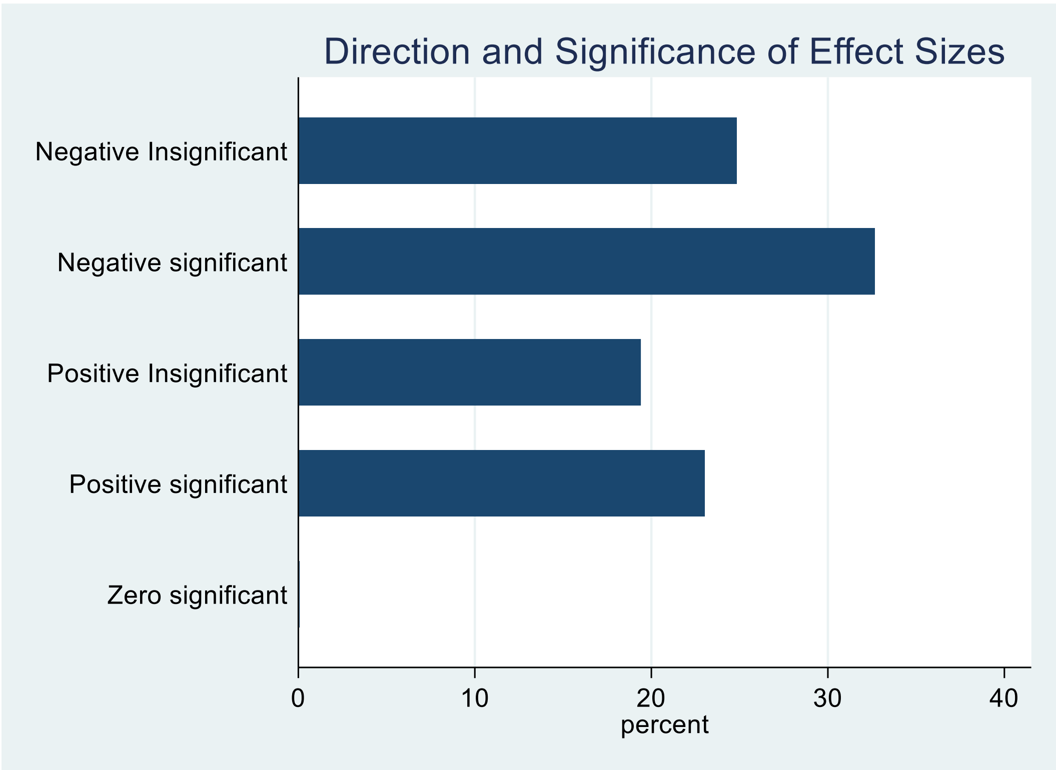
Island effect sizes reported in 57 studies and published between 2010-2019 (N=1,546)



Source: Author's compilation from 1,546 estimates of Island effect sizes on trade flows

Figure 1.2

Categorization of effect sizes per direction and significance



Source: Author's compilation from 1,546 estimates of Island effect sizes on trade flows

Given this lack of clarity in the island/trade literature, the overarching objective of this study is to investigate the underlying or true effect of islands on trade flows. Hence, the question guiding this research is as follows:

1.2.1 Primary Research Question

- Do Islands have a negative underlying effect on trade?

1.2.2 Secondary Research Question

- Does publication bias[1] exists in the Island-trade literature?

1.2.3 Hypothesis

- H_o : Island status on trade flow is negative. i.e. Island < 0.
- H_a : Island status on trade flow is positive or insignificant. i.e Island ≥ 0

1.3 Justification and relevance of this research

This study is important in two respects. One is its status as the first empirical study that is interested in deploying the methodology of meta regression analysis (MRA) in its analysis of Island country impact on trade. This is a conclusion that was reached after a repeated search on google scholar and web of science for all possible studies that has investigated the impact of islands on trade, using this methodology. Secondly, this study will join the rank of the very few studies that has investigated islands/trade relationship in an outcome capacity, instead of in control capacity; which typically populates the literature prevalently. Some of the few instances islands status on trade is investigated in outcome capacity are in De Benedictis and Pinna (2015) and Novy (2013). In these cases, island variable is measured as a proxy for geographical dimension of trade cost, and in which its impact on spatial discontinuity of trade integration is deemed to effect trade negatively.

Besides, meta regression analysis is relatively new in economics, when compared with other methodologies. Hence, this study will enrich the empirical literature and help produce the underlying effect of an island on bilateral trade flows.

1.4 Why Meta-Analysis

As the title of this study suggests, the methodology of MRA would be deployed in this study's estimation strategy. Ordinarily, a simple econometric method such as a panel OLS or GLS could have been used, and in which we estimate for the within and between in the place of the MRA. But this would have been inadequate to deal with the very nature and focus of this study. This is why an MRA is preferred. MRA is usually deployed in order to deal with the controversy that comes up when individual studies fail to agree on a given empirical outcome (Hunter and Schmidt, 2004). According to Stanley et al.(2013:391), the MRA is

[1] Publication bias or publication selection bias in full occurs when studies are picked for publication based on being significant in a given direction (Doucaligous and Stanley 2013). This leads to the preponderance of studies with a given direction in the literature, thereby biasing the effects of published results.

"…a systemic review of the economic evidence behind a given economic hypothesis". As already established in figure 1.1 of section 1.2, the reported effect sizes in island trade literature do not agree as per direction and significance. This necessitates the need for a study technique that can synthesize and analyse the reported effect sizes for its true or genuine effect. This is the primary purpose of meta-analysis. Other ends is in investigating for the existence of publication bias if it exists and reasons for heterogeneity. Problems on heterogeneity usually arise from differences in study characteristics or study populations (Stanley et al. 2013).

However, problems on heterogeneity is beyond the scope of this study. This is because of time constraint. Regardless, the MRA is built to answer the questions this study is set to answer. Against this backdrop, this study will follow the newly updated guidelines for conducting and reporting of meta-analysis in Economics. This guidelines can be found in Havránek et al. (2020: 472). It informed the choice of studies to search for, its compilation and analysis, data construction, modelling and reporting/interpretation of estimated results.

For instance, the protocol started with an extensive research for eligible studies on Google scholar, in order to find out all accessible relevant empirical studies published before 2020. Using some keywords and the help of Boolean connectors, we searched for: "trade + island" and "gravity model"; and between 2010 and 2019 (years of interest), this study found 27,000 studies which we reviewed depending on title and abstracts. Also, we used references of already found studies to find more studies to include in the analysis. This is to make sure all possible empirical studies missed from the search are included in the analysis, if found eligible for inclusion as part of the study sample. This search was implemented around the second to fourth week of January, 2020.

This is followed by a screening process that involved identifying an initial sample of 57 empirical studies (all in English) which were included on three criteria: Island, Trade and Gravity model. Hence, all the studies included focused on trade-goods and services alike; must have an Island variable in either outcome or control capacity and must be estimated with the gravity model. This is to ensure that the literature from which we draw our samples and effect sizes share similar characteristics. From the 57 studies, we coded 1,546 effect sizes alongside a number of moderator variables. However, we excluded 113 effect sizes extracted from 5 studies on our Bivarite analysis and hence proceeded with 1,433 effect sizes from 52 studies. This process was cross-checked by a second coder. From these empirical studies, we built a data base that formed the basis of the MRA.

Besides the data construction process, the guidelines was essential in framing of our research question and handling modelling problems. For instance, we made sure the research question is as specific as possible. To handle modelling problems, we used inverse-variance weights to accommodate for heteroscedasticity. We also present a table that provides coding information, such as the meaning of coded variables. This is provided in two places: in the acronym section before this chapter and in section 3.4 of chapter 3, where we provided a descriptive statistics of all used variables. With respect to the variables, we included theoretically relevant variables and ones that appear regularly in the modelling of trade flows. Also in our coding list is specification controls for multilateral resistance and zero flows. Hence, we coded the variables, alongside the specifications control on a dummy scale of "0 and 1"; in which case "0" stands for the absence of a specification control or a theoretically relevant variable, i.e GDP, Distance and language etc.; while "1" stand for its presence. Finally, we follow this guideline in the reporting and discussion of practical significance of study

1.5 Organisation

This study is organised in five chapters. The first chapter is the introductory part and that is the purpose of this chapter. This is followed by chapter two, three, four and five. Chapter two will provide a view on how the "lay of land" of the literature looks like in the more than four decades of analysis of bilateral trade flows and how it intersects with the status of an island on trade, or otherwise known as insularity condition. Chapter three follows immediately with an expanded look into the methodology of Meta-Regression Analysis. Specifically, it explains the study protocol, empirical strategy and the meta-data set. Chapter four is a presentation of the analysis that answers the primary and secondary research question of the study, bordering on genuine effect and publication bias. Chapter five summarizes the study, while noting the limitations and suggestions for further empirical inquiry.

Chapter 2: Literature Review

2.1 Introduction

Island literature is quite vast as it extends to topics outside the realms of economic development or economics in general. For instance, a google search on the subject will produce both relevant "searches" necessary for the analysis of the trade effect of Islands, as well as irrelevant ones outside the scope of Island effect on trade. Examples can be found on ones bordering on marine and biological sciences. For the purpose and scope of this study, review and analysis of the topic is specifically on literature bordering on the trade case of Island or insularity as used literatures such Armstrong et al. (1998) and Briguglio (1995). But despite the vast reach of the Island literature, the extant literature on the trade effect of Island is quite uncertain (Armstrong and Reads 2004). Worthy of note here is that trade is used in a broad level for this study, and not in the narrower sense of merchandise trade or trade in service. But to proceed, the study will provide a working definition of Island. It will examine the two strands of literature underlying the trade effects of Islands. One view believes that Islands are geographically disadvantageous to trade and believes these disadvantages can be viewed from the context of a number of penalizing factors that are peculiar to islands (Armstrong and Reads 2004). This view dominates the literature, but also believe the disadvantages is not a "fait accompli" and believe that second-nature geographical characteristics such as openness /connectedness and good institutions can reverse the curse of first-nature characteristics such as remoteness, islands and landlock (De Benedictis and Pinna 2015).

The second view believe islands may induce positive trade outcomes when it has some positive socio-economic features associated with the condition of insularity. This include social cohesion and homogeneity which facilitates contracts (Baldacchino 2006; Bertram and Karagedikli 2004). Other related views relates to the attractiveness of Islands for tourism (see Sinclair and Stabler 2002; Balaguer and Cantavella-Jorda 2002) and the fact that Islands can provide natural protection in the face of high transport cost that will allow the development of domestic industries (Sinclair and Stabler 2002). After reviewing the general "state of art" on Island trade effect, this study will proceed to situate these impacts from the view point of extant prevalent theoretical models of trade (the New Trade Theory, New Economic Geography and The Gravity Model). This will be followed by snapshots of the empirical literature on Island-trade effects and end with developments in the modelling of island-trade effect.

2.2 Islands: Definition and Description

According to Licio and Pinna (2013), a great percentage of developing countries are in a bind of 'bad geography'. This is due to the problems posed by the inaccessibility or increased cost of accessibility and connectivity of Islands. But the condition of insularity is not the only the condition of "bad geography" as termed by Licio and Pinna (2013). There are other geographical features that impede trade outcomes. A good example is the condition of being landlock or remote in trade. As hinted previously in chapter one, there are a number of literatures which have explained the geographical dimension of economic development and believe geography as imposed by some first-nature characteristics (i.e. disease environment, climate and location and proximity to the sea or centers of commerce) is the ultimate influencer of today's patterns and trajectories of economic development. For instance Sachs and Mellinger (1999) on how geography correlates with development or Acemoglu et al.(2001) on the colonial origins of development. Building on insights from such literature, variations of new economic geography, trade and growth theories have sprung to show the connection between geographic locations and its features on different economic outcomes such as trade.

From this perspective, the condition of being an Island literary refers to a geographic condition of being surrounded by water. To avoid vague and broad interpretation, Islands refers to any piece of subcontinental land that is surrounded by water. This clarification is important otherwise continents such as Africa or North America would qualify as Islands, and this would make analysis cumbersome and unclear. Spilanis et al. (2013)[2]. provides a more befitting and nuanced definition/description of Island. The study states that an island is a "…sub continental piece of land with specific characteristics: (a) a surface area of at least $1km^2$; (b) permanently inhabited by a statistically significant population (more than 50 inhabitants); (c) not linked to the mainland by permanent structures; (d) separated from the European continent by a stretch of water at least 1 km wide; and e) not containing a capital city of one of the member states". This definition and description is directed at continental EU islands and overseas territories (i.e. Madeira the Azores, and the Canary Islands) belonging to members of the EU such as France and the Netherlands; and are deemed by the European Union to be worthy of special economic policy treatment in the areas related to agricultural sector (Spilanis et al. 2013). The interest in islands is motivated by the finding of ((Spilanis et al. 2013) that European Islands are lagging behind the continental mainland in indices of sustainable development and in terms of agglomeration economies. Nonetheless, this study will be adopting the above definition of island. Its defining features can be applied to Islands elsewhere.

There are different classifications of islands found across the literature. There are cases of archipelagos of which Indonesian Islands is typical of. There are also cases of partial island and full Islands. According to De Benedictus and Pinna (2015), partial islands are partial because they are not completely surrounded by water. This would be distinguishing characteristic between partial islands and full islands (i.e classical case of island). Regardless of the classifications, the quality of insularity is the connecting glue that underline every classification of islands irrespective of their areal size, market size, isolation and remoteness (Deidda 2015). This is because insularity express measurable and objective characteristics through measures such as areal size and market size. Given this definition and characteristics, this study will now examine the different strands of literature outlining the trade effect of islands.

2.3 Islands as a Geographical Advantage

The literature on island trade impact is predominantly in the direction of pessimism. This is as a result of problems associated to the characteristics and topography of islands (Briguglio 1995). However, there are a few outstanding studies that believe island trade impact is positive or advantageous. The argument of studies in this strand try to portray, lies in the tourism-led economic development model. Following Seetanah (2011), Island countries are good destinations for tourism. Studies such as Sinclair (1991 and 2002) and Candela and Figini (2010) were exhaustive in their treatment and analysis of trade effect of tourism for an open macroeconomy and hence, found tourism to be very advantageous. But the focus was

[2] Spilanis et al. (2013) is the final report of ESPON 2013 programme.

not on islands or developing countries in their treatise. With respect to islands, many studies have examined the causal relationship between island and many proxy indices of development, i.e economic growth. For instance, few studies such a Durbarry (2002), Kim et al. (2006) and Hernandez-Martin (2008) investigated tourism impact for the case of Mauritius, Taiwan and structural change in a chain of island countries respectively.

Specifically, Durbarry (2002) examined "the effect of tourism on Mauritius economic growth", using a cointegration time series technique. Results from the study showed tourism to be part of the transformational success story of Mauritius economy, that was hitherto referred to as an extreme case of mono-crop economy; relying only on the production and export of sugar to a net exporter of non-traditional goods (textile) and services (tourism). In the same vein, Kim et al. (2006) investigated "the relationship between tourism expansion and economic development in Taiwan", using a granger causality test. Study result indicate two things: a long-run equilibrium relationship and a bi-directional causality between two factors. Inversely, the results suggest that tourism expansion and economic development reinforce each other. For Hernadez-Martin (2008), the study was interested in using the framework of structural change (at sectoral level) to explain the rapid growth rates of a chain of small islands developing countries (SID). However, empirical results was inconclusive due to data unavailability. A more nuanced investigation of the relationship between tourism and economic growth is Seetanah (2011). The study employed the GMM to explore the potential contribution of tourism to economic growth and development of 19 island economies and spanning a 17 year period (1990-2007). The results show that tourism is significant in explaining economic growth over the time period.

2.4 Islands as a Geographical Disadvantage

As earlier indicated, the prevailing narrative of the theoretical literature on island effect on trade is gloomy. This is evident in the titles of studies that follow this trend of narrative (i.e Armstrong and Read 2006 on the "Geographical handicaps of small states" and Briguglio 1993; 1995; and 2004 on "small islands developing countries and their economic vulnerabilities"). Also, a bird's eye view of the literature shows that studies that view islands as producing an economic disadvantageous effects, share some themes or perspective in common. According to Armstrong and Read (2004), most of these literature approach the island effect question from the standpoint of the myriads of problems facing both islands and small states; and has treated islands and small states as if they face similar problems.

Consider Briguglio (1995). The study x-rayed the vulnerabilities of small island developing economies, and argued that the vulnerabilities stem from their geographical disadvantage. The study constructed a composite index of vulnerability, which is intended to measure the economic resilience of these states. An outline of these vulnerabilities according to Briguglio (1995) stems from the following four general characteristics of islands. They are: smallness[2] ,"insularity and remoteness", "proneness to natural disasters" and environmental factors. Following the study, the small[3] sized nature of islands (small islands developing countries) has implication for both its economies of scale and the return to scale of its firms. This is directly attributable to factors such as limited natural resource endowment, small domestic market and dependence on export markets, and limited ability to exploit economies of scale. With respect to insularity and remoteness, this has to do with the fact that islands are surrounded by water. This fact according to De Benedictis and Pinna (2015) implies spatial discontinuity, which has implications related to trade frictions/barriers, and through

[3] Here smallness refers to market size. An exception is made for some big islands such as Japan and the United Kingdom Briguglio (1995).

higher per-unit transport price and uncertainties of supply. This might not be so for islands that are not remote or located far-flung off (De Benedictis and Pinna 2015). Then there is the case of natural disasters and environmental factors. This stems from the regular episodic inbounds of natural disasters on islands. These disasters are more frequent in islands than main-lands. Some of them include "cyclones, earthquakes, landslides and volcanic eruptions" (Briguglio 1995; Spilanis et al. 2013). Also the pressure arising from the processes of economic development has dire costs consequences for the environment. These costs is estimated to be more for islands than other countries (Spilanis et al. 2013).

In the same light, Armstrong and Read (2002) analysed the "link between economic growth in small island developing countries and their vulnerabilities". The study used Briguglio's "Vulnerability Index" and relevant quantitative technique to investigate the relationship between growth and vulnerability. They found the growth performance of countries in this category is limited by their vulnerability to exogenous shocks. This is attributable to their size and other factors pointed out by Briguglio (1995). Importantly, Armstrong and Read (2002) points that the concept of "vulnerability" is crucial in analysing the economic performance of islands, as it contains risk and uncertainty which characterise the economic processes of islands. Outside the geographical burden of islands, Armstrong and Read (2002) noted that islands by their very nature are vulnerable to economic and political headwinds outside the islands which can constrict and magnify the fluctuations in their growth potentials; and with a disproportionate effect relative to other larger countries.

Moreover, Briguglio's index employs 3 quantifiable proxy variables for measuring the main sources of vulnerability . These are "exposure to foreign conditions", "insularity and remoteness", and "proneness to natural disaster". These factors are hypothesised to be positively correlated with development. The first factor in the index-exposure to foreign conditions or dependence on world market, is proxied by trade to GDP ratio. The second factor-insularity and remoteness is proxied by UNCTAD's ratio of transport and freight costs to exports. This, according to the study is because using costs associated with transport infrastructure and trade pattern is better than using simple distance. Lastly, the index factors in the proneness to natural disaster is proxied by getting estimates of the economic costs of such disasters. The data for these factors is standardized, combined and weighted exogenously in the proportions of 50:40:10, and respectively, to produce a ranking for 114 countries (Briguglio 1995)[4].

Still on the strand of literature that view island as being disadvantageous, we have Armstrong and Read (2006) which analysed the island problem alongside, being an archipelago and having mountainous entities. The study found that transport cost worsens the cost posed by island condition. This problem is termed the case of double and reinforcing challenge of island (Armstrong and Read 2006). Deidda (2015), has argued that problems associated with transport cost can lead to high trade cost. This is because problems associated with transport cost can result in the creation of transport monopolies for small island economies, reduce the reliability of transport infrastructure, lead to increased stockholding costs, results in high insurance cost, lead to relative diseconomies in loads and routings (when compared with non-island countries) and can increase the possibility of goods damaging while on transit. Ultimately, these related costs problems can snowball into full problem of trade barrier. This findings by Deidda (2015) is in line with the findings of series of similar studies conducted by Armstrong et al. (1998) and Armstrong and Read (2000, 2002 and 2006).

From the foregoing, it is evident that one of the greatest disadvantage island condition imposes on economic outcome is its impact on trade cost. This view is supported by

[4] See Adrianto and Matsuda (2003) for a case study assessment of small island regions.

Armstrong et al. (2016). The study argued that of all of the disadvantages faced by islands, trade cost is the most visible one and manifests through transport/ transhipment costs. This costs include loading and unloading, which mainland or non-island countries don't have to incur. More specifically, these costs extends to transhipment costs which affect both freight and passenger transport, includes cost of physical movement, and are considered to be quite high when compared to line-haul element of total transport costs. Perhaps, the first robust econometric study of island effect on trade is Licio and Pinna (2013) which is on the correlates of economic growth and various measurements of insularity . This is followed by De Benedictis and Pinna (2015) . The study explores the geographical dimension of insularity and measured its effect on a comprehensive measure of trade costs within a 15 year period (1995-2010) ; and as modelled by Novy (2013)[4].

The study (De Benedictis and Pinna 2015), among other aims, tried to investigate the cost implication of islands relative to other geographical conditions such as being a landlock country, coastal country and sharing a common border. With the help of a maximum likelihood random effect model in which multilateral resistance and heterogeneity was controlled for, the study found that the estimates for island dummy coefficient showed higher trade costs when compared to other geographical covariates. Interestingly, it also showed that these costs widens as distance increases. For instance, the study showed that insularity effect (island) have costs which are higher and between 20% and 49%, with respect to coastal countries that are used as reference group. This estimates are comparable to the geographical conditions of "landlockness". But the study found landlock countries to have a cost that is less severe to the costs associated with being an island. However, the study showed that the trade cost effects of islands can be mitigated when islands are administratively connected to a mainland or when an island is in close proximity to another country, despite the spatial discontinuity imposed by geography.

These findings are in line with an earlier study (Licio and Pinna 2013). The study strived to achieve two goals. One is to use different geographical data on islands to measure different states of insularity and two is to investigate whether heterogeneity in an insular state is associated with heterogenous outcomes in terms of income, and using a box plot analysis. With the studies categorisation of island in its state (i.e. full insularity, partial insularity and not-an-island), the study found that islands in the extreme case of full insularity is correlated with poor economic outcomes; and which is comparable to correlates from landlocked countries featured in the study's model. These reasons underline the prevailing pessimism associated with the island effect on trade.

2.5 Islands and Theoretical Models of Trade

Despite the fact that there is no consensus on the direction of island trade effect, the theoretical literature reviewed has provided a good description of islands and its distinguishing characteristics or conditions. These characteristics underline its negative or positive effect. Briguglio (1995) and Deidda (2015) provide a good analysis of the effect of these individual characteristics, and how it undermines economic outcomes. In this sub-section, an attempt will be made to situate these mentioned bolstering conditions of island in the context of leading theoretical models of trade. Given these goal, the NTT (new trade theory), NEG (new economic geography) and the gravity model will be reviewed. This review is not an exhaustive review of the theories, rather, the review made here is made in connection to the implications of these theories on the peculiar conditions of an island. The Hecksher-Ohlin and Ricardian model are left on purpose. These is because they are not "state of the art" and the above mentioned models can explain or be used to analyse the problems related to the peculiar conditions of island-i.e. remoteness and small size. Empirical studies quoted in this study, unlike the theoretical studies, extricated these conditions as separate variables that has its own specific impact on trade. For instance, economic size is given by the GDP or GDP per capita , while remoteness is given by distance or remoteness itself, depending on how multilateral resistance is modelled in the given empirical model. Hence, this section will try to attempt this theoretically by trying to extricate the effect of islands individually from ones posed by similar conditions of being an island.

2.5.1 New Trade Theory (NTT)

Following Deidda (2015), the NTT shows a connection between aggregate productivity and territorial accessibility, which highlights the cost associated with the problem of being an island on trade. The background behind the NTT stems from the idea of economies of scale and network effects, which are important determinants of trade (Melitz 2003; Melitz and Ottaviano 2008). Under the assumption of perfect competition, Melitz (2003) built a model where highly efficient firms are able to profit in the international market. The same goes for the more heterogenous version of monopolistic competition of Melitz and Ottaviano (2008), in which the study incorporated heterogenous firms and endogenous mark-ups, which are influenced by the structure or level of competition in the market. In the two models, size of the market affects an industry's performance as it spurs tougher competition which results in lower average mark-ups and greater productivity. Because firms are in close competition, they are able to reap a network effect which reinforces the economies of scale that underline their operation at a competitive market (Melitz and Ottaviano 2008). Inferentially and with respect to islands, the twin problems of small size and remoteness would constrain firms from realizing economies of scale. This is because the size of the market would limit competition, causing average mark -ups to be unaffected or increased as a result of an increasing product costs and consequently diminishes productivity. Besides, remoteness of islands- especially for far-flung islands increases transportation costs, thereby, dampening network effects.

On inferential basis also, the twin problems of small size and remoteness would constrain firms from realizing economies of scale. This is because the size of the market would limit competition, causing average mark -ups to be unaffected or increased as a result of an increasing product costs, and consequently diminishes productivity. Also, this imply that there will be little or no domestic competition which is a key feature of islands. For islands that are open economies, this has consequences on their trade margins. On the intensive margins, this means that the volume of traded goods and services would be lower as a result of uncompetitive prices; while on the extensive margins, this imply that new trade deals and networks would be constrained. Regardless, it is expected that exports will be low, while imports will be high as a result of competitive prices from foreign firms outside the islands.

2.5.2 New Economic Geography (NEG)

Attributable to Paul Krugman in Krugman (1991) , the NEG model tries to explain the riddles of spatial concentration of industries (Garretson and Martin 2010). Specifically, it tries to explain how factors that create increasing returns to scale and reduces trade cost, generates centripetal and centrifugal forces that either lead to the agglomeration (centripetal force) of economic activities or leads to its dispersion (centrifugal force); and whose joint interactions influence the geography of economic activities (Deidda 2015). When centripetal forces are at play, agglomerating factors such as market size (when big), external economies and co-operative and functional linkages between firms causes spatial concentration. The reverse is the case for centrifugal force-when at play (Deidda 2015). When at play, forces such as external diseconomies of scale, labour immobility, lower land and property price etc leads to spatial de-concentration (Deidda 2015). With respect to islands, their small size, remoteness and accessibility has implications for the location or clustering of economic activities. For instance, small size of islands imply small market. This further means that islands are not able to reap economies of scale and so no agglomeration advantage that would cause clusters to establish. The same is true for other mentioned centripetal forces such as dense labour market and co-operative and functional linkage between firms. For remoteness, this has to do with core-periphery problem as advocated by Krugman (1991) or the ultra-periphery, periphery and central region accessibility problem according to Ottaviano (2003)'s taxonomy. Hence, given that islands are remote and spatially discontinuous as a result of being surrounded by water, trade is plagued by a high transport cost. In other words, the condition of being an island worsens the disadvantages caused by distance. This is at the very macro level of trade analysis. At individual firm level, one can infer that spatial de-concentration arising from the geographical burden of island would cause centrifugal forces of external diseconomies and labour immobility etc. to lower the competitiveness of local firms. Ultimately, this condition results in low trade.

2.5.3 The Gravity Model

The gravity model explains the trade flows between country pair(s) and equates the interactions between them (trade flows) as being related directly to the pair countries' economic mass; and indirectly to the distance between the pair (Deidda 2015). In other words, the model explains that trade relationship between large countries is stronger than small countries, and that countries nearer to each other attract each other than countries that are farther (Bergeijk and Brakman). The model captures two defining characteristics of islands: economic size and distance. For small island developing countries, these has two implications. One is that given the small size (economic wise) of islands in the SID category, that trade flow between any island pair with the same characteristics would be low or small. And would be large on the contrary. Two is remoteness. The model captures it as distance and can be used as a proxy to capture some observable cost associated with being far-flung of the coast or mainland of larger countries (Deidda 2015). Also, distance can be used to capture problems associated with the probability of encountering bottlenecks when a given good requires the synchronization of multiple inputs that need to be assembled together in order for production to take place. Besides, greater distance often translates to greater cultural differences (Okafor et al. 2018). This lowers the probability that trade deals would be made on time and can also affect the intensive margin of trade. Okafor et al. (2018)'s empirical investigation of the link between common unofficial language and tourism lends support to this belief. This is because the distance coefficient showed a more than 100% reduction in international tourism as distance increases. Results is significantly different from zero at 1% and robust for all regions of the world (Europe, North America & Latin America, Asia & middle east and SSA).

Hence one can see that the gravity model provides a good enough insight upon which the peculiar problems of small islands can be analysed. The same goes NTT and NEG. However, for the purpose of this study, this study will be employing the gravity model as its theoretical framework. Reason for this has been stated ab initio, but it has do with the fact that gravity model has been the major workhorse upon which trade flows has been analysed since the last four decades. It is best suited and innately built to analyse and predict trade flows, whereas the NEG and NTT were more designed to analyse problems related to spatial location/agglomeration of industries. Nevertheless, on a cumulative basis, the 3 models provide an incredible insight that is critical in analysing an important constraint of island trade: trade cost. The verdict from the models underlines the geographical disadvantage of islands as manifesting in terms of increased cost to trade. This heightens the problem of trade barriers.

2.6 Empirical Studies

Just as the theoretical literature showed some uncertainty as to the direction of island economic impacts, this uncertainty is even more so for the empirical literature, especially when the focus of analysis is on trade. A brief scope of the empirical studies carried out using gravity model and enlisted for this study highlights this fact, as the studies come with mixed results-with respect to the impact of island on trade flows (measured either as exports, imports or as trade). Figures 1.1 and 1.2 highlights this uncertainty graphically. In these studies, island variable appear in the models in control capacity, instead of being the core variable of interest. This is the case in more than 90% of studies reviewed and collected for this study. In the theoretical gravity equation, distance substitutes for all possible geographical covariates, but empirical model distinguishes and estimates for specific geographical covariates (i.e island, remoteness, landlock, area size, contiguity etc), that might potentially influence the deepening of trade either in intensive or extensive capacity. The sub-sections below will highlight these mixed results. But typically, an average empirical study follows a simple gravity equation such as the one in equation (1). Besides, all studies used in this study's sample list (included studies) are typically of this format, regardless of differences in estimation characteristics.

$$\textbf{In } T_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \ln(Dist_{ij}) + \beta_4 Island + \beta_5 Land + \beta_6 Lang + \beta_7 Rel + \mu_i \quad \textbf{(1)}$$

Where T_{ij} represents trade flow between an i^{th} and j^{th} partners and can be modelled as either as exports or imports, or fully as trade. On the explaining variables side, we have Y_i and Y_j which stands for output or GDP, $Dist_{ij}$ stands for distance, **Island** for island variable, **Land** as landlock and **Lang** as language, Rel stands Religion, while μ_i represents the error term . Broadly, these variables represent the major variables that finds its way in the modelling of trade flow and can be categorised as economic variables (GDP), geographic variables (distance, island and landlock), and culture variables such as language and religion etc. A good example of empirical studies estimated following this format and model include the studies reviewed in sections 2.61, 2.62 and 2.63.

2.6.1 Positive Effect

Consider the case of Okafor et al. (2018) in which the study investigated whether the use of "common unofficial language" promotes tourist flows, while at the same time comparing how underlying relationships pairs between different regions of the world. Data was collected for 200 countries and for a 20 year period ranging between 1995 to 2019. Proceeding, an augmented gravity model is deployed alongside a panel data set of bilateral tourism, and augmented with classical (core) gravity variables such as GDP, distance, population and geographical and cultural variables of which island, landlock, border, language and colonial history are part of. Results showed after a panel OLS estimation, in which random effects and multilateral resistance was controlled for is that "common unofficial language" has a positive effect on international tourism. However, this study is interested on the island variable alone. It found the variable positive and significantly different from zero at 1% level of significance. This means that island greatly influence international tourism. This is so for all regions under investigation.

Similarly, Karkanis (2016) investigated the factors underlying trade between "China and the EU28". With the gravity model as theoretical for analysis of trade flow, and estimated with an OLS method for the period between 2001 and 2015, and estimated separately for exports and imports. The study found that geographical condition of EU28 was beneficial for bilateral trade flows. This is because island and landlock variables were positive and significantly different from zero. In the case of Wong et al.(2017) on the "impact of ASEAN free trade area on intra-ASEAN manufacturing trade", the study found, while using a panel data with random and dyadic effects that all the core variables of the model behaved as theoretically expected. For Island variable dummy in the model, it found it positive and very significant at 1%. Also, results obtained from fixed effects for model suggests that the free trade area deepened the extensive margin effects among the members of the ASEAN.

For De Benedictis and Pinna (2015) and as quoted previously, the study measured the "effect of the geographical dimension of islands" on trade costs. They found after controlling for other geographical characteristics and special proximity; that in terms of trade cost, that being an Island is not bad. This is because they found a very positive and significant effect of island on trade costs. This result is in sharp contrast to that of Novy (2013), who measured trade cost with panel data and found the Island variable to be negatively significant. Interestingly, while the two studies adopted the same empirical framework, their findings were markedly different. Lastly, Yasmine and Hussaine (2015) investigated the "determinants of bilateral trade flows of Bangladesh with her 52 major trading partners". The study estimated the gravity model using panel data for the period between 1975-2005. It found island coefficient to be positively significant on pooled OLS.

2.6.3 Negative Effect

Raihan 2014 analysed the patterns of trade between developing countries or trade relationships between "South-South countries", in order to find out its determinants and potentials. The study found with the use of an Augmented gravity modelling, that the volume of North-North trade as a percentage of the global trade has declined to 32% in 2010 from its level of 55.5% in 1990. In contrast, South-North trade, saw its share increase to 16.5% form 13.9% during the same time. South-South trade was remarkably spectacular, as share in global trade increased by more than 300%. It increased to 19.4 in 2010 from 6.4 in 1990 . The study also found that the increase in South-South trade is not uniform for all countries within the category. Also, it found that trade involving advanced south countries such as Brazil, China and India was the major contributor to the changing landscape in global trade. All variables behaved as theoretically expected, but island variable was found to be negative in about 80% of all estimations in the study.

For Denny (2012), the study found a negative coefficient on island dummy estimated, while trying to investigate the trade effect of "High level Chinese diplomatic visits in Africa". The study used a data set covering the visits of these officials and a gravity model, and found that there is a strong correlation between visits by high official-i.e. correlation between the Premier and Chinese exports to that country. Specifically, this visits is significantly correlated with about 40% increase in Chinese exports. In the same vein, visits by the commerce minister to African countries is expected to lead about 200% increase in Chinese exports to the countries. Relatedly, Martincus et al. (2011) explored the existence of "asymmetric effects of export promotion" in forging new trade relations in Latin American and Caribbean countries, and within a 9 year period spanning 1995-2004. The study's result adds to the growing evidence related to trade promotion organisations and exports in countries of interest. Specifically, the study found that diplomatic foreign mission and trade promotion organisations tend to be associated with larger exports along both the intensive and extensive margins of trade. From the study, island coefficient estimated with an OLS was found to be negatively significant at 1% level of significance.

2.6.4 Zero Effect

Studies under this category returned island effect sizes that are not significantly different from zero. By zero effect, we imply that some of the studies returned effect sizes that are insignificant, even though they could be positive or negative in direction. Hence, we categorized all effect sizes within this category as having a zero effect. Some good examples of studies in this category include Fiankor et al. (2006) on the "effect of EU-African regional trade agreements in reducing EU border rejections"; Husain and Yasmin (2015) on the direction of Bangladesh's trade, using a panel gravity approach' and Miron and Cojocariu (2019) on "using gravity model to analyse Romanian trade flows". Specifically, Fiankor et al. (2006) aims to achieve two things. One is to investigate the effect of eligibility for various types of regional trading agreements on exports; and secondly, on rejection at EU borders. With a gravity framework and a panel OLS estimation, the study found that eligibility on European border agreement reduces at a significant rate, the exports of fruits, nuts and vegetables to the European Union. Importantly, the study found no significant impact of island variable on all classes of agricultural products under consideration.

In the same vein, Husain and Yasmin (2015), used a pooled OLS with fixed and random effects estimation to investigate the determinants of bilateral trade flows between Bangladesh and her 52 major trading partners over a 30 year period (1975-2005). Results from the estimation followed the theoretical gravity expectation, with respect to GDP per capita and distance for OECD and NON-OECD trading partner countries. For geographical characteristics, the result showed that apart from characteristics such as 'distance' and 'area', that geography variables such as island and landlock have no significant effect on bilateral trade. The same zero effect applies to the island coefficient found in Miron and Cojocariu (2019). The study used gravity model to analyse Romanian trade flows. It deployed a Panel Least Square methods and Estimated Generalised Least Square method to analyse the factors that influence the dimension, dispersion and the level of efficiency of Romania's trade flow between 2001-2015.

2.7 Theoretical and Empirical Developments in Island-trade modelling

The specification of today's theoretical gravity model or its equation to be more precise, has seen a great improvement. From a simple trade flow equation of Tinbergen (1962) to a more nuanced equations of Anderson and van Wincoop (2003), the equation has incorporated advancements and contributions of researchers which has culminated in the format expressed in Anderson and van Wincoop (2003). Early contributions on the model include studies such as Linnemann (1966)[5], Learner and Stern (1970)[6]. Polyhonen (1963)[7],

[5] Linnemann (1966) was an econometric study of international flow and expanded on the gravity model.

[6] Learner and Stern (1970) was on quantitative international economics.

[7] Polyhonen (1963) was on the modelling of trade between countries

and Pullianen (1963)[8]. All of these mentioned studies, are according to Bergeijk and Brakman (2010), are motivated by the need to find a wider understanding of the "...a broader understanding of the empirical base of the pure theory of international trade".

After these efforts, the next attention the model received was by Anderson (1979), but despite its success in providing the micro-economic foundation of the model, his efforts received no wide attention as would be expected. Anderson (1979) showed that the gravity equation can be derived from the pure expenditure systems, which is in itself a rearrangement of "Cobb-Douglas expenditure system". This progress is matched by a series of studies by Jeffrey Bergstrand in Bergstrand (1985, 1989, 1990). Bergstrand's major contribution was in showing the relationship which exists between trade theory and bilateral trade, and by so doing, he incorporated the supply side of the economy in the equation (Bergeijk and Brakman 2010:8). These efforts laid the foundations of the formulations in Anderson and van Wincoop (2003), which according to Bergeijk and Brakman (2010:8) has become the main reference on gravity equation. The equations below capture the advancement in the gravity equation. Equation (2) captures the gravity equation at its embryonic stage while equation (3) captures the equation post Anderson and van Wincoop (2003).

$$\mathbf{T_{ij} = (Y_i * Y_j) / Dist_{ij}} \qquad (2)$$

Where T_{ij} istrade flows between i and j partners.Y_i is economic size (often specified as GDP or per capita income) of $partner_i$. Y_j represents the economic size (often specified as GDP or per capita income) of $partner_j$, while $Dist_{ij}$ is the distance between the two partners. One of the advantages of the equation is it simplicity and clarity, both at its theoretical and empirical applications. At an empirical level, the natural log of equation (2) can be taken , and with the addition of chosen control variables to transform the equation to a format such as the one in equation (1) in section 2.6. For the transformations that resulted in Anderson and van Wincoop (2003), we have below:and

$$\mathbf{T_{ij} = Y_i E_j \left(t_{ij} / \Pi_i P_j \right)^{1-\sigma}} \qquad (3)$$

Where "T_{ij}" equals the trade flow between "I" and "j"partners, Y_i is the output of "i", while E_j is the expenditure of "J". " t_{ij}" represents the trade cost between the two partners, while the denominators are $\Pi_i P_j$ are multilateral resistance terms. These terms would be highlighted in the subsection below. Arising from this background, empirical application of gravity equation incorporate developments seen in the theorizing of gravity equation. These developments include treatment/accounting of the already mentioned multilateral resistance (MRT) and zero flows, measurement of distance and micro-data and product groups (van Bergeijk and Brakman 2010:11). With respect to island-trade gravity modelling and particularly the empirical studies used in this study, this study will briefly highlight three of these developments. They are MRT, zero flows and measurement of distance. Briefly, the sub-sections below highlight these indicated three, while micro-data and product groups is explained in the foot note below.

2.8.1 MRT

Current modelling of gravity equations include control for multilateral resistance (MRT) which are controls for resistances posed by trade barriers. Adam and Cobham (2007) defines MRT as the resistance which each country face in their trade with other countries. This

[8] Pullianen (1963) was an econometric study of patterns of international commodity flows.

means, following the expose of Anderson and van Wincoop (2004), that trade flows between any two trading partners does not depend solely on bilateral trade barriers between the partners. Instead, it depends on trade barriers across all trading partners. Cobham (2007) believes the presence of MRT is the major difference between current modelling of trade flow and traditional versions developed by Jan Tinbergen and Hans Linnemann during the early years of the model (Linnemann 1966), and new versions developed by Anderson and van Wincoop (2003 and 2004). Cobham (2007) also views MRT as third party effects that constricts trade flow, and therefore believes that these third-party effects need to be taken into consideration in order for one to be able to make an accurate evaluation of the effect on trade. For instance, Baldwin and Taglioni (2006) has faulted the estimates of Rose (2000) and Frankel and Rose (2002) on the grounds of upward bias, for not accounting for MRT in their studies on the "effects of currency union on trade". This is because an upward tick in inflation rate could lead to omitted variable bias. Besides, Baldwin and Taglioni (2006) believed that not controlling for MRT explains the implausible large point estimates that emerged from the above mentioned studies by Rose (2000) and Frankel and Rose (2002).

The treatment for MRT has evolved in gravity estimations over the years, and a number of approaches or treatments has been recommended in the literature in order to solve the problems associated with its presence in gravity equations. Leading treatments include that of Anderson and van Wincoop (2003), Baier and Bergstrand (2009) , and Feenstra (2004). Anderson and van Wincoop (2003) recommends the use of a customised non-linear estimation technique. This is done by first solving for price indices (P_i *and* P_j) between the trading partners and in terms of the observable determinants of trade barrier, an then estimating with the use of non-linear estimation. Baier and Bergstrand (2009), proposed the use of a first-order Taylor series expansion. This is to generate a linear approximation to the multilateral resistance terms (Cobham 2007). The idea behind this is to solve for the price functions with the help of an OLS, instead of a non-linear estimation as used by Anderson and van Wincoop (2003).

Another widely known treatment of MRT, according to Cobham(2007) is to use "country-specific fixed effects" as proxy for multilateral resistance terms. The terms are then replaced by a vector of N country- specific indicator variables C_i and C_j, with each taking the value of 1 for trade flows between the two countries and zero (0) otherwise. For Feenstra (2004), he advocates for the use of "exporter and importer fixed effects" in cross sectional estimations. However, to control for time-varying unobserved trade costs in gravity equations, Baltagi et al. (2003) has recommended the incorporation of a full interaction effects design in the gravity equations. This is to be able to control for "unobserved heterogeneity". Other treatments include approximating for MRT with remoteness indices, which are constructed as weighted averages of bilateral distance; and in which the GDP is used as weights (Cipollina et al. 2016), and the use of spatial econometrics to control for MRT. (i.e Behrens et al. 2010).

2.8.2 Zero Flows

Zero flows results from the fact that there are cases when there are no, or very few trade between trading partners. Hence, trade flows is accounted for as zeros or missing (de Groot and Linders 2006). This has impact on the estimation of gravity model, given that the model predicts trade to be positive for the partners. Besides, the use of log-linear formulations of gravity model becomes impossible, given also that the logarithm of zero is undefined (de Groot and Linders 2006). Still on de Groot and Linders (2006), the paper argues that omitting zero flows can bias estimates if the zero flows are not as a result of chance or occur randomly. Specifically, When omitted, it hides potential information that can explain why there is no trade between the partners and results in the underestimation of the variables on trade (Rauch 1999:18-19). This is because variables such as geographic distance, islands, low levels of GDP or lack of cultural ties could be strong enough to impede trade completely(see Rauch 1999 and de Groot and Linders 2006). As a result, disregarding zero flows undermines the potential causes of no or low trade.

Generally, gravity equations are usually specified in log-linear form (Silva and Tenreyro (2006). Also according to according to Silva and Tenreyro (2006) and Burger et al. (2009), gravity equations estimated in log-linear format suffer from "three bias" that can ultimately result in the production of biased estimates. They are "bias related to logarithmic transformation-this is related to the opinion of de Groot and Linders (2006); bias related to the "failure of the assumption" of homoskedasticity and the way zero values are handled".

In order to handle this, several approaches has been deployed by researchers in order to handle problems associated with zero flows. Some of them include a) The use of "Poisson pseudo maximum likelihood estimator (PPML)" as proposed by Silva and Tenreyro (2006) or its modified version-Poisson fixed effects that is modified on for "negative binomial and zero inflation"(Burger et a. 2009). b) The practice of confining the sample to non-zero values, so as to eliminate estimations problems arising from zero values, or the substitution of zero values with small negligible constant that allows for a double log format to be estimated (papers that follow this treatment include van Bergeijk and Oldersma (1990) and Raballand (2003)). C) The use of censored regression (i.e.Tobit model). The idea behind the model is that it allows for the estimation of data sets in which a significant part of the observations cluster at zero (de Groot and Linders 2006). This treatment procedure was followed by papers such as Anderson and Marcouiller (2002)[9] and Rose (2004)[10]. Other approaches include the Heckman two-stage specification used by Assane and Chiang (2014)[11] and the Eigenvector spatial filtering used by Rodolfo Metulini et al.(2018)[12].

2.8.3 Measurement of distance

According to van Bergeijk and Brakman (2010:12), measurement of distance is perhaps the most valuable contribution of gravity equation. This is because it highlights the importance of trade cost. A quick inference of this importance can easily be made following the analogies used in the earlier sections of this study (i.e. section 2.7 and 2.5.3). For emphasis, this revolves around the inverse relationship between trade flows and measures of distance. However, measures of distance has been very crude and hence does not capture the emanating costs-trade costs or transport costs arising from distance (van Bergeijk and Brakman 2010:12). From studies such as Anderson and van Wincoop (2004), Limao and Venables (2001) or Combes and Lafourcade (2005), we now know that the story about the "death of distance" is quite exaggerated, and further renders journalistic views of a flat world incorrect. An often cited evidence against a "flat world" is the ground-breaking findings of Anderson and van Wincoop (2004). The study showed that ad valorem tax equivalent is

[9] Anderson and Marcouiller (2002) is empirical examination of the link between insecurity and pattern of trade.

[10] Rose (2004) was on whether the WTO actually promote trade as designed.

[11] Assane and Chiang (2014) was on the link between "trade, structural reform and institutions in Sub-Saharan Africa".

[12] Rodolfo Metulini et al.(2018) used a "spatial filtering ZIP approach to estimate the gravity model.

about 170% of mill prices goods. Further, Berthelon and Freund (2008) found that the "…the elasticity of trade to distance increased (in absolute value) by about 10% since 1985".

Hence given this knowledge, recent gravity equations now use new measures of distance that reflects trade costs/transportation costs in the stead, or in comparison to old ones such as great circle distance, real distance or real time. Some of this new measures include the ones used in Combes and Lafourcade (2005) and Limao and Venables (2001). Combes and Lafourcade (2005) used a measure that incorporate infrastructure characteristics, vehicle and energy to develop a mechanism to accurately calculate transport costs. Limao and Venables (2001) found, while using their measurement for transport costs, that African trade flow is low as a result of a trade cost factor of "-3", and which reduces trade volume by about 28%. Hence, these new measurements capture the advancement in the measurement of distance. Some studies still rely on old measures and might be part of the reason behind the heterogeneity of reported effect sizes in the empirical literature.

2.9 Conclusion

This chapter has explored relevant and accessible theoretical and empirical literature of islands on trade. The object of this exploration is to understand the "the lay of the land" of the literature. It is important in understanding the evolution of uncertainty that has trailed the understanding of island's underlying effect on trade. By exploring the literature (empirical literature), we note a possible source of heterogeneity in the literature-with respect to the divergence of reported empirical effect sizes of islands. This has to with various accounting for MRT and zero flows and distance. We also note that in general, a large percentage of studies in recent times(2010-2019) did not incorporate the latest advancements in their estimation of gravity equation. However, this study is structured only to answer questions regarding the true or underlying effect of islands on trade, and the investigation of publication bias, if it exists; and how it influences the direction of reported effect sizes found in the empirical literature. This is what the rest of this study is designated to achieve, but the next chapter will start this journey by setting up the study's empirical approach, data construction and a description of the meta-data set.

Chapter 3

3.1 Data and empirical approach

This chapter provides a roadmap and framework upon which the objectives of this study is achieved. To do this, the study started by reviewing accessible primary empirical studies. This is because eligible studies in this category would form the study samples from which island effect sizes needed for this study would be extracted from. From the search, efforts were made to ensure that all empirical studies reviewed for this study were all relevant published and unpublished studies in English language and are chosen on some defined characteristics such as: a) using the gravity model as the study's theoretical framework, b) reports island effect sizes in either core or control capacity and c) study effect sizes must at the minimum be reported alongside the standard error, t-statistics or significance level. Hence, due diligence was followed to ensure that this study's empirical approach follow the recently updated reporting guidelines for meta-analysis in economics. This is in respect to its protocols and data construction, modelling and the reporting/data construction . The guidelines are well detailed in Havranek et al. (2020:472). The new guidelines is an upgrade to the prescriptions in Stanley et al. (2013). The rest of this chapter shall cover the study's protocol and data construction, description of meta-data set and the set-up of the empirical strategy.

3.2 Protocol and data construction

The protocol started with a careful and extensive research for primary empirical studies on Google scholar and EconLit advanced search. This is to make sure the study identifies and reviews all accessible and relevant empirical studies published between 2010 and 2019. Generally, the literature selection process for this study can be categorised into two: identification and "selection-for-review". Identification started on searches on Google scholar and Econlit. Using some keywords and the help of Boolean connectors, the study searched for: "trade + island" and "gravity model"; and for periods between 2010 and 2019 (years of interest). Starting with google scholar, the study found 27,000 search reviews from the search first search in January 24, 2020. Out of the reviews the study found 150 studies which appeared relevant based on eye ball examination of title. From Econlit the study found 65 studies (using the same keywords and Boolean connectors) , out of which 26 studies was also chosen based on eye ball examination of title.

Specifically, the study identified **176 studies** (150 +26) from both google scholar and Econlit. In comparative terms, the 150 studies identified from google scholar represents about 1% (0.006) of the total 27,000 reviews that appeared on first search. The reason for this is because despite the Boolean connectors, google scholar search, unlike other narrower search engine(s) such as Econlit is quite broad. This means that the search included a lot of irrelevant results that is way outside the objectives or scope of this study, and so after a point, the study couldn't find relevant studies despite the large number of potential studies returned using the key words and Boolean connectors. So this warranted a move to other secondary, but more advanced search engine(Econlit). For Econlit, we identified 26 studies which represents 40% of all 65 reviews found in the search engine. After the identification of the studies, 23 studies were removed, while we retained only 3 out of the 26. We also added two studies suggested by one of our advisors (Binyam Afewerk Demena) that were missed from the search results on the two search engines. This reduces the studies earmarked for full review to **155** studies (176-23+2).

Next is the "selection-for-review" stage. In this stage, the 155 identified studies were fully reviewed for their abstracts, study methodology, data and estimation techniques. From the 155 studies, the study further removed another 98 studies, while retaining 57 studies. The removed studies were found to be ineligible as they didn't meet either one or all of the final studies inclusion requirement. These requirements are as follows: a) study must be estimated with a gravity model; b) study must report island coefficient in any or all of the regression outputs; c) study must report alongside the island effect sizes, either of the standard error(s) or t-values of the reported effect sizes and d) the study must not be estimated with a logit or probit regression as its main regression technique. The reason for this further restriction is because logit/probit regressions[13] estimates probabilities, instead of actual trade flows. However, studies with a second stage Heckman was included, as it accounts for actual trade flows. To ensure all potential relevant studies are included, the researchers scanned the references of the included 57 studies for further studies. But saw that relevant referenced studies have already been added to the study's inclusion list. Hence, from studies in the inclusion list, the researchers coded 57 studies from which 1,546 effect sizes was extracted from.

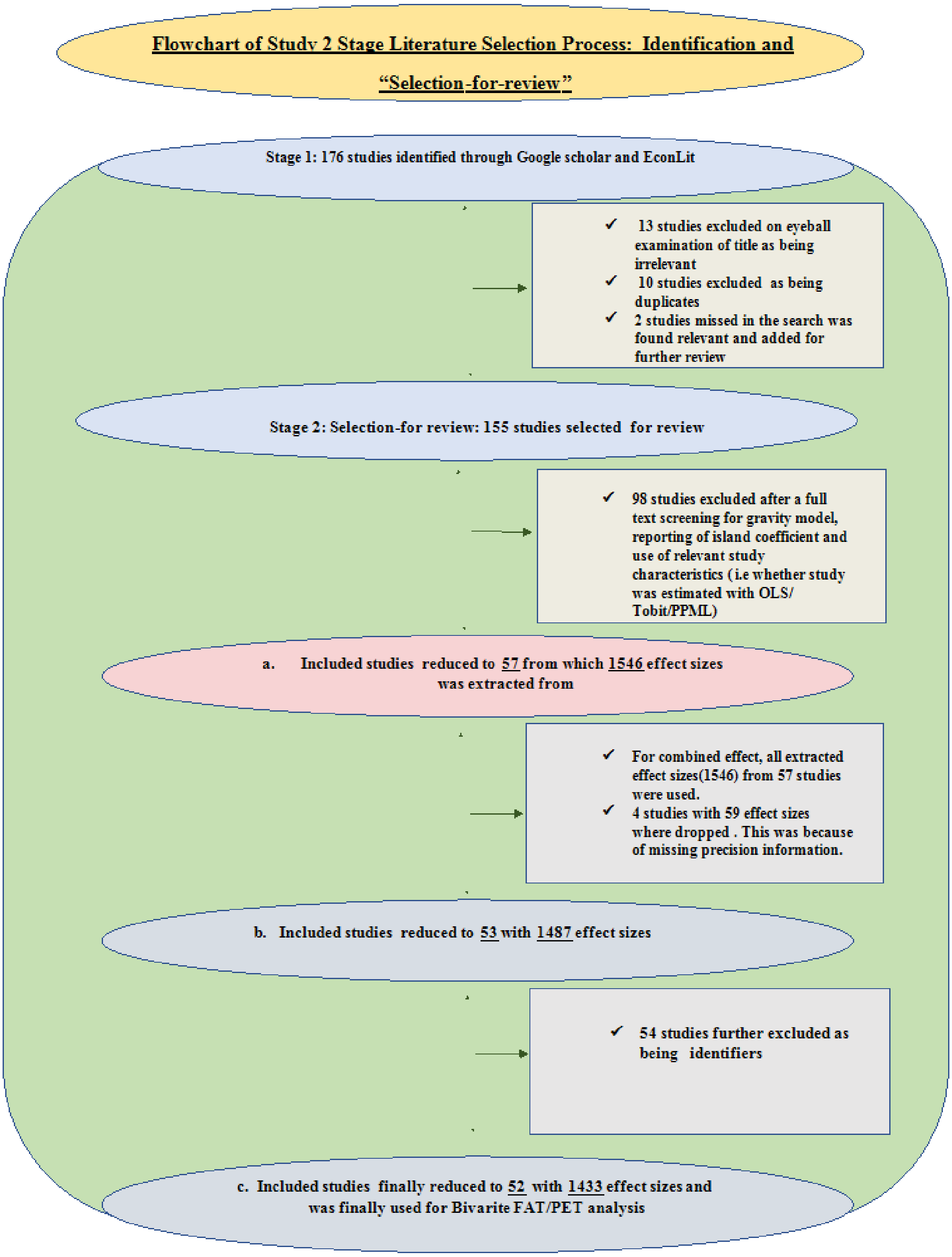
Worthy of note here is the disagreement between the first and the second coder. This relates to further exclusion of some of the extracted effect sizes[14]. The first coder contended for the removal of the effect sizes on the grounds that it lacked either of precision information (standard error or t-values), but the second seconder argued that it should be retained since the effect sizes where reported with their level of significance. Nonetheless, a decision was reached to partially retain it for the estimation of the combined effect; while omitting them at the level of meta significance testing. This is because precision information is required to test investigate the genuine effect and existence of publication bias, and would get omitted automatically using stata software when running analysis involving precision testing. The number of affected effect sizes is 59 and they are from four studies[15]. This reduced the number of effect sizes used in this analysis to 1487 (1546-59). Further, we saw that there are outliers in the data set. This is for 54 effect sizes out of the remaining 1487 effect sizes. Knowing that it might affect our result, we decided to remove them also. This means that the meta-analysis was finally ran on 1433 effect sizes (1487-54) extracted from 52 studies. This formed the last data base used for analysis in this study. Below in figure 3.1 is PLASMA flowchart of the study's two stage literature/data extraction process. The flowchart illustrates clearly the steps used in constructing the data base better.

[13] Studies estimated solely with a logit and probit regression are not suitable for analysing trade flows, as we are dealing with actual trade flows and not probabilities or potential trade flows. But this is not the case when it is accompanied with another regression that serves as the main regression. This is easily the case in estimations following a two stage Heckman estimation procedure. For instance, studies estimating the intensive and extensive margins of trade. For our study, this implies that we excluded all studies estimating the probability of trade with a partner.

[14] An agreement was reached between the first and second coder as it pertains to what to do with some of the extracted effect sizes reported without t-values or standard error, despite having their level of significance reported. The agreement was to momentarily retain them in order to find the combined effect of all the reported effect sizes within the 10 year period (2010-2019), and to discard them while running a meta-significance tests for genuine effect and publication bias. This is also because we know that stata automatically will drop effect sizes without standard errors while running this tests.

[15] Authors of these studies have been contacted for more information regarding the effect sizes in question, but no response yet after a first reminder. But we will send a reminder again and report after the submission of this research paper. This applies to other missing information in the data e

Figure 3.1: PRISMA Flowchart of Literature Selection/Data Extraction Process



Besides, efforts for accuracy was taken by getting a second coder who cross checked all the data entries within a 2-3 week period. This cross checking was after a 7 weeks initial coding by the first coder. This is because coding and crosschecking of data is time and labour tasking.

Lastly, the data set is fraught with multiple estimates from the same study conducted with different models, and with controls made for a number of outcomes-depending on the interest of the study. But this is mainly to ensure robustness and consistency. According to Stanley and Doucouliagos (2013), this is due to the demand and need for robustness by editors and reviewers, who prefer studies with multiple models, methods and estimates. Besides, the data set is filled with unavailable information, coded as NA (not available) on excel. On stata such data points was converted to missing values (.) to enable computation or analysis. Hence, the study proceeded with available information on the data sets, with the resolution of dropping any effect size that proves to be an outlier, following an appropriate statistical method of analysis. The issue of outliers is dealt with in the later part of this chapter. Table 3.1 below summarises the reported studies[16].

Table 3.1 : Summary of Final Primary Studies included in the Study

Summary of Reported Studies											
ID	Study(year)	Pub type	Region	Data start	Data end	No of estimate	Mean estimate	Median	Std. Dev	Min	Max
1	Miron et al.(2019)	PR	Both	2001	2015	4	-0.17	-0.15	0.07	-0.41	0.07
2	Rodolfo Metulini et al.(2018)	PR	Developing	2000	2000	10	-0.44	-0.49	0.19	-0.88	-0.01
3	Okafor et al.(2018)	PR	NA	1995	2015	20	0.34	0.28	0.08	0.17	0.51
4	Karkanis (2018)	PR	Both	2001	2015	2	0.96	0.96	0.55	-0.60	7.90
5	Mathee and Santana-Gallego (2017)	PR	Both	2012	2012	16	-0.31	-0.31	0.05	-0.42	-0.21
6	Wong et al. (2017)	PR	Developed	1995	2014	2	1.35	1.35	0.52	-0.53	7.97
7	Fiankor et al. (2016)	NPR	Developing	2008	2013	6	0.63	0.62	0.29	-0.33	1.19
8	Mishra and Roy (2016)	PR	Both	1970	2009	10	-1.14	-1.42	0.28	-1.76	-0.52
9	Patuelli et al. (2016)	PR	NA	NA	NA	6	-0.17	-0.29	0.10	-0.43	0.09
10	Lee and Wang (2016)	NPR	NA	2000	2008	18	-0.48	-0.12	0.08	-0.65	-0.31
11	Macanas (2015)	NPR	Both	2000	2012	12	-7.87	-6.68	2.13	-12.56	-3.19
12	Hussain and Yasmine (2015)	PR	Both	1975	2005	10	-0.19	-0.20	0.14	-0.50	0.13
13	Benedictis and Pinna (2015)	NPR	NA	1995	2005	16	0.18	0.15	0.04	0.10	0.27
14	Sonora (2014)	PR	Both	2000	2009	21	0.72	0.75	0.03	0.67	0.78
15	Vila-Goulding (2014)	NPR	Developing	2002	2012	5	-0.11	-0.53	0.69	-2.04	1.81
16	Nastos et al. (2014)	PR	Both	2004	2012	4	0.39	0.45	0.41	-0.91	1.69
17	Raihan (2014)	NPR	Both	1988	2011	816	-0.46	-0.32	0.08	-0.61	-0.30
18	Frankel (2014)	NPR	NA	2006	2006	14	-0.34	-0.42	0.24	-0.85	0.18
19	Assane and Chiang (2014)	PR	NA	1984	2006	6	-0.54	-0.26	0.11	-0.84	-0.25
20	Avsar and Unal (2014)	PR	NA	1950	2006	6	-0.23	-1.43	0.04	-0.34	-0.12
21	Melece and Hazners (2014)	NPR	NA	1950	2006	4	-1.43	-0.24	0.02	-1.49	-1.37
22	Zhu (2013)	NPR	NA	1976	2008	5	0.25	-0.29	0.05	0.12	0.38

[16] Excluded studies are on the appendix section of this study.

23	Cowgilll and Dorobantu (2013)	NPR	NA	2008	2011	6	0.04	0.16	0.07	-0.14	0.23
24	Miran et al. (2013)	NPR	NA	1998	2008	1	0.16	0.09	.	.	.
25	Ram and Prasad (2013)	NPR	NA	2005	2005	12	0.11	-0.55	0.01	0.08	0.14
26	Bortnikas (2013)	NPR	NA	1982	2010	1	-0.55	0.34	.	.	.
27	Greene (2013)	NPR	NA	1990	2011	7	0.16	-0.18	0.15	-0.20	0.52
28	Novy (2013)	PR	Developed	2000	2000	6	-0.21	-0.94	0.04	-0.31	-0.11
29	Roman et al (2013)	NPR	Developed	1995	2009	4	-0.67	0.28	0.92	-3.61	2.26
30	Al-Rashidi and Lahiri (2013)	PR	NA	1990	2009	9	0.29	-0.26	0.00	0.28	0.30
31	Lee et al. (2012)	NPR	NA	2000	2008	144	-0.15	0.30	0.05	-0.24	-0.06
32	Grant and Boys (2012)	PR	NA	1980	2014	11	0.29	-1.36	0.01	0.28	0.30
33	Denny (2012)	NPR	Both	2003	2010	64	-1.36	0.25	0.06	-1.48	-1.23
34	Sapwaroboal (2012)	NPR	Both	1983	2000	14	0.75	-1.20	0.99	-1.40	2.90
35	Gokmen (2012)	NPR	Both	1950	2001	15	-1.60	1.16	0.18	-1.99	-1.21
36	Zelekha (2012)	PR	Both	1982	2008	18	1.09	1.04	0.02	1.04	1.14
37	Qureshi and Tsangarides (2012)	PR	Both	1972	2006	16	0.31	0.43	0.07	0.17	0.45
38	Bista (2012)	NPR	Both	1950	2000	4	0.60	0.54	0.50	-0.97	2.18
39	Eicher et al. (2012)	PR	Both	1960	2000	3	-0.18	-0.22	0.06	-0.45	0.10
40	Balding (2011)	PR	Both	1950	1999	1	-0.72	-0.72	.	.	.
41	Santana-Gallego et al. (2011)	NPR	Both	1995	2006	6	-0.83	-0.82	0.03	-0.90	-0.76
42	Mejia (2011)	PR	Both	1990	2008	3	-0.77	-1.31	0.55	-3.13	1.59
43	Martincus et al. (2011)	PR	Both	1995	2004	3	-0.43	-0.48	0.14	-0.10	0.17
44	Lohman (2011)	PR	Both	1948	1999	2	.065	0.07	.075	-0.89	1.02
45	Kim (2011)	PR	Both	1948	2007	3	0.08	0.09	0.02	-0.01	0.18
46	Haq and Meilke (2011)	PR	Both	1990	2000	48	0.23	0.04	0.51	-0.80	1.26
47	Rudolph (2011)	NPR	Developing	1995	2006	20	0.29	0.03	0.19	-0.11	0.70
48	Eicher and Henn	PR	Both	1950	2000	2	0.15	0.15	0.00	0.13	0.17
49	Yakop and van Bergeijk (2011)	PR	NA	2002	2002	5	-0.11	-0.07	0.04	-0.22	0.01
50	Aiello et al. (2010)	PR	Developed	1995	2003	24	0.50	0.41	0.10	0.28	0.71
51	Campbell (2010)	NPR	NA	1870	2000	11	0.84	0.59	0.35	0.05	1.62
52	Santana-Gallego et al. (2010)	PR	Both	1995	2004	6	0.14	0.23	0.11	-0.14	0.41
53	Ghemawat et al. (2010)	PR	Developing	1995	2006	4	-0.14	-0.08	0.13	-0.56	0.29
54	Santana-Gallego et al. (2010)	PR	NA	1995	2006	6	0.19	0.15	0.25	-0.46	0.83
55	Edmund and Li (2010)	NPR	Both	2000	2000	26	1.01	0.70	0.20	0.60	1.41
56	Konya et al. (2011)	NPR	Both	1960	2005	16	0.14	0.17	0.03	0.08	0.19
57	Moons and Boer (2017)	NPR	NA	2006	2006	12	-2.15	-8.38	19.55	-45.18	40.88

Source: compiled by author.NA stands for "not available" ; while "Both" stands for developed and developing countries and "PR" and "NPR" for peer reviewed and non-peer reviewed studies.

3.3 Meta-dataset

The study samples comprises prevalently of empirical studies in which island variable-often specified as a dummy variable were modelled in control capacity. This is about 94.7% of sampled primary empirical studies or 54 out of 57 sampled empirical studies. The remaining 5.3% (4 empirical studies) featured island variable as a core variable of interest. These studies include Metulini et al. (2018) on the use of "spatial-filtering zero-inflated approach" to the estimation of gravity model, and which they pointed it is appropriate when dealing with zero trade flows; Patuelli et al. (2016) on "the space of gravity"; Benedictis and Pinna (2015) on "islands as bad geography" and on "Gravity redux" by Novy (2013). The featured empirical primary sample studies consists of 31 peer reviewed studies and 26 non-peer reviewed studies. The oldest study from which the effect sizes was extracted from was by Edmund and Li (2010), while the earliest study was in 2019 by Miron et al.(2019). The median study year was 2014 and featured Raihan (2014), a study sample from which 51.7% of the estimates was extracted from.

3.3.1 Data characteristics

We found that about 93.1% of the effect sizes are from panel studies, while about 6.9% are from cross-sectional studies. We found also that on average the number of exporting and importing countries in the data sets are about 37 and 63 respectively. On modelling of trade flow, we found that about 61% of effect sizes are from study samples in which trade flow is modelled as imports. This number is about 32% for exports and 8% for trade. On estimation characteristics, we found that about 89% of the effect sizes in data sets were estimated with OLS. Others were estimated with other techniques. We found also that about 71% of the effect sizes were estimated while controlling for multilateral resistance. For zero flows, this number was just about 7%. This means that about 93% (92.5) of effect sizes are from studies without treatment for zero flows. This is surprising and warranted a recheck of the datasets and study samples. But we found that truly, an overwhelming majority of the effect sizes are from studies without any any treatment for it. Details of this can further be found in Table 3.4.

Also, we found that 19 of the reported island effect sizes are individually more than 10 in absolute value. First impulse again on noticing this was that the effect sizes are outliers, and might be as a result of coding errors. Already, studies such as Stanley and Doucouliagos (2013) opined that unusual estimates could be as a result of coding errors. For Mebratie and van Bergeijk (2013), they argued that such large estimates are outliers and should be excluded from the main study. Regardless, a second check was conducted again, and we found that the effect sizes are not coding errors. Hence, we decided not to drop the effect sizes from such studies. Nevertheless, these 19 estimated effect sizes warranted a concern about outliers in the general data set (These studies are from Macanas 2015, Raihan 2014, Haq and Meike 2011 and Moon and Boer 2017). Given this concern, we decided to adopt the multivariate outlier method suggested by Hadi (1992 and 1994) to identify outliers jointly with their standard errors or precision. According to Demena and Afesorgbor (2020), Hadi's method is very appropriate and robust in detecting outliers in big multivariate data sets (such as ones found in Havranek and Irsova (2011) and in Demena and van Bergeijk (2017)). When we implemented this method, we found that 54 effect sizes out of the 1,487 effect sizes picked by the method are outliers. Ordinarily, examined samples should be 1,546 effect sizes, but 59 effect sizes were not examined. This is because of missing precision information (t-values). This means that effect sizes found to be without precision information would be further excluded in the FAT/PET analysis for publication bias and genuine effect. It also means that estimations in chapter four will be made and reported for 1,433 effect sizes not designated as outliers. Hence, effect sizes examined, and found to be outliers represent about 3.6% of the total effect sizes examined (1,487). This is illustrated in table 3.2 below.

Table 3.2: Hadi Outlier Identification

Hadi outlier (p=.002)	Frequency	Percent	Cummulative
0	1,433	96.37	96.37
1	54	3.63	100
Total	1,487	100	
Source: Author's own computation from stata			

Further inspection showed that about 87% or about 47 out of the 54 the identified outliers are from peer reviewed studies, while the remaining ones are from non-peer reviewed studies. Given this, we suspect that effect sizes from peer reviewed studies might have resulted from non-robust estimation techniques or that the effect sizes are from sub-standard journals. Demena (2015) opined that outliers could represent research with low quality. Also, Havranek and Irsova (2011) argued that the rank of a journal on "Institute of Scientific Information" is an indication for research quality. In our own case, a more than proportionate number comes from non-peer reviewed sources, so we suspect that the studies are from low quality journals. In any case, we decided to run our meta significance tests without effect sizes picked as outliers. But we run another regression with it, alongside other regressions that are used as Robustness check. Table 3.3 shows the distribution of the outliers.

Table 3.3: Distribution of Outliers

ID	**Status**	**Frequency**
11	NPR	4
13	NPR	8
17	NPR	6
18	NPR	2
29	NPR	9
30	PR	2
33	NPR	1
46	PR	2
47	NPR	9
50	PR	1
52	PR	3
57	NPR	7
Total		**54**
Source: Author's compilation		

Table 3.4 Summary and Descriptive Statistics of Used Variable

Definition and Descriptive Statistics of Explanatory Variables					
No	**Moderators**	**Definition**	**Mean**	**Median**	**St. error**
A	Precision	Precision of estimated island effect sizes	10.082	3,488	21.643
B		**Outcome characteristics**			
1	orige	Estimated island effect sizes	-0.349	-0,146	6.091
2	se	Standard error of estimated island effect sizes	2.389	0,290	35.916
3	t	T-value of estimated island effect sizes	-2.146	-0,347	12.797
C		**Data Characteristics**			
1	panel	=1 if data set is panel	0.931	1,000	0.253
2	cs	= 1 if data set is cross sectional	0.069	0,000	0.253
3	obs	no of observation	8.051	8,031	2.085
4	years	time span/years covered by the study	2.7	3,178	0.895
5	disagg	=1 if data is disaggregated	0.141	0,000	0.348
6	Noimporter	No of importing countries	63.464	23,000	76.413
7	Noofexporter	No of exporting countries	37.985	185,000	67.182
8	Nocount	No of trading countries	93.301	52,000	76.957
D		**Dependent Variable**			
1	exports	=1 if effect size is modelled in exports specification	0.323	0,000	0.468
2	Imports	= 1 if effect size is modelled as imports specification	0.603	0,000	0.488
3	trade	=1 if effect size is modelled as trade specification	0.074	0,000	0.267
E		**Estimation Technique**			
1	OLS	= 1 if effect size is estimated with OLS	0.873	0,000	0.33
2	Tobit	= 1 if effect size is estimated with Tobit	0.017	0,000	0.131
3	Heckman-2S	= 1 if effect size is estimated with 2nd stage Heckman	0.022	0,000	0.147
4	PPML/ZIP	= 1 if effect size is estimated with PPML/ZIP	0.041	0,000	0.199
5	SLS/SEM	=1 if effect size is estimated with a 2SLS/SEM	0.149	0,000	0.121
6	GLS/GMM/MLE	=1 if effect size is estimated with GLS/GMM/MLE	0.030	0,000	0.170
7	Random	=1 if Random effects are included	0.032	0,000	0.175
8	Fixed	=1 if fixed effect is included	0.012	0,000	0.107
9	Yeartimefe	=1 if Year/Time fixed effect is included	0.663	0,000	0.473
10	Countfe	= 1 if country fixed effect is included	0.626	0,000	0.483
11	Pair_countfe	= 1 if Pair_country fixed effect is included	0.005	0,000	0.071
12	Exporteryrfe	= 1 if Exporter year fixed effect is included	0.086	0,000	0.280
13	Importyrfe	= 1 if Importer year fixed effect is included	0.086	0,000	0.280
F		**Treatment of Multilateral Resistance**			

1	AvWMRT	=1 if MRT is accounted with Anderson & van Wincoop(2003)	0.004	0,000	0.062
2	BBMRT	=1 if MRT is accounted with Baier and Bergstrand(2009)	0.003	0,000	0.057
3	CtryTFEMRT	=1 if MRT is accounted with country and time fixed effect	0.684	0,000	0.465
4	DyadicFEMRT	=1 if MRT is accounted with Dyadic fixed effect	0.001	0,000	0.036
5	ESFMRT	=1 if MRT is accounted with Eigenvector Spatial Filter	0.017	0,000	0.123
G		**Treatment of Zero Flows**			
1	HMRZeros	= 1 if treated with an HMR specification	0.015	0,000	0.09
2	Zeros1	=1 if treated with the additon of 1	0.028	0,000	0.157
3	PPMLZeros	=1 if treated with a PPML specification	0.027	0,000	0.163
4	TobitZeros	=1 if treated with a Tobit specification	0.005	0,000	0.067
5	ESF	=1 if treated with an Eigenvector Spatial filter	0.005	0,000	0.071
6	nozeros	= 1 if study does not account for zero flows	0.925	0,000	0.264
H		**Specification Controls(variables)**			
1	distance_od	=1 if specification controls for distance	0.966	0,000	0.182
2	border_od	=1 if specification controls for border	0.726	0,000	0.446
3	currency_od	=1 if specification controls for currency	0.083	0,000	0.277
4	language	=1 if specification controls for language	0.784	0,000	0.412
5	landlock	=1 if specification controls for landlock	0.986	0,000	0.118
6	P-reviewed	=1 if specification controls for landlock	0,186	0,000	0,389

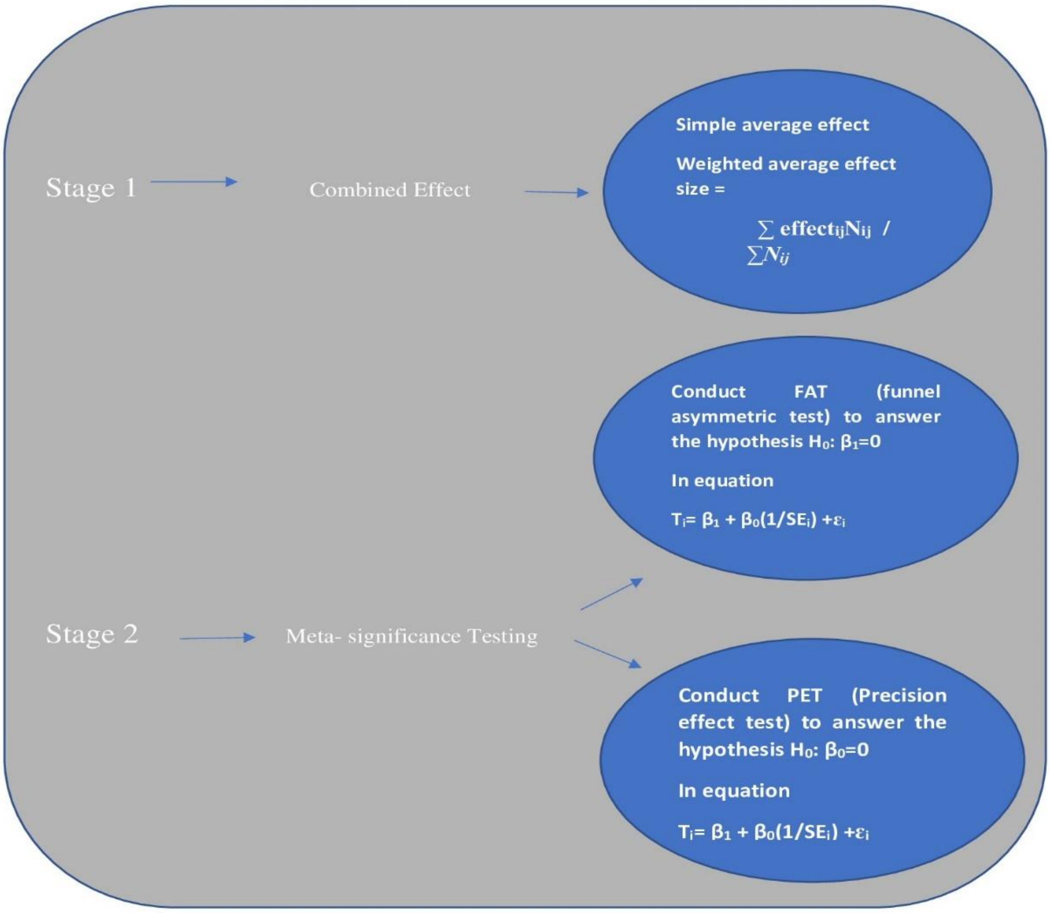
3.4 Empirical Approach

As mentioned previously, a typical empirical primary study from which data is extracted from must analyse trade flow the standpoint of the gravity model. The basic theoretical form of the model can be found in equation (2) of section 2.8 in chapter two. When MRT is treated in the study, it takes the form of equation (3) of the same section in chapter two.

All reported effect estimates from the primary studies were estimated with this analytical background. In this subsection also, I will outline the chosen estimation technique for this study, albeit briefly. They comprise of steps upon which this study relied on to examine the underlying effect of island on trade and in identifying publication bias in the island-trade literature. They comprise an estimation of the weighted average effect size and meta significance testing for FAT/PET. These steps can be seen even further in figure 3.2 which shows a two stage empirical process undertaken to answer the research questions of this study.

Figure 3.2: Study's Two Stage Empirical Technique

FLOW CHART OF STUDY'S 2 STAGE ANALYSIS



3.4.1 Weighted Average Effect

To answer the primary research question of this study, we proceed by computing the weighted average effect of island. The weighted average effect size is given by equation (3).

$$\textbf{effect}_s = \sum \textbf{effect}_{ij}\textbf{N}_{ij} / \sum \textbf{N}_{ij} \qquad \textbf{(4)}$$

Where effect$_s$ = underlying effect size.

effect$_{ij}$ = reported effect size of the i^{th} estimate from j^{th} study

N$_{ij}$ = associated sample size.

3.4.2 Funnel Plot

The funnel plot is an informal and the easiest examination technique, upon which the presence of publication bias is tested (Sutton et al. 2000:1574) In a more elaborate manner, Doucaligous and Stanley (2013) defines a funnel plot as a "…scatter diagram of all empirical estimates of a given phenomenon again the estimates' precisions (i.e. the inverse of the estimates' standard errors, 1/SE)". Further, Doucaligous and Stanley (2013) explained that funnel plot shows the variability of each estimates (effect sizes) with respect to the precision or to the inverse of the estimate's standard errors (1/SE). When placed on a vertical axis , reported effect sizes at the bottom of the plot will be widely distributed. This is as a result of their large standard errors; while those with low standard errors or more precise estimate would be located at the top and more compactly distributed.(Doucaligous and Stanley 2013). In the medical and social sciences, the problem funnel plots exposes-publication selection bias, is quite perverse (Doucaligous and Stanley 2013). Hence, a damaging threat to statistical inference. Essentially, publication bias exists if scientific outputs (i.e. research papers) are chosen for their statistical significance. This results in the dominance of effects with a given statistical direction, which thereby undermine the reliability of scientific output. Furthermore, publication bias when present do not have to come from a perverse intent (Doucaligous and Stanley 2013). Besides, the major issue with it is not its presence, but the bias that can result in when one is providing an account of a given empirical knowledge. Hence, when a bias is present, the funnel plot is usually skewed or asymmetrical from the mean in either directions. The reverse is the case if it is symmetrical. Despite its usefulness, there is need for further statistical testing(FAT) in order to effectively establish its presence, and the degree of its presence. This is also because eyeball-examination could be misleading.

3.4.3 Meta Significance Testing

With meta-significance testing, we statistically examine the presence of publication bias and the genuine effect of islands on trade. With respect to publication bias, Doucaligous and Stanley (2013) has observed, while following a random sampling theory, that in the presence of publication bias, the "…reported effect is positively correlated with its standard error, ceteris paribus; otherwise, estimates and their standard errors will be independent". This means that studies with small samples and low standard errors will have to use a number of possible econometric techniques and specifications so as to find larger estimates. If this is not so, the estimates will not be significant (Doucaligous and Stanley 2013). The reverse is the case for studies with large samples; as they need not search much in order to be able to obtain estimates that statistically significant. Stated differently, meta-analysis such as Demena (2015) on "productivity spill over and FDI" has noted that a direct correlation exists between the observation size and the absolute value of the t-stat. This results in a more precise and significant estimates for studies with large samples. This idea can be represented in equation (5) as :

$$\ln |t_{ij}| = \beta_0 + \beta_1 \ln Sobs_{ij} + \varepsilon_{ij} \qquad (5)$$

Where the dependent variable $\ln |t_{ij}|$ is the natural logarithm of the absolute value of the t -value and **lnSobs** represents the natural logarithm of the observation size. The betas at all times remain the parameter estimators, while the last term is disturbance term. Following the analogy of Demena (2015), equation(5) implies that as when $\beta_1 > 0$, there is a genuine island effect on trade flows as observation size- **lnSobs**- increases, and so is the t-value of the estimated island effect. This is not so when $\beta_1 < 0$; and further means that the effect sizes is influenced by publication bias. This reasoning goes back to earlier quoted opinion of Doucaligous and Stanley (2013), who observed has observed that in the presence of publication bias, the "reported effect will be positively correlated with its standard error, ceteris paribus; otherwise, estimates and their standard errors will be independent. However, given that the reported effect sizes are easily influenced by publication bias such as in a case where $\beta_1 < 0$, the meta significance testing for the relationship between the observation size and t-value becomes misleading (Demena 2015; Doucouliagos and Stanley 2013). This necessitates a the need for a more nuanced statistical approach in form of a meta-regression analysis (MRA). A model of this is expressed below in equation 6.

$$effect_{ij} = \beta_0 + \beta_1 + Se_{ij} + \varepsilon_{ij} \qquad (6)$$

The MRA has its roots in econometric theory, and the assumptions in the sample studies from which the effect sizes (i.e. effect $_i$) are extracted from (Doucouliagos and Stanley 2013). But the drawdown of this model (equation 5) is that it is riddled with heteroskedasticity. This is because of the variance effect or the fact that the disturbances will vary from one estimate to another. Furthermore, this means that the ordinary least square (OLS) would become in appropriate for its estimation. Hence, the weighted least squares is used in place of OLS. To adjust for the effect of heteroscedasticity, Doucouliagos and Stanley (2013) suggests "weighting the squared errors with the inverse of each estimates' variance". This simply entails weighting or dividing equation (6) with the standard error, **Se_{ij}**. . This yields equation (7) as

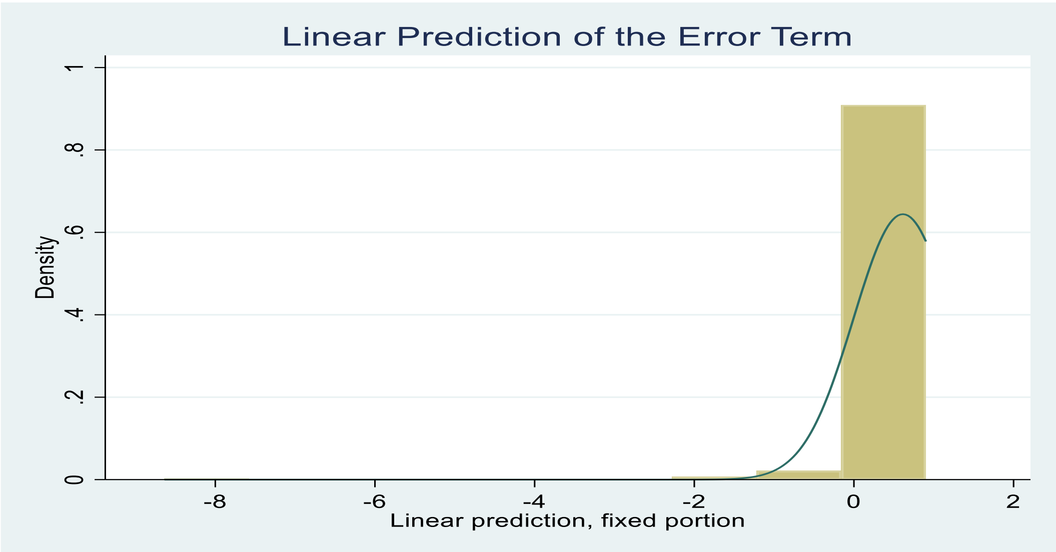
$$t_{ij} = effect_{ij} / Se_{ij} = \beta_1 + \beta_0 (1 / Se_{ij}) + \mu_{ij} \qquad (7)$$

Where t_{ij} is t-stat of the reported i^{th} estimate of the j^{th} study. **$1/ Se_{ij}$** gives the precision. μ_{ij} still gives the error term weighted with the precision to remove the variability. The error term accounts for the study level random effects and measurement error (Doucouliagos and Laroche 2009). We predict that the error term in the model above is positive at 0.678 and with a standard error of 0.007. This is easily seen in table 3.5 and figure 3.4 below

Table 3.5 Prediction of the Error Term Used in the MRA

Variable	No of Obs	Mean	Std. error	[95% Conf. Interval]	
resid	1433	0.678	0.007	0.664	0 .692

Figure 3.4: Graphical Prediction of the Error Term



β_1 and β_0 are parameters estimates for FAT and PET, in which β_0 estimates for both direction and size of a genuine effect, while β_1 estimates for the size of the bias. PET stands for precision effect testing while FAT stands for funnel asymmetric test. Flowing from this, we now investigate both the genuine effect of islands on trade and existence of publication bias and link it with the hypothesis guiding this study. That is :

1. **H_o :** Island status on trade flow is negative. i.e. Island < 0.
2. **H_a :** Island status on trade flow is positive or insignificant. i.e Island ≥ 0

Hence we hypothesised that from model (equation 7) that:

1. **H_0: $\beta_0 = 0$** and
2. **H_0 :$\beta_1 = 0$.**

Moving from here, if the results of the meta regression coefficients are statistically different from zero for **β_0**, it then provides substantive evidence against the null hypothesis. For instance, If it is different from zero and negative, it provides evidence that the underlying or genuine effect of islands on trade is negative. From the same model, we test the **β_1** to see if it is statistically different from zero. If it is different from zero and negative, it provides evidence there is a publication selection bias.

Chapter 4: Results and Discussion

We start by assessing the combined effects using the simple and weighted averages. This provides a hint on possible direction of genuine effects. Results of this exercise are presented in section 4.1 of this chapter. This is followed by a funnel plot in section 4.2. The plot ushers in the meta-significant testing of this study. After this, we ran a series of MRA Bivarite regressions that are presented in section 4.3. Findings in section 4.3 is further checked in section 4.4 for robustness. The regressions comprise of three models, the mixed effects multilevel model (MEM), clustered data analysis (CDA) and fixed effects model (FE). The MEM model is preferred , given that it accounts for within and between study variations (Doucouliagos and Laroche 2009). The presence of the CDA and the FE models are for just comparative purposes. Hence, decisions of this study do not rely on their estimates.

4.1 Simple and Weighted Average Effect Sizes

In estimating the combined average effect sizes, we recognised that effect sizes were trimmed down at different stages as a result of lack of precision information and outliers. The main analysis is premised on the number of effect sizes (1,433) with precision information and that are not flagged as outliers. However, we decided to estimate 1) a simple average involving all the coded effect sizes, 2) a weighted average estimated only for effect sizes with precision information and 3) a weighted average estimated only for effect sizes with precision information and that are non-outliers. The reason for this is to see if effect sizes increases/decreases in a given direction as the number of estimates increases.

Consequently, we found the simple average effect to be negative for all studies with 1,546 effect sizes at **-0.349** and significant at a 95% confidence interval of -0.652 to -0.045. On a weighted scale for 1,487 estimates, this number becomes **-0.255** and between a confidence interval of -0.306 to -0.204. For our chosen 1,433 effect sizes upon which our major analysis rely on, the weighted average effect is **-0.258** and between a confidence interval of -0.346 to -0.169. Also, whole studies[17] are lost as we remove outliers and effect sizes without precision information. For instance, the number studies ultimately reduced to 52 from the 57 we started with. This is the number of studies that was used as part of the main regression or analysis of this study. These estimates are reported with their standard errors and are clearly illustrated in in table 4.1A.

Table 4.1 A: Combined Effects of Islands on Trade at Different Levels of Included Studies

Simple Average and Weighted Average Effect Sizes of Islands on Trade						
Averages	**No of Studies**	**No of Obs**	**Effect sizes**	**St. error**	**(95% Conf. Interval)**	
Simple Average$_a$	**57**	**1,546**	**-0. 349**	**0.155**	**-0.652**	**-0.045**
[1]Weighted Average$_b$	**53**	**1,487**	**-0.255**	**0.026**	**-0.306**	**-0.204**

---

[17] Some studies have just 1 or 2 reported effect sizes. This mean that if the effect sizes from such studies are flagged as outliers, whole study information might be totally lost at the given level of analysis.

[2]Weighted Average$_b$	52	1,433	**-0.258**	**0.050**	**-0.346**	**-0.169**

[a] is calculated with arithmetic average while [b] is weighted with inverse of the inverse of the standard error of an effect size's precision.[1] accounting for missing precision information. [2] accounts for outliers. Results approximated at three decimal places.

In table 4.1B, we streamed the analysis down to only effect sizes from peer reviewed studies, we found the simple average effect of 306 effect sizes from all peer reviewed studies (32 studies) to be positive at **0.102** and between a 95% confidence interval of 0.074 to 0.279. On a weighted scale for 259 effect sizes with precision information (31 studies), this is found to be **0.109**, and lies between 0.058 and 0.162 confidence interval. When we further remove effect sizes flagged as outliers, we have a weighted average effect of **0.101** for 244 effect sizes (30 studies), and between the 95% confidence interval of 0.043 to 0.158. Notice also, that whole studies are lost as we remove outliers and effect sizes without precision information. For instance, the number of peer reviewed studies ultimately reduced to 30. This is the number of studies that was used as part of the main regression for this study.

Table 4.1B : Combined Effects of Islands on Trade at Different Levels for Peer-reviewed studies

Simple Average and Weighted Average Effect Sizes of Islands on Trade						
Averages	**No of Studies**	**No of Obs.**	**Effect sizes**	**St. error**	**(95% Conf. Interval)**	
Simple Average$_a$	**32**	**306**	**0.102**	**0.090**	**0.074**	**0.279**
[1]Weighted Average$_b$	**31**	**259**	**0.109**	**0.026**	**0.058**	**0.162**
[2]Weighted Average$_b$	**30**	**244**	**0.101**	**0.029**	**0.043**	**0.158**

[a] is calculated with arithmetic average while [b] is weighted with inverse of the inverse of the standard error of an effect size's precision.[1] accounting for missing precision information. [2] accounts for outliers. Results approximated at three decimal places.

Given the results of this combined effects, both on a simple average and weighted scale, one might wrongly infer that the underlying or genuine effect of island on trade is negative for all studies under examination and positive for peer reviewed studies. Hence, caution is called here as the results of these tables provide no more than a hint. Besides, Doucouliagos and Stanley (2013) has pointed that "…science is not democratic". We only have these results because of the preponderance of effect sizes in a given direction, whether the focus is for peer reviewed studies alone or for all studies combined. Hence, the need for a robust technique for estimating the genuine effects. The results of this endeavour is shown in section 4.3 of this chapter.

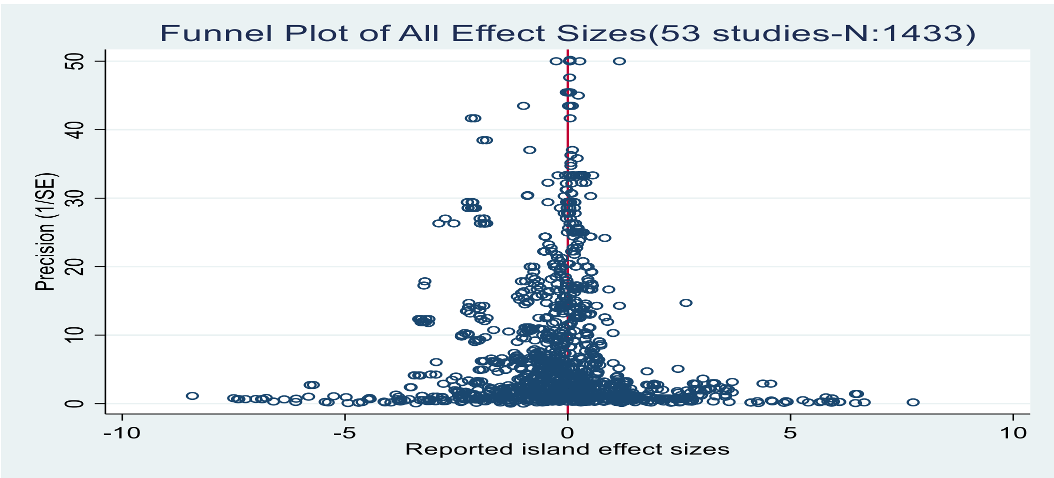
4.2 Funnel Plots

In figures 4.1 and 4.2, we present two funnel plots. The first one is a funnel plot for 1,433 effect sizes from the 53 studies under observation (As mentioned previously, the 1,433 effect sizes is a "narrow-down" from the extracted 1,546 effect sizes that were further trimmed account of missing precision information and from effect sizes identified as outliers(1,546-

59-54=1,433). This is repeated again to avoid confusion. On the funnel plot, the effect sizes at the top are usually regarded as being statistically significant (Doucouliagos and Stanley 2013) . This because of their high precision. To buttress this point even further, Stanley et al. (2010) pointed from a simulation result that about 10% of the most precise effect sizes used in meta-analysis corrects for publication bias. To correct for publication bias, Roberts and Stanley (2005) has recommended averaging the effect sizes from about 10% of the largest studies.

In any case, from figure 4.1, the top of the funnel plot is sparsely populated with effect sizes, unlike the bottom. This suggest that paucity of precise estimates from the sample studies. At the top also, there are estimates that are far dispersed from "0", just at as the ones concentrated at the bottom and are mostly negative. There is also one estimate at the very top of the distribution that is positive. Ordinarily, this should be a flag for outlier, but estimates identified as outliers were duly removed from the funnel plot before plotting. Regardless, we checked the data sets and sample studies to make sure it is genuine. We found it genuine and concluded that the estimates are imprecise. Nevertheless, we conclude from the general skewness of the plot towards the negative or left half of the distribution, that there is a negative bias, when all studies under observation are taken into account.

Figure 4.1: Funnel Plot of All Effect Sizes



The same thinking applies to peer -review studies in figure 4.2., just as in figure 4.1. Precise estimates are sparsely distributed around the "0", at the top of the funnel plot. Also, there is an estimate with a deviation that is far from "0", just as some that can be easily found at the base of the funnel plot. Closer inspection indicate that this estimate in the peer reviewed studies funnel plot is the same as the one found at the very top of the funnel plot for all studies in figure 4.1. Meta-analysis such as Demena (2015) used the logarithm of precision for a better eye-ball-comparison or visualisation. For this study, the plot remained the same even we use the log of precision for a better eye-ball- comparison. This is seen in figure 4.2B[18]. In any case, we sense that the graph is asymmetrically positive. Also, Demena (2015) has pointed that when publication bias is corrected or accounted for, funnel plots can be used to detect the direction of a true effect Nevertheless, eye-ball examination is easily prone to misinterpretation. This necessitates the need to test for a genuine effect using an econometric approach . Results of these exercise is reported in section 4.3

[18] When estimated with the logarithm of precision, we found the distribution of effect sizes to be the same as in 4.2A.

Figure 4.2A: Funnel Plot of Peer-Reviewed Studies

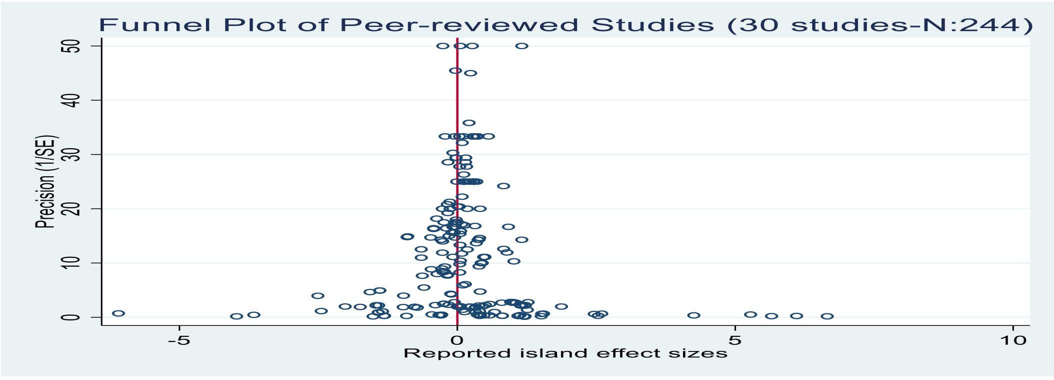
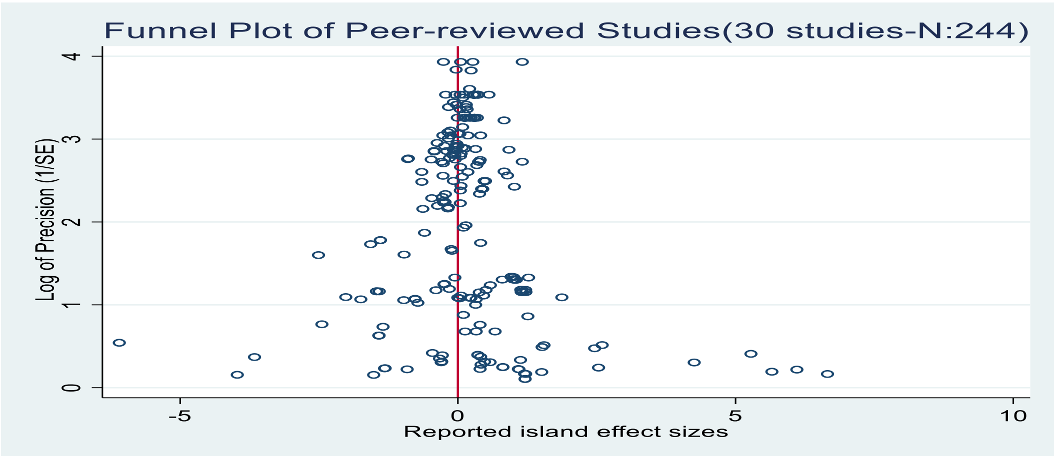


Figure 4.2B: Funnel Plot of Peer-Reviewed Studies Estimated with the Logarithm of Precision



4.3 Bivarite FAT/PET Analysis

Generally, we found evidence against the null hypothesis for both β_0 and β_1, which suggests that 1) the underlying effect of islands equals zero($\beta_0=0$), and 2) that there is no publication bias ($\beta_1=0$). Instead, we found 1) that the underlying effect of islands on trade is positive and statistically different from zero; and 2) That a moderate publication bias exists, and negative in direction. Specifically, and as illustrated in in Table 4.3 in which an MRM was ran for 52 studies (Panel A), we found, while using the preferred MEM model, that FAT and PET estimates are **-0.645** and **8.412**; and both significantly different from zero at 1%. Consequently, we conclude that that a negative publication bias exists in the literature and modest ; and that the genuine effect is positive. The direction of genuine effect as found in the PET test is in contrast to this study's hypothesis, which states that the genuine effect is negative. It also runs contrary to the combined effects presented in table 4.1A and further reinforces the view that "science is not democratic"(Doucouliagos and Stanley 2013).

When we narrow this analysis to Panel B, which featured 30 out of the 31 peer reviewed studies, we see also see modes evidence publication bias, but the direction of effect is positive. To be more precise, the FAT estimate is **0.112** and statistically significant at 5%. However, we found no significant evidence for genuine effect at peer-review level, given that

PET result on our preferred model is insignificant. The same applies to the sister models (CDA and fixed effect) in the panel.

Table 4.3 Bivarite FAT/PET Analysis for Both "All Included Studies" and Peer-Reviewed Studies

Panel A-52 Included Studies (N:1433)				Panel B -30 Peer -reviewed Studies(N:244)		
	Column(1)	Column(2)	Column(3)	Column (1)	Column(2)	Column(3)
Variable	CDA	Fixed Effect	Mixed Effects Method	CDA	Fixed Effect	Mixed Effects Method
Bias/FAT	-0.304 (0.279)	-0.710*** (0.192)	-0.645*** (0.0348)	0.169 (0.106)	0.0826 (0.154)	0.112** (0.0524)
Genuine effect/PET	-0.181 (0.692)	2.995* (1.504)	8.412*** (1.406)	-0.149 (1.045)	0.876 (1.817)	-0.0939 (1.040)
No of Observations	1,433	1,433	1,433	244	244	244
R-squared	0.063	0.218		0.059	0.007	
Number of ID		52			30	
Number of groups			52			30
*Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1*						

4.4 Robustness Check

Here we implement some robustness checks to see if the results obtained above are robust to 1) presence of outliers, 2) results of the comparison between peer-reviewed studies and non-peer reviewed studies, 3) exclusion of ID 17 in the general regression and 4) estimates from effect sizes extracted from 1D17 alone. Sequentially, results of these checks are presented in tables 4.41, 4.42, 4.43 and 4.44. Based on the results of these checks, we will decide whether the evidence presented from table 4.3 is enough to answer our research questions.

Starting with table 4.41, we found that outliers have a significant impact on the estimates in table 4.3. For instance, when we compare the estimates in panel A of 4.3 and panel A of 4.41, we find that outliers makes the results obtained in 4.41 to be insignificant. Despite this, we find in panel A of 4.41 : a little evidence of publication bias that is negative, as FAT estimate is **-0.00316;** while the PET estimate for the genuine effect is **1.504.** This is positive but insignificant. In panel B of the same table, we find a significant moderate estimate of publication bias, given that our estimate is **0.089** and significant at 1% level of significance; while for genuine effect, we found the PET estimate to be insignificant and 0.689. Lesson from table 4.41 indicate that estimates in 4.3 are not robust to the inclusion of outliers and that outliers have a significant effect on results. See results below:

Table 4.41 Bivarite FAT/PET Analysis for Both "All Included Studies" and Peer-reviewed Studies and with Outliers

Panel A-53 Studies(N:1487)				Panel B -31 Peer -reviewed Studies(N:259)		
	Column(1)	Column(2)	Column(3)	Column (1)	Column(2)	Column(3)
Variable	CDA	Fixed Effect	Mixed Effects Method	CDA	Fixed Effect	Mixed Effects Method
Bias/FAT	0.0776 (0.0905)	-0.0398 (0.177)	-0.00316 (0.0176)	0.160* (0.0838)	0.0504 (0.0658)	0.0891*** (0.0275)
Genuine effect/PET	-2.932*** (0.857)	-1.749 (1.781)	1.504 (0.966)	0.219 (1.165)	1.914* (1.017)	0.689 (1.070)
No of Observations	1,487	1,487	1,487	259	259	259
R-squared	0.017	0.003		0.139	0.012	
Number of ID		53			31	
Number of groups			53			31
*Robust standard errors in parentheses *** p<0.01, ** p<0.05, p<0.1*						

Next we compare peer-reviewed studies with non-peer reviewed studies in table 4.42. Peer reviewed studies noticeably has more studies than non-peer reviewed studies. However, Non-peer reviewed studies has more effect sizes than Peer reviewed studies (i.e. 1,228 effect sizes versus 259 effect sizes). Results of Peer-reviewed studies in Panel A of 4.42 are the same as the results found in Panel B of 4.41. That is, there is a significant but moderate presence of publication bias, given that the estimate is **0.089** and significant at 1% level of significance; while for genuine effect, the estimate was found to be insignificant and positive at 0.689. For Panel B in 4.42, we found a little evidence of negative publication bias at **-0.0286.** For genuine effect, the estimate is **0.902** and insignificant. On a comparative basis, we find that the bias in peer review studies is positive while that of non-peer review studies is negative. We also see that bias in the peer review is stronger than the one in non-peer reviewed studies. For genuine effect, we find estimates that are positive, but not significant. This is for both peer-reviewed and non-peer reviewed studies. In sum, we note that the comparative estimates of this table are not able to robustly or consistently support the results in table 4.3. This is Results shown below.

Table 4.42 Bivarite FAT/PET Analysis for Peer-reviewed Studies and Non-Peer reviewed Studies (comparison)

Panel A-31 Peer-Reviewed Studies				Panel B-24 Non-Peer Reviewed Studies		
	Column(1)	Column (2)	Column (3)	Column (1)	Column (2)	Column (3)
Variables	CDA	Fixed Effect	Mixed Effects Method	CDA	Fixed Effect	Mixed Effects Method
Bias/FAT	0.160* (0.0838)	0.0504 (0.0658)	0.0891*** (0.0275)	0.0485 (0.126)	-0.0552 (0.215)	-0.0286 (0.0206)
Genuine Effect/PET	0.219 (1.165)	1.914* (1.017)	0.689 (1.070)	-3.605*** (0.765)	-2.677 (1.921)	0.902 (1.504)
Observations	259	259	259	1,228	1,228	1,228
R-squared	0.139	0.012		0.006	0.005	

Number of ID		**31**			**24**	
Number of groups			**31**			**24**
Robust standard errors in parenthesis p<0.01, ** p<0.05, * p<0.1***						

For table 4.43[19], we note the preponderance of 1D17 (Raihan 2014) in the study, a study with about 55.5% of reported effect sizes (825 of 1487) in the data set. Consequently, we run a regression in which when we control for ID17, we are left with 662 effect sizes from 52 studied. Curiously, we want to know the extent 1D17 alters the result of the estimate garnered from other 52 studies. Flowing from this, we found little and significant evidence of publication bias. This evidence is replicable using a FE and a CDA. For genuine effect, we found negative but insignificant estimate. This imply that ID17 is undermining the significance of the FAT estimation, and that the genuine effect is inconsistent with previous estimations.

Table 4.43 Bivarite FAT/PET Analysis for All Studies without ID17

52 Studies (N:662)			
	Column(1)	**Column(2)**	**Column(3)**
Variable	**CDA**	**Fixed Effect**	**Mixed Effects Method**
Bias/FAT	**0.147***** (0.0223)	**0.111***** (0.0318)	**0.125***** (0.0134)
Genuine effect/PET	**-0.681** (0.453)	**-0.174** (0.451)	**-0.434** (0.726)
No of Observations	**662**	**662**	**662**
R-squared	**0.199**	**0.087**	
Number of ID		**52**	
Number of groups			**52**
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1			

Lastly, we run a regression in which we estimated singly for ID17 alone, using only the MEM. This is reported in table 4.44 and immediately below. We see a significant publication bias that is moderate and negative. This is at **-0.934**. And a genuine effect in positive direction that is significantly different from zero at 1%. The estimate is **1.330**. This result is markedly different in terms of the direction of effects or level of significance from results in tables 4.42 (in which we ran an estimation that compared peer-reviewed and non-peer reviewed studies) and 4.43 (in which we ran an estimation without ID 17). This suggests that ID 17 has a significant impact on the direction of effect sizes and in the main results shown in table 4.3.

[19] Table 4.43 does not control for outliers. The 662 effect sizes in the estimation comes from a deduction of 825 effect sizes extracted from ID 17 alone. Hence 1,487- 825 =662.

Table 4.44 Bivarite FAT/PET Analysis
for ID 17

ID17 (Raihan 2014) = N: 825	
Variables	Mixed Effects Methods
Bias/FAT	-0.934*** (0.0482)
Genuine effect/PET	1.330** (0.520)
No of Observations	825
R-squared	0.391
Number of ID	
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1	

Chapter 5: Conclusions

Going backward, this study is set up to answer two questions. They are to investigate to see if the underlying effect of islands on trade is negative and to investigate for the presence of publication selection bias. We have followed the newly updated guidelines for the conducting and reporting of MRA to implement a meta-analysis that answered these questions. From our findings in our main regression, we saw that the genuine or underlying effect of islands on trade is positive (**8.412**)**;** and that a moderate publication bias exists in the literature and negative in direction(**-0.645**). However, robustness check on this result using outliers and controlling for ID 17 shows these results to be inconsistent. On a narrower level, we note that not all studies are peer reviewed, so we implemented the same analysis for island effect on trade for studies that are peer-reviewed. The study found no significant evidence for a genuine effect for studies in this category. For publication bias we saw a little but significant evidence of positive bias. But like the analysis conducted at the general level or for all included studies, the results of peer reviewed studies are not robust. Consequently and cumulatively, this study suggests that the underlying effect of islands on trade is positive. But given that this result is not robust, we cannot on the basis of this study conclude that the underlying effect is positive; and that a publication bias that is negatively moderate exists.

This evidence, though not robustly corroborated suggests that islands may not be geographically disadvantaged in trade as nearly viewed by about 70% of literatures consulted for this study and as depicted in the theoretical review part of this study. To quote Doucouliagos and Stanley (2013) again, "…science is not democratic", otherwise the prevalence of negative effect sizes in the study would have resulted in an underlying or genuine effect that is negative. In any case, we hope these findings provide a better guide for future inquiry on the subject.

5.1 Limitations

The major limitation of this study is experience and brevity of research period. This is because the methodology of Meta Regression Analysis is still new to the researchers (first and second coder), when compared with other econometric study approaches familiar to the researchers. This means that the researchers had to learn and implement at the same time, the guidelines for the conducting and reporting of meta regression analysis. Hence, this is the first study in which the researchers are implementing using this methodology on. Besides, the brevity of research period imposes a constraint on the length and scope of this study. Another limitation of this study is incomplete information. As discovered by the researchers, there are study samples without full information for all the required coding parameters. Efforts were made to reach the author(s) of the studies, but in most the cases, there was no response.. However, the study will report on this information when available.

5.2 Lessons

Conducting a meta-analysis is a labour intensive enterprise, especially as it concerns its data gathering and screening process. But in hindsight, we found this process interesting and stimulating. We found it interesting because of the curiosity that comes with the innate nature and structure of this research. This curiosity is centred around trying to sieve out the true effect of islands on trade from a pile stack of empirical studies. Having achieved this end, we make two observations that might serve as lessons for further inquiry on the subject. One is to evaluate study samples with number of effect sizes that are considerably large as a fraction or percentage of total number of effect sizes available for MRA. In the analysis ran in this study, ID17 was considerably large as a percentage of total effect sizes, and we saw that it impacted the direction of our true effect. Secondly, we observe that the outliers might influence the level of significance of FAT/PET estimates. Hence, we advise researchers to be mindful of this, while carrying out further investigation on the subject.

5.3 Data Links and Codes of Core Analysis

This study will share the data used in this meta-analysis. This is essentially for credibility and transparency purpose; and also to follow the new guidelines for conducting meta-analysis to the later, and as much as it applies to this study (see Havránek et al. 2020: 472).

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Appendix 1: List of Excluded Studies

No	Study (1st Author and year)	Justification for exclusion
1	Mahfuz Kabir(2019)	Estimated using gravity model but no Island variable
2	Vipula Wickramarachchi(2019)	Estimated using gravity model but no Island variable
3	Reuben Ellul (2019)	Estimated using gravity model but no Island variable
4	Martina Lawless (2019)	Estimated using gravity model but no Island variable
5	Gill Montant (2019)	Estimated using gravity model but no Island variable
6	J.M Balogh (2019)	Estimated using gravity model but no Island variable
7	David Driver (2019)	Estimated using gravity model but no Island variable
8	Festus Adedoyin (2019)	Estimated using gravity model but no Island variable
9	Javed Iqbal (2019)	Estimated using gravity model but no Island variable
10	Huigang Chen (2018)	Not included bacause it analyses the model not the trade between countries
11	Sarath Chandran (2018)	It focused on india trading with ASEAN country partners but didn't include island variable

12	Kumuthini, Sivathas (2018)	Estimated using gravity model but no Island variable
13	Tamara Gurevich (2018)	Estimated using gravity model but no Island variable
14	Mustafizur Rahman (2018)	Not included bacause it analysed the model, not trade and does not include island variable.
15	Harriet Harden-Davies (2018)	Excluded as focused wasn't on trade
16	Surendra K. Uprety (2018)	Excluded as focused wasn't on trade
17	D. Gould (2018)	Excluded as focused wasn't on trade
18	Shunli Yao (2018)	Estimated using gravity model but no Island variable
19	K. Takahashi (2018)	Not in English and doesn't include island variable
20	Alan Wilson (2018)	Focused was not on trade
21	Sayef Bakri (2018)	Focused was not on trade
22	Inmaculada Martínez-Zarzoso (2018)	Estimated using gravity model but no Island variable
23	Shekoofe Nagheli (2018)	Estimated using gravity model but no Island variable
24	Oleg Firsin (2018)	Estimated using gravity model but no Island variable
25	Keshmeer Kanewar Makun (2018)	Estimated using gravity model but no Island variable
26	Toshihiro Atsumi (2018)	Estimated using gravity model but no Island variable
27	A Gounder (2018)	Estimated using gravity model but no Island variable
28	J. Yue (2018)	Estimated using gravity model but no Island variable
29	Luqman Afolabi (2017)	Estimated using gravity model but no Island variable
30	Nina Ranilovic (2017)	Estimated using gravity model but no Island variable
31	Heid Benedikt (2017)	Estimated using gravity model but no Island variable
32	Kenichi Kashiwagi (2017)	Estimated using gravity model but no Island variable
33	Murhammed Sadiq Irshad (2017)	Estimated using gravity model but no Island variable
34	Godfred Turkson (2017)	Estimated using gravity model but no Island variable
35	Andreas Lendle (2016)	Estimated using gravity model but no Island variable
36	Andrew K.Rose (2016)	Estimated using gravity model but no Island variable
37	B. Ghadirifaraz (2016)	Estimated using gravity model but no Island variable
38	S.J Bahadur (2016)	Estimated using gravity model but no Island variable
39	Vania Manuela Licio (2016)	Estimated using gravity model but no Island variable
40	Lee Sin Yee (2016)	Estimated using gravity model but no Island variable
41	Mohammad A Razzaque (2016)	Estimated using gravity model but no Island variable
42	D. Maiti, (2016)	Estimated using gravity model but no Island variable
43	Luis Augusto Baez Hernandez (2016)	Estimated using gravity model but no Island variable
44	David H. Bearce (2015)	Estimated using gravity model but no Island variable
45	D. Maiti, (2015)	Estimated using gravity model but no Island variable
46	H. Chen (2015)	Excluded as it represent the pacific island countries trade as a dependent variable
47	Luca De Benictis (2015)	Estimated using gravity model but no Island variable
48	Mohand Yasir Tariq (2015)	Estimated using gravity model but no Island variable
49	Luis Alama- Sabater (2015)	Estimated using gravity model but no Island variable
50	Tristan Kohl (2015)	Estimated using gravity model but no Island variable
51	Rahul Sen (2015)	Estimated using gravity model but no Island variable
52	Emmanuel Mudakenga (2015)	Estimated using gravity model but no Island variable
53	Thorvaldur Gylfason (2015)	Estimated using gravity model but no Island variable
54	Bernard Poirine (2014)	Study is a theoritical treatise on island trade but no gravity model
55	Andreas D¨ur (2014)	Estimated using gravity model but no Island variable
56	Rukmani Gounder (2014)	Estimated using gravity model but no Island variable

57	Martina Paulin (2014)	Estimated using gravity model but no Island variable
58	Wei Luo (2014)	Estimated with gravity model but uses geo-social app tool in analysing trade network and no island variable
59	Joseph S. Shapiro (2014)	Estimated using gravity model but no Island variable
60	Fabien Bertho (2014)	Estimated using gravity model but no Island variable
61	Jayant Menon (2014)	Estimated using gravity model but no Island variable
62	Pavel Yakovlev (2014)	Estimated using gravity model but no Island variable
63	Grace Awuoth Otieno (2014)	Estimated using gravity model but no Island variable
64	Uwaoma G. Nwaogu (2014)	Estimated using gravity model but no Island variable
65	Shintaro Hamanaka (2014)	Estimated using gravity model but no Island variable
66	Türkcan, Kemal (2014)	Estimated using gravity model but no Island variable
67	Péter Márton (2014)	Estimated using gravity model but no Island variable
68	Steven Nystrom (2014)	Estimated using gravity model but no Island variable
69	Capannelli, Giovanni (2014)	Excluded as used qualitative methods and does not account for island variable
70	Nazife Pehlivan (2014)	Estimated using gravity model but no Island variable
71	Mmatlou Kalaba (2014)	Estimated using gravity model but no Island variable
72	M. K Chand (2014)	Does not account for gravity model
73	Craig R. Parsons (2014)	it does not have apply gravity model while analysing trade in japan
74	Antti Weckstrom (2013)	Estimated using gravity model but no Island variable
75	Bruno Larue(2013)	Estimated using gravity model but no Island variable
76	Hoang Chi Cuong (2013)	Estimated using gravity model but no Island variable
77	Jonathan Reuben(2013)	Estimated using gravity model but no Island variable
78	Yusuf Ismaila Akanni (2013)	Estimated using gravity model but no Island variable
79	Christoph Vietze(2012)	Estimated using gravity model but no Island variable
80	Shang-Ho Yang (2012)	Estimated using gravity model but no Island variable
81	Davidová, Lucie (2012)	Estimated using gravity model but no Island variable
82	Massimo Geloso Grosso (2012)	Estimated using gravity model but no Island variable
83	Johann Harnoss (2012)	Estimated using gravity model but no Island variable
84	Raymond Hicks (2012)	Estimated using gravity model but no Island variable
85	Abiodun S. Bankole (2012)	Estimated using gravity model but no Island variable
86	Florian M€olders (2012)	Estimated using gravity model but no Island variable
87	Dibyendu Maiti. (2012)	Estimated using gravity model but no Island variable
88	Joseph S. Shapiro. (2012)	Estimated using gravity model but no Island variable
89	Gokmen, Gunes (2012)	Estimated using gravity model but no Island variable
90	Shawn Arita (2012)	Estimated using gravity model but no Island variable
91	T.K. Jayaraman (2012)	Estimated using gravity model but no Island variable
92	Seetaram, Neelu (2012).	Estimated using gravity model but no Island variable
93	Uwaoma George Nwaogu (2012)	Estimated using gravity model but no Island variable
94	Hamanaka, Shintaro (2012)	Estimated using gravity model but no Island variable
95	Onai Muvingi (2012)	Estimated using gravity model but no Island variable
96	Catherine Beswick (2012)	Estimated using gravity model but no Island variable
97	Natalie Chen (2011)	Estimated using gravity model but no Island variable
98	Chengang Wang (2010)	Estimated using gravity model but no Island variable