The impact of being an island on trade: A meta-analysis evidence from gravity models

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Contents

List of Tables Figures and Appendices

Tables

Figures

Appendices

List of Acronyms

ISS	Institute of Social Studies
UNDP	United Nations Development Programme
OLS	Ordinary Least Square
PPML	Poisson pseudo-maximum likelihood estimation
SIDS	Small Island Developing States
CDA	Clustered Data Analysis
FE	Fixed Effect
GMM	Generalised Methods of Moments
SUR	Seemingly Unrelated Regressions

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To my fellow student, let us keep going while connected and change our respective nations.

Abstract

Geographical characteristics of countries plays a major role determining the level at which a country participate in international trade. Geographical location of a country is a factor that influences trade openness. Island is one of the geographical characteristics that we are interested in. Island variables have been used as a control variable in the gravity model. Despite divergent findings of island variable to trade, there has been no meta-analysis to resolve the diverging results. Following the Protocol outlined in Meta-Analysis in Economics Research-network (MAER-Net), we meta-analyse 48 primary studies with 628 diverse island coefficients collected from studies published between 2000 and 2009 inclusive.

We investigated if being an island country will generate a positive or negative effect on international trade. Despite the island variable has been mostly used as a control variable, it still suffers from publication bias. Regardless of publication status, (i.e., whether peer-reviewed or not), the literature suffers from severe negative publication bias. The genuine effect size of being an island to trade for all studies was positive, with a magnitude of 0.217 and 0.223 for the peer-reviewed studies. Our findings show that island countries trade more due to their connectedness and cheap transport availability via sea.

NB: *This RP is part of a RP research project. Students have collaborated in the phase of collecting and coding data providing a common data set. The analysis in this RP has been done for different periods for the purpose of supervision and to enable individual grading.*

Relevance to Development Studies

The impact of being an island country to international trade has not been clearly delineated. The misleading information on being an island to trade from diverse reported empirical studies needs to be addressed and give a true position of island countries to trade. Information is a crucial issue in achieving sustainable development and for strategic planning for countries. Researchers plays a crucial role in generating scientific information by analysing the past and focusing on the future.

Research that gets published and considered informative needs to be accurate as policies are formed based on these research findings. Despite the treasure of published research articles, publication bias has brought mistrust and watered published articles' power. Policymakers who depend on these articles have made misleading policies that might have led to island countries fail to achieve sustainable development. Development for island countries and all countries, in general, depends on well-developed institutions and well-grafted economic policies that unlocks their maximum production capacity.

Island countries have small land area mass, isolated, and limited internal market. Global warming is felt across the globe, and natural agricultural production cannot sustain global demand and need for international trade engagement. International trade unlocks the countries' potentials by allowing them to produce at their optimum capacity and gain global market access through international trade. Small island developing states have been in the United Nations reports' headlines for the continued poverty growth. Several studies have shown a mixed reaction of being an island to trade. To understand the impact of being an island to international trade, we had to meta-analyse all the primary studies. The island countries' genuine island impact on trading will enhance island governments and respective trade policymakers to reformulate developmental policies that will boost the island states' economy.

Keywords

Island countries, publication bias, meta-analysis, genuine effect, international trade

CHAPTER 1: INTRODUCTION

1.1. *Background Information*

The blueprint for achieving sustainable development depends entirely on the well-thought structures and policy designs based on proven theories. These structures and policies come about through research by scholars who have done an in-depth analysis of the project and seen that the best and viable way to achieve development is to have these policies that guide implementation of their guidelines. Trading globally has enabled countries to produce more and increase their income. Some States have a geographical advantage to trade more than others, and these gives them the upper hand to explore their capabilities and benefit more on trade. Countries with large land areas, accessibility to the coastline, and bordering the broad market are forms of geographical factors beneficial to trading. Those with negative geographical features like landlocked and small land areas make countries trade less. For these nations to gain more on trade, they need to have policies like capital-intensive production models to produce more products that will be competitive in the global market. Research has to produce reliable evidence to understand its position in trade. This may call for whether the geographical feature of being an island have a positive impact on bilateral trade?

The gravity model applied to explain trade effects on variables was first done by Tinbergen (1962). Since then, the gravity model has been used to model the impact of various exogenous variables on bilateral trade (van Bergeijk and Brakman, 2010). These exogenous variables include GDP of importer and exporter countries, distance, common language, common currency, membership in world trade organization (WTO), regional trade agreements (RTA), landlocked, island, religion, and culture, among other factors. If there is consensus on the impact of being island on trade, it can be expected that estimation of island should be the similar. Or if it varies, then the magnitude will slightly change but not the sign (either negative or positive effect), but this has not been the case. We have collected the effect size across the studies published since 2000 - 2009 and have shown divergent results (Figure 1). This calls for investigating the underlying effect size of island on trade.

In investigating the underlying effect of island, it is important to consider whether publication bias is a threat to the empirical evidence. Publication bias in the economic literature poses a threat to sustainable development agendas and arises from selecting studies that 'satisfy preconceived theoretical expectations' or based on their statistical significance (Demena and van Bergeijk, 2017). Does publication bias scan all variables applied in the model to ascertain these

preconceived theoretical expectations and statistical significance? Or do they check only on the variable of interest the researcher is focusing on than other control variables?

Over time, economic model robustness is being improved with variables and accounting for other factors like multilateral resistance (MRT), zero trade flows, and endogeneity. This improvement tends to converge the results and hence genuine effect size in any economic model. The absence of publication bias and improved knowledge in the economic field and the island's effect to trade is expected to converge to a real effect of being an island on trade. Island's geographical position on trade with improved knowledge invested in upgrading gravity model efficiency has proved futile in convergence presumption to the genuine effect.

Since there has been no effort to harmonize the divergence in the impact of island variable to trade, calls for an approach that will consolidate these differences and come up with underlying genuine effect size of the island. We need to find out if there is any evidence of publication bias and, if there is, where does island countries stand in terms of their geographical capability to trade.

Island is characterized by small landmass area, extensive coastline, insularity, geographic remoteness, the smallness of economy, and connectedness to provide temporary anchorage to large shipping while on transit before reaching their destination. There has been no convergent opinion that island countries are geographically advantaged to trade or (island) are disadvantaged to trade with these characteristics.

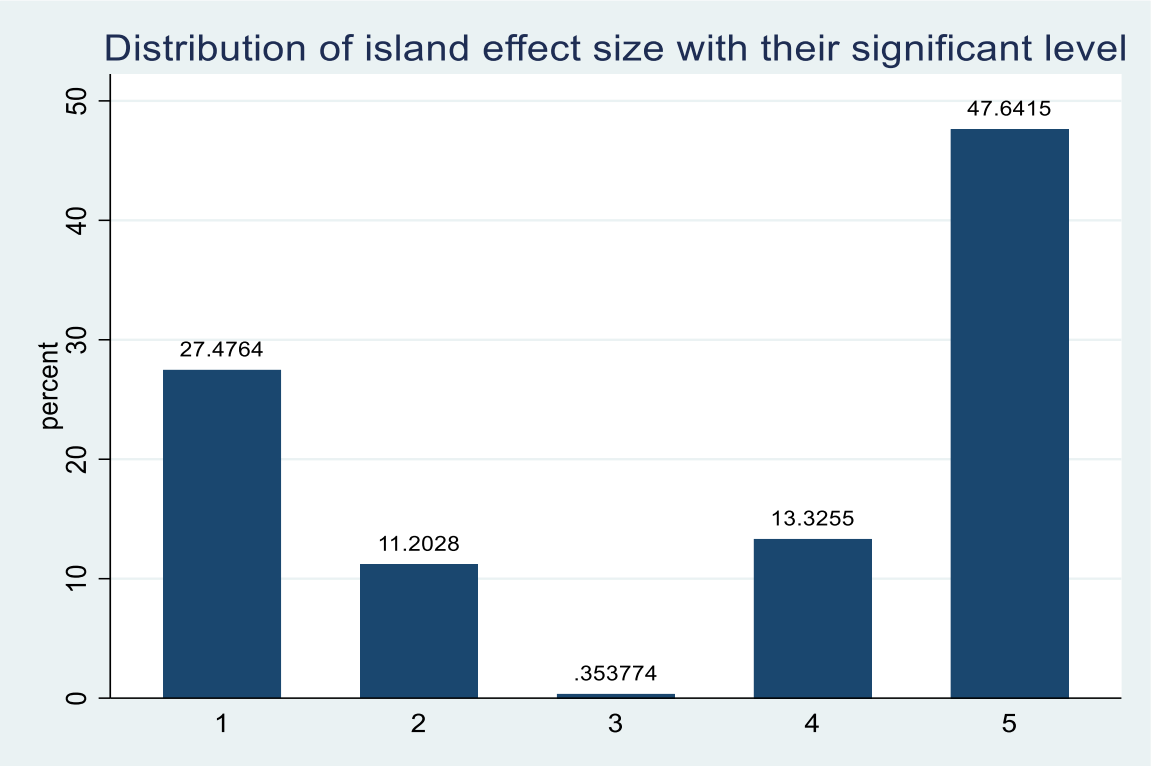
According to the United Nations (2014), small island developing states (SIDS) have extensive accessibility to sea transport, export-oriented, and a profound openness to international trade characterized by massive importation. The transport cost factor had been a significant determinant of the competitiveness of the country's products. When the production cost is assumed to equal, island countries with accessibility to sea transport enjoy these cheap means of transport compared to landlocked countries, but this is not the case for all islands.

1.2. *Justification and significance of the Study*

The importance of international trade in achieving sustainable development agenda to island countries plays a crucial role. With limited market within their geographical area, islands seek to trade with other countries, export their surpluses, and import essential products not available in their country. With mixed reactions of island effects to trade, island policymakers are in a dilemma to know the potentiality of the island in the trade as some collected articles between 2000 to 2009 shows 48% are in support that islands are positively and significantly trade more while 27% states that island countries are statistically significantly disadvantaged and trade less. 25% of the studies collected found that island countries' effect size on a trade is not statistically different from zero.

Figure 1 presents this disagreement in the empirical evidence. Decision-making and policy formation targeting island countries by government officials, marketers, and other traders' interest in international trade from island countries have not benefited from these published articles. They have been giving contradictory results on the island's effect on bilateral trade. This divergent and contradictory information calls for a need to harmonize the divergence of islands' effects on international trade.

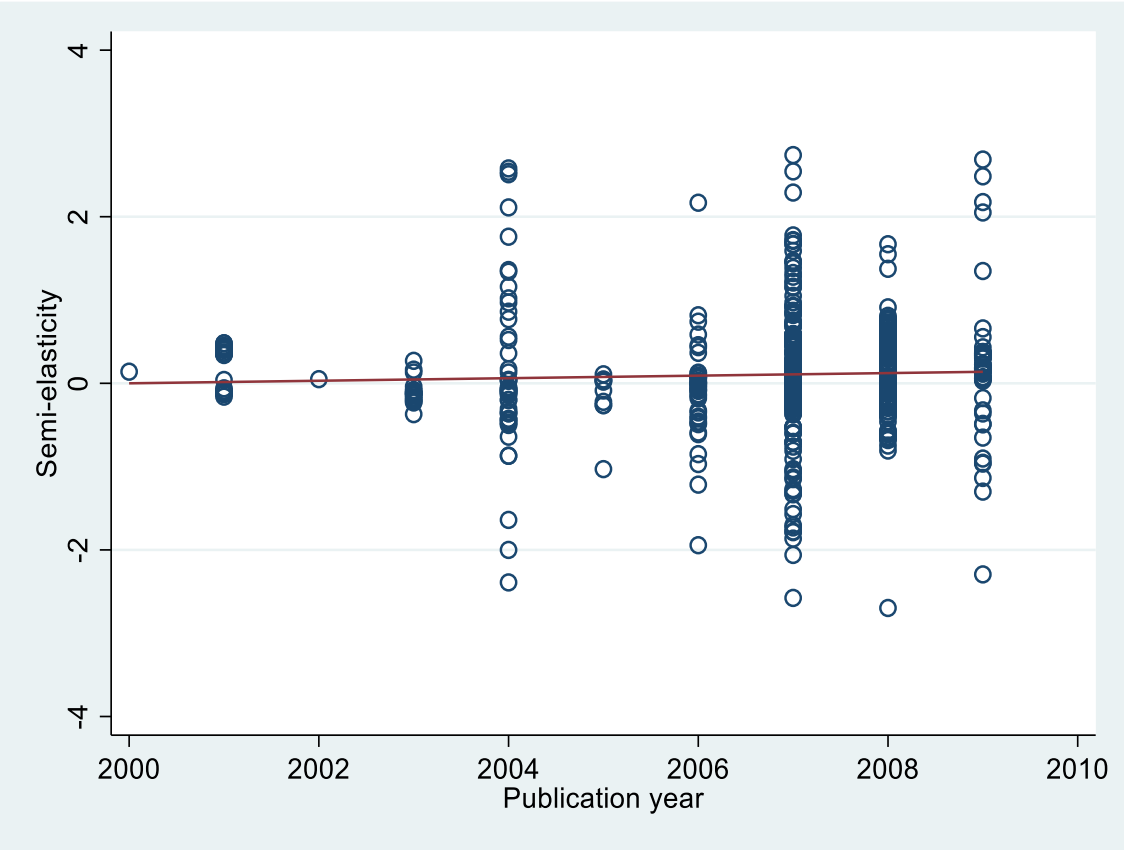
Figure 1: island coefficients in the included literatures



Note: 5 Represent Positive and Significant; 4. Positive and insignificant; 3. Zero Value; 2. Negative and Insignificant; 1. Negative and Significant

Although there is a broad tendency of positive effect sizes, we are unsure if this is an island's true position to international trade. Over the advancement of knowledge and economic models, as expected, there will be a convergence of island effect size to trade to genuine effect size overtime. With that in mind, this has not been the case, as Figure 2 below has shown variation increasing with time. What might then be the cause of the increasing variation? Publication bias might be an issue that more statistically significant and island effect sizes were published than the actual effect size. Averaging is not the best practice, bearing in mind that policies need accuracy.

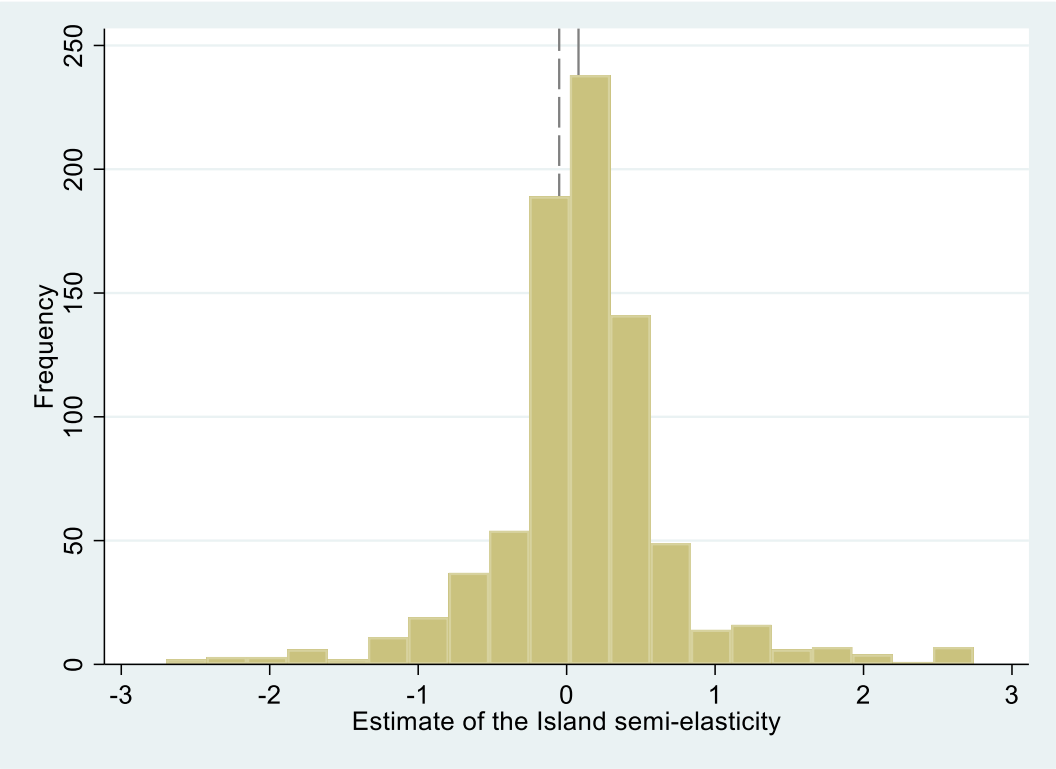
Figure 2: Variance of semi-elasticity increase over time but not mean.



From Figure 2, we could see the distribution of the mean effect size of being an island to trade has not been significantly increasing over-time, but the variation has been increasing. Divergence of these semi-elastics of the island to trade increased with studies published in the year 2004 onwards. What changed to spike divergence between studies? Or was the effect size underestimated before, and if so, what is the actual effect size of island variable to trade?

Figure 3 shows island effect size varies around zero, with the mean of the 56 studies at -0.05 and a median value of 0.08. Comparing this negative mean and the major distribution at the positive and significant effect size of the island to trade as seen from Figure 1 makes us ask the question; does the island have a positive or negative effect on international trade, and if this is distorted with publication bias of these published results?

Figure 3: Reported semi-elasticity are often around 0 but varies widely.



Note: the histogram of the reported semi-elasticities of island. The short-dashed line represents the median of reported estimates (0.08), where is the solid line is the mean (-0.05).

Based on the inconclusive evidence of island effect on trade and the presence of divergence as demonstrated in the Figures above, this requires for the use of meta-analysis to resolve the variation of island effects on international trade so as to estimate the underlying genuine effect size. Meta-analysis is a statistical tool that analyzes similar research topic or objectives from secondary published studies to estimate the underlying genuine island effect size to trade taking into account publication bias … to estimate the genuine island effect that enables us account for publication bias and outliers (Demena and van Bergeijk, 2017).

1.3. *Research Questions*

1.1.1. 1.3.1: Main question

Does being an island generate a positive effect or a negative effect on international trade?

1.1.2. 1.3.2: Sub-questions

i. Is there any selection bias in publishing the empirical evidence?

ii. Is there any evidence that peer-reviewed studies give a more precise estimate?

1.4. *Why meta-Analysis*

The meta-analysis choice is because of its quantitative method that synthesizes knowledge gain on international trade amongst countries' characteristics and innovation in the development sector (van Bergeijk and Lazzaroni, 2015). Meta-analysis has applied in international economics by scholars in harmonizing the divergent views on a given topic: for instance, Demena and Afesorgbor (2020) on the effect of FDI on environmental emissions; Moons and van Bergeijk (2017) investigates whether economic diplomacy works in improving trade and investment; and Havranek and Irsova (2017) applied meta-analysis to test the impact of borders on international trade.

Different estimation approaches have been applied in the gravity model, with some being robust or others, led to underestimating or overestimating the island coefficient. Indicators that were of significant interest and needed meta-analyzing to harmonize the difference were coded. These included the year of publication, number of citations, outlet, peer-reviewed, control for multilateral resistance, zero trade control, endogeneity, panel data or cross-sectional dataset, number of countries under investigation, and how distance is measured in the gravity model. Comparing these studies harmonizes different knowledge and provides a conclusive genuine effect size of being an island to trade.

In this meta-analysis, we first have to uncover if there is publication bias. We will provide the genuine effect of being an island country to trade upon controlling for the publication bias. Since this research paper we will not cover heterogeneity, we have presented the possible sources of heterogeneity in terms of descriptive statistics.

1.5. *Limitations of the Study*

The focus of this study is limited to the period between 2000 – 2009 inclusive, as the screening produces more than 150 potential empirical studies. Meta-analysis requires a substantial amount of labor effort to construct the required data, and with the limited time for this, I was forced to limit my period of focus. As this was a new technique, I had to devote some of the time to learn independently and with my supervisors' help as the technique was not part of the ISS-curriculum. The absence of t-values in some studies reduced our sample size to 629. Upon emailing the authors without reply, we had to confine ourselves to using the limited studies with t-values dropping 219 observations. Given the short time period (the intensive labour required for the data collection), we were also unable to conduct econometric analysis on sources of heterogeneity in driving the results.

1.6. *Structure of the Paper*

The remaining part of the research paper is structured as follows: Chapter 2 provides a literature review of the impact of being an island to trade and a motivation tracking the advancement of the gravity model. Chapter 3 entails data and empirical approach that will be adopted; chapter 4 provides the findings and discussing of meta-analysis results for the island coefficient and lastly, Chapter 5 provides the conclusion of the articles.

CHAPTER 2: Review of the Literature

2.1. Introduction

Over the past two decades, many studies have treated the island in the gravity model as a control variable. In this chapter, we will first define islands as applied in the gravity model to understand which countries are considered islands and which are not. We will then link the island's characteristics to trade, followed by the gravity model modification over time. Lastly, we organize the literature based on sign and statistical significance and how the study incorporated the gravity model.

2.2. The island as a geographical function

Island, according to Britannica Encyclopedia, is a mass of land that has the following characteristics of being surrounded by water and smaller than a continent. Island countries are therefore surrounded by water and can be made up of more than one island. Based on the definition above, continents like Australia fail to be island country categories rather than a continent.

Geography plays a vital role in determining economic development and what policies are needed to compensate for their geographical disadvantage. According to Spolaore and Wacziarg (2013), who studied the 2015 dataset for a set of geographical variables of absolute latitude, percentage of land area within the tropics, landlocked and island all jointly accounted for 44% of the variation in the natural log of per capita income of a country for the whole world but when they excluded neo-European countries which includes New Zealand, USA, Australia, and Canada this value went up to 54.6%. For a variation of GDPPC to occur, there must be a change in consumption pattern, investment, government spending, and net export (export value minus imports) divided by population at that time.

Geography greatly influences production due to climatic conditions, distance to the global markets, natural resources, transportation costs, and technological advancement, among other factors that define a country's trade level (Benedictis and Pinna, 2015). This geographical vector variable includes the island states, and the measured effects to trade have been contradicting as some economic authors conclude that they have positive effects on trade. In contrast, others get a negative coefficient to trade.

The geographical condition of a country can be either beneficial or not in the worst case. Lack of direct access to the sea is one of the worst geographical conditions that has hindered trade based on both empirical and theoretical evidence, and it is through this that coastal countries are wealthier and trade more by 30% as compared to land-locked countries (Chen et al., 2014; Poirine, 2014; Benedictis and Pinna, 2015). Being surrounded by sea, an island should be more beneficial

to trade as they have cheap means of transport. Still, most economists have refuted this claim citing trade cost through distance from some island to major markets in the mainland and insularity cost effect. To debunk the issue of distance from the mainland, (Benedictis and Pinna, 2015) constructed taxonomical units that grouped countries into land-locked countries, coastal countries which it has access to the sea and the percentage of the insular territory is below 2%, a negligible number of islands countries also known as partial insularity island countries which have at least 2% of its territorial surrounded by sea and permanent island or just island countries which are fully insularity. Exports tend to increase as one moves from landlocked countries towards coastal regions than on partial insularity countries. It suddenly dropped as we go further toward the fully remotest island countries like south Pacific Island (Poirine, 2014). The significant issues that come up from this categorization of the island taxonomy are: first, the size of the island had a colossal influence on the capacity of the island to trade and produce; secondly, the distance from the mainland which influences transport costs as the primary market as they are attributed to border sharing advantage to trade; and lastly, the connectivity of these islands to the shipping routes of sea transports.

Islands have been defined to have small domestic markets due to their small size and insularity level. Investors, due to trade liberalization, prefers to invest in export-oriented projects and with a pull of cheap labor force which small island country with less population cannot provide and they tend to invest in large countries blocking small islands from benefiting from trade diversion to these large markets' countries (McLaren, 1997). Because of their small size, they should have benefited more from trade as they expand their global market and increase their economy (Poirine, 2014). Trade integration with the rest of the world is an essential element in developing the economic growth of a country and in the case of pacific Island countries with the small domestic market which hinders them from exploiting their full potential and hence disadvantaged in economies of scale production (Chen et al., 2014). The critical policy issues to be adopted by these small is-land countries to boost their trade is through joining regional trade agreement like being a member of the regional trade agreement (RTA) (Vila-Goulding, 2014; George and Yamaguchi, 2018; Studnicka, Thierie, and Van Hove, 2019), having a common currency union as in the case of Euro in Europe which has seen that they have been able to trade with each other as compared to countries which do not have common currency(Rose, 2000) and to have better institutions and economic diplomacy and consulate which are tasked to broaden their market to global levels as shown by (Yakop and Van Bergeijk, 2011). In terms of microeconomic operations, Island countries have small land area mass, and global warming, this

calls for specialization and effective trade strategy to counteract the negative or zero growth in trade due to smallness and remoteness.

Distance plays a crucial role in the gravity model and defines how remote and isolated an island is from the mainland or the rest of the world. According to (Benedictis and Pinna, 2015), bilateral trade between geographically distant countries has adverse effects. The remoteness is a weighted average distance between the countries pair to measure its absorptive power of the partner country has a positive effect of trading. With this island paradox of distance, the absence of connectivity extrapolates transport costs, and this eats away the positive effect of remoteness in the distance. Still, if the island is located along the ship navigation routes, the remoteness factor in the distance can dominate, and hence the island will be able to participate more in trade.

Islands far away from the mainland's trade less when the remoteness factor is minimal and transport costs too high such that the cost of transporting products from such islands will make their products less competitive in the market due to high prices as transport cost are incorporated into the price of the final products. While making a comparison between Pacific Island countries (PIC), Caribbean island countries (CIC), and all the small island developing countries (SIDS), distance and remoteness have different magnitudes. Doubling distance will reduce the bilateral trade in PIC by two-third and remoteness increases by 4 to 6 percent and comparing to CIC, which has its significant markets nearer by 30%, especially in the United States, a distance of 2850km, if the distance doubles, the bilateral trade will reduce by a third. In contrast, remoteness will increase trade by 82% (Borgatti, 2008).

For developing countries, export flows from 1980 to 1999 for a short distance were increasing while the exports taken to a long-distance destination were decreasing over time. Whereas in developed countries exported less to short distance countries and more exports for long-distance countries were being recorded over that period (Márquez-Ramos, Martínez-Zarzoso, and Suárez-Burguet, 2007). Technology has made it easier to sell and find the required information on products, making the products in developed countries competitive in the global market. eBay has reduced the negative elasticity effect of distance by 45% (Lendle et al., 2016). Developed countries that have adopted eBay have made their world look flatter as the distance increases. The transport cost slightly increases, and goods can now be moved from the previous 4500km distance to 6000km after adopting the eBay system (Lendle et al., 2016). The adoption of eBay supports the findings that were previously stated that developed countries are increasing export flows to long-distance because of economies of scale and with the help of technology. Island far away from the mainland should incorporate this to reach global markets far away and trade more as they

should. With the increased distance of island countries from major markets, this calls for a well-developed sea transport system.

Their accessibility of sea transport provides them with cheap transport mode compared to the landlocked countries, which need to traverse other countries to arrive at the nearest shipping ports. According to a World Bank report for 1998, eight were island countries out of the top 15 rankings for nonprimary export performing countries (Limão and Venables, 2001). it means that the island exports more as compared to either being landlocked or any other economy. The connectivity with the shipping network sometimes does not favor these islands with isolated island countries, but others found along the navigation routes enjoy connectivity benefits. While tracking the Seaford ship navigation history for 14 years, islands were the most likely territories that the ship had some rest in before resuming with their journey. This connectivity exposes the said isolated island to other major trading countries (Benedictis and Pinna, 2015). But what then gives a divergent view on the island trade effect? What is the actual effect size of trade on the island?

2.3. Gravity Model modification over time

General gravity model states that trade between two countries is directly proportional to GDP (i.e. 'mass") and inversely proportional to trade costs (i.e., distance and other geographical factors) (Lopez and Excaray, 2015). The model has extended this specification to include (among other things) embassies and consulate or economic diplomacies (Rose, 2007; Yakop and Van Bergeijk, 2011; Assane and Chiang, 2014; Moons and van Bergeijk, 2017), …preferential trade (Kandogan, 2008; Foster et al., 2011; Hayakawa and Yamashita, 2011), contiguity (Bergstrand, 1985; Thoumi, 1989), common language and ex-colonial ties (e.g., Rose and van Wincoop, 2001), or even to cater for the effect of distance along different hemispheres as well as remoteness (Melitz, 2007), and being landlocked (MacPhee *et al*., 2013)" (Lopez and Excaray, 2015). The basic form of gravity equation normally used encompasses these arrays of variables stated above, and the island is one of them. After incorporation of price variation and treatment of disaggregated products, it took the form:

$$lnTrade_{ij} = \beta_0 + \beta_1 lnY_i + \beta_2 lnY_j + \beta_3 lnDistance_{ij} + \beta_4 Island_{dummy} + \beta_5 Landloecked_{dummy} + \beta_6 X + \varepsilon_i \quad \ldots\ldots \quad 2$$

where $Trade_{ij}$ represents either export, import, or the sum of both between country *i* being an exporter and country *j* being an importer. These are the major dependent variables category that we have extracted from the included studies. *Y* represents the GDP for trading partner countries (*I* for exporter and *J* for importer), and $Distance_{ij}$ represents the distance between the two countries measured in Kilometers. Based on several authors, distance has had diverse measurements. Many have measured the distance between two countries using crow flies, Ram and Prasad (2007), or

great circle distance Moktan (2008), and others used distance measured using between major cities in a country. Different distance measurements might have a heterogeneity effect on the effect size of being an island on trade. Dummy variables Island which is our variable of interest, represents the island and LL represent landlocked countries, and X is a vector of other control variables used in the model. These include common border, common language, common currency, colony, and land area mass. In this regard, this study is interested in the coefficient of β_4, for island dummy in the gravity model.

Since the dependent variable often takes the natural logs, then country' pairs that had zero trade or their trade value was low yields undefined values as the natural log of zero is undefined. According to Helpmann et al. (2008,p.443), 50% in their sample of 158 countries had zero trade with each other (Bergeijk and Brakman, 2010). The major cause of zero trade can be either missing values, low trade between pair countries, and when rounded-off, it becomes zero or truly zero. For random zero trade values, the standard procedure to treat this as proposed by Linnemann (1966) is to drop them, or by adding a small value always 1 to trade as applied by Santos Silva and Tenreyo (2006) to be able to run log-linear model (Bergeijk and Brakman, 2010). Suppose the zero-trade values distribution is not random; adding small value or two-stage method is applied. In that case, two-stage distribution is undertaken with the first step to check for the probability of the two countries to trade before regression estimation. Others have used non-linear models like Tobit with censoring or pseudo Poisson model (PPML) without taking dependent variable logs.

Control for a multilateral resistant term (MRT) refers to bilateral trade barriers that show how a country finds itself difficult to trade with the world (Lopez and Excaray, 2015). According to Rose and Van Wincoop (2001), MRT is an unobserved factor, but it can be approximated using Country (product)-year fixed effects, and this was the easiest method to apply. The only disadvantaged this method has was that it could not be applied to "calculate the comparative-static effects involving changes in trade costs"(Bergeijk and Brakman, 2010). Straathof fixed the problem of the non-linearization of MRT by coming up with linearized analytical MRT methodology. His MRT method achieved the linearization objective but had an endogeneity problem. However, it was able to produce exact results as for Van Wincoop. With endogeneity and comparative static issues from the above models, Baier and Bergstrand (2009) developed an MRT that weighted trade-costs (Bergeijk and Brakman, 2010). The remoteness variable is another way that has been proposed to measure MRT.

Distance has been a significant pillar in representing trade costs in the gravity model. Limao and Venables (2001) used actual shipping costs and proved that the distance variable used as a proxy for transport cost was inadequate (Disdier and Head, 2008; Demena and van Bergeijk, 2017).

Underestimation of distance in model amongst some studies leads to the divergence of the results of island variables.

2.4. Included Empirical Studies

In this section, I will discuss the data type applied by the studies included. The data type includes the number of observations and how it is associated with the period and number of countries analyzed. I will discuss the empirical methods and if there is any bias to a given results and provide a subsection of positive effect sizes examples and negative effect size. Lastly, the trend section will discuss if there is a pattern in publication and if data type yields specific sign or not.

Studies included in our sample are research done by economic scholars using gravity model and this allows us to meta-analyze their results. Cross-sectional data are year specific and there will be some years that have positive results while other years have negative results. Countries trade is affected by business cycle environment as there are some period where a country will have high sales or trade due to high production in good season, country at expansion/peak stage and vice versa. During recession period, consumer spending falls, therefore the imports drop because they become very expensive for citizens to import them. On the other hand, export products become cheaper and more competitive in the market and hence export volume increases during recession. If exporter countries are facing recession and the importing countries are not, then at this period using cross-sectional data, exporting countries will be biased toward having a positive effect size. Panel dataset avoids the year-specific biasness as it takes the average for many years.

Large samples of countries give a clear estimate of the true effect size. Japan and other few developed countries if only used in the dataset will gives a positive effect size of being an island to trade. The study by Moktan, S (2007), which investigates the impact of the trade agreement on exports between 1996 -2005 based on SAARC countries had only 7 countries, 420 observation, with Maldives and Sri Lanka being island countries under examination gravity model had a largest effect size of -27.46 when countries dummies are included. The number of observations is directly proportional to the number of countries in a sample and the period under investigation.

Countries have products which they have a competitive advantage in global market. Natural resource curse in a country renders them to export more as compared to others. Disaggregating the products call for a differentiated products' coefficient of islands. Some product classification will be positive while others will be negative as shown in the following sub sections depending on island specialization.

Some models applied on its own takes into consideration of zero trade. PPML model and censored Tobit model need not to transform zero trade by adding small value to them. OLS on the other hand needs transformation of zero trade by adding one before natural log is introduce. Other authors fail to do so and despite their sample size being large, zero-trade samples if systematic and no transformation done will yield.

Based on the results from the included studies, the following sections presents examples of the island coefficient signs, magnitude and significance. They are categorized as Positive effect on trade, negative affect on trade and a brief discussion on the existing trend.

2.4.1 Positive effects on trade

According to (Grant and Kathryn, 2009), island trade more with agricultural and non-agricultural products as they investigate the effects of imports on some variables included in the gravity model between 1980 and 2004. Despite not including the endogeneity issues, MRT, and zero import flow for a sample of 226 importing countries and 235 exporting countries, his findings were significant at 5% with island effects size was between 0.22 and 0.26 for agricultural products. Non-agricultural products had a higher effect size of about 0.31 to 0.34, also significant at 5% (Grant and Kathryn, 2009). Both agricultural and non-agricultural imports to island countries showed that GATT/WTO had a positive effect island on trade. It is with the reason for the small geographical land area that they import more non-agricultural products to foster intensive production as population and climatic effects are felt globally.

Another paper investigating the effects of the bilateral trade agreement between ASEAN countries trading with the United States and under the umbrella of Enterprise for ASEAN Initiative (EAI) yielded positive impacts of being an island to international trade. Using 178 countries from 1948 to 1998 found that island had a positive effect on all international trade while secluding the industrialized countries in the sample leads to an insignificant negative effect of being an island to trade (Naya and Plummer, 2006). Furthermore, island countries were found to trade more with the US by 0.128%, although it was not statistically significant. Still, the remoteness' positive sign of Caribbean island countries' remoteness factor doubling the weighted distance increases trade by 82% (Borgatti, 2008) and island trade more by 0.434% with NAFTA countries (Naya and Plummer, 2006).

The specialization of different products in specific countries has a comparative advantage compared to others. It is with this trajectory that some island countries trade more with partner countries on particular products. The overall SITC (0-9) for 1962 – 1999 in a sample of 178 countries, island countries traded more by 0.11 percentage points. When the period was adjusted from 1990-1999, the effect size changed to 0.31 to 0.35 percent (Derosa and Gilbert, 2006). Island

trading with (SITC 3), minerals, fuels, and lubricants positively impacted trade of about 0.47 to 0.65 percent. Lastly, island trade more with manufactured goods (SITC 5-8) with an effect size of about 0.02 to 0.37 percent, and they are statistically significant (Derosa and Gilbert, 2006). Since the dependent variable used in the gravity model was trade, we cannot quantify the items that the island exports more or imports more in the model.

With the use of the Tobit model to control for the zero trade while assessing Fiji's global trade potential, (Ram and Prasad, 2007), using 245 importing countries and 146 exporting countries found that the island had a significant positive effect on trade in the year of 2000 with a magnitude of 0.07- 0.15 percent. This paper, despite controlling for Zero trade but did not control for the resistant terms in bilateral trade and the issue of endogeneity among other variable factors that have been proven to yield biased results.

2.4.2 Negative effects on trade

According to (Eichengreen, Tong, and Rhee, 2004), the impact of China's growth on exports from other Asian countries between the period of 1990 to 2002 on a sample of 13 exporting countries to 180 importing countries found a negative effect of being an island country by a magnitude of between -0.07 to -0.641. While investigating if truly world trade organization (WTO) increases trade with a dataset of 175 countries from 1948 to 1999, another author concluded that being an island had a slightly negative effect of a magnitude of 0.03 to -0.87 percentage (Rose, 2004).

In terms of manufacturing exports, the Islands have high transport costs including from shipping charges, insurance fees, and other manufacturing machines (Chen et al., 2014). Island countries had a competitive advantage to exports given products while they are disadvantaged to export others. A sample of 140 importing countries and 137 exporting countries investigated, island exports less of manufactured goods due to high transport costs transferred to the price of finished products (Lee, Koo, and Park, 2006). Change in exports between 1993 to 2003 data, and island variable reduced exports per year by -0.15 to -o.59 (Lee, Koo, and Park, 2006).

Foodstuff category of goods SITC (0$1) traded less in the island country with a coefficient value -0.02 to -0.08. Raw materials (SITC 2$4) had a mixed finding due to periods used; 1962 to 1999 panel dataset countries traded less if they are island by -0.08 and significant, but when the period was from 1995 to 1999, the sign changed to positive with a magnitude of 0.02 and still significant at 1% (Derosa and Gilbert, 2006). In conclusion, the disaggregated data with specific products or sectors will positively or negatively affect being an island. Some products from islands have a higher competitive advantage in the global market, and hence they will be traded, exported, or imported by island countries. According to Rose (2007), while focusing on the impact of foreign

service and foreign trade promotion by consulate and embassies during 2002 – 2003, export data by large exporters found a negative effect of being an island country.

In conclusion, the divergence in island meta effect to trade tends to widen over time. Are the new authors not adopting the proposed new knowledge in their subsequent articles, or publication bias is an issue? The latest knowledge application seems not implemented by the latest studies, yet it has published articles. Some variables like distance as a proxy of transport costs without other accompanying costs underestimate the gravity model. Like multilateral resistance terms of country/product fixed effect are not best proxies as they are not comparative-static. Therefore, it is difficult to draw a general conclusion because of the heterogeneous literature that being an island will positively or negatively affect trade. Other works of literature that some consider the zero-trade issue. Some used the multilateral resistant term of bilateral trade. Others controlled for the endogeneity effects, among other moderator variables used in the gravity model. All these inconsistencies led to the heterogeneity effect on the impact of being an island to trade. To give an accurate and fair position of being an island is advantageous or not, needs to collect studies from all parts and sectors of the economy. The selected articles can be analyzed using meta-analysis to combine the information collected to unfold the pattern that these studies have yet to be revealed and conclude that island countries can make a viable policy to foster trade economic growth.

2.5 *Trend*

Reported island effect size has been increasing with an increasing variation over time. There were few island effect sizes reported at the early period from 2000 to 2003 but since then the reported island effect sizes had an increasing trend. Since we were focusing on our period between 2000 to 2009 inclusive, 92% of our sample came from 2004 onwards. Taking the number reported at the mid-period of the sample period, 77% came from studies published after 2005.

Furthermore, most of the cross-sectional data had a high tendency of reporting positive island coefficient estimates. There were 67% proportion of the cross-sectional dataset in our sample to report positive island effect size. For example, Le, H. (2009) while assessing impact of ISO 9000 certification on international trade for a cross-sectional data for year 2004 found that being an island country had a positive effect on exports. Panel dataset which avoids the year-specific findings in most cases had a large proportion being negative, 56% of panel data in our included studies.

CHAPTER 3: Data and Empirical Approach

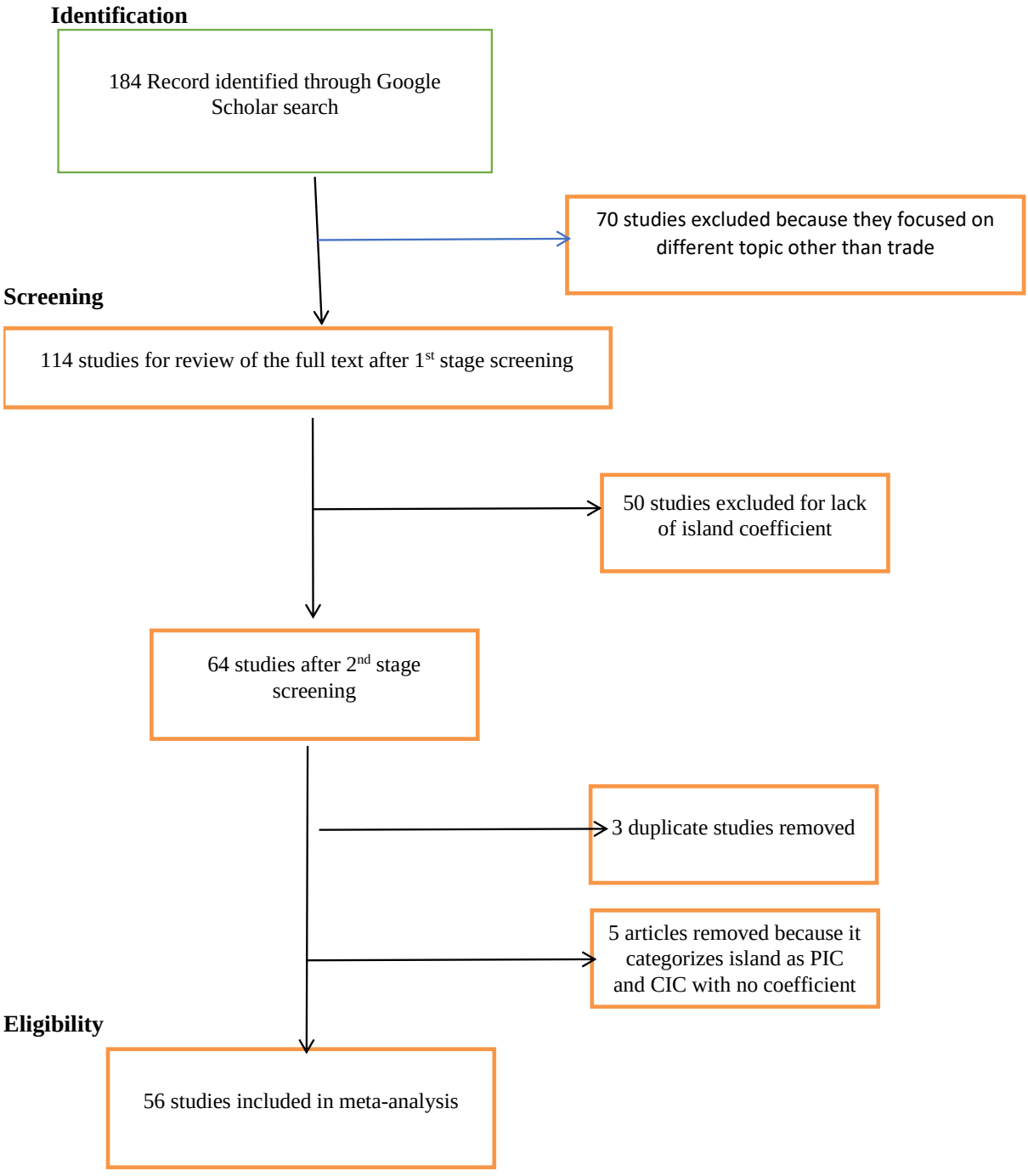
3.1. *Methods, Protocols, and Data Construction*

To investigate the research questions, we followed the recently updated reporting guidelines for meta-analysis in Economics (Havránek et al., 2020) in searching, coding, analyzing the reported and available empirical studies. The island effect size extracted from primary studies had to fulfill some characteristics, which includes that they must be English language studies that applied the gravity model, they report the coefficient of island variables and the standard error or t-statistics.

The studies that empirically apply the gravity model to investigate the island's effect on trade represent our dataset that we constructed by first getting the required articles included or excluded based on the set criteria. The required literature was searched using Google Scholar and supplemented by the EconLit database for empirical studies published from 2000 to 2009. The main keywords for searching the empirical studies were gravity *model, island countries, trade*. The keywords above provided us with published articles, books, conference papers, working papers, and masters' thesis. When we applied the Google Scholar search engine's main keywords, potential studies to be included were 104,000 studies. Given these large number of studies that possibly includes false hots of the general keywords, we further limit our search to the Boolean of "*gravity model" AND "island countries" AND " trade"* which generates 616 results to review, and but for the period of this research, i.e., 2000 to 2009, there were only 184 potential primary studies. In the first screening, we examined the titles and abstracts and keywords followed by examining introductions and conclusions. This yield 101 English language potential empirical studies (we observed a similar procedure specified by Demena, 2017). Additionally, we searched using the EconLit database and hand searching. The latter resulted in 16 additional studies.

In the second stage of the screening based on the full-text assessment, we strictly follow the inclusion criteria, including island regression-based coefficients, standard errors, or t-values. Applying these restrictions, we end up with 56 empirical studies for coding. The main reasons for excluding the studies: 53 studies did not include the island variable; 3 studies were duplicates. Five studies categorized the island as PIC and CIC with no coefficient in the regression-based analysis. See Appendix 2 for a detailed list of excluded studies. Following Demena et al. (2020), Figure 4 provides the empirical studies selection process's flowchart.

Figure 4: schematic flowchart of the empirical studies selection process



Sources: Adapted from Demena et al. (2020): https://www-liebertpub-com.eur.idm.oclc.org/doi/full/10.1089/apc.2019.0181

After the selection of the empirical studies, we started the extraction of relevant research dimension using Microsoft Excel. Demena designed an initial Microsoft Excel template for coding, but we modified to suit our objective by adding some variables into the coding sheet. Data were coded on a number of characteristics, which we grouped as follows:

1. **Island variable characteristics/ outcome variable**: island coefficient, t-values, standard errors and their significance levels of the island coefficient.

2. **Dependent variable:** Import, exports, trade, transport cost, imports/ (income of both countries))

3. **Model characteristics**: Ordinary least squares (OLS), Seemingly unrelated regression (SUR), fixed effects (FE), Random effects (RE), Poisson pseudo-maximum likelihood (PPML), Tobit model, Probit, First difference, Instrument variable, two-stage least squares (2SLS), linear model, log-lin or lin-log.

4. **Data characteristics**: if it was a panel or cross-sectional data, disaggregated, type of goods/sector and the number of countries included under the examination, but others reported this number by splitting into two (the number of importing countries and number of exporting countries, the number of observations and which region these countries are in terms of development.

5. **Treatment of zero trade flows:** Tobit model, use of PPML, zero plus 1, Heckman and probit

6. **Treatment of multilateral resistance (MRT):** year fixed effects, country fixed effects, Pair-country Fixed effect/Dyadic.

7. **Other control Variables included:** GDP, Population, Distance, geographical area, currency, language, landlock, regional trade agreement, reviewed, citation, and year of publication.

After the 1st coding, a 2nd coder (Ebuka Mathias Itumoh) checked all data's consistency before the analysis using Stata software. Errors of omission of (island coefficient, t-values, and standard errors), wrong capturing of the number of countries included and observations, categorizing countries into regions, and how controlled was MRT. As a requirement to undertake the meta-regression analysis (MRA), if two coders failed to come to an understanding, the third coder needed to break a tie. The third coder goes through the work to ensure that they yield the quality dataset. In this regard, we later consulted the supervisors of this project for a third view to reaching a consensus. The search and coding process took about seven months, i.e., between Feb – August 2020.

3.2. *Data*

The 56 studies that screened thoroughly had 876 observations identified. Island estimates reported were treated as semi-elasticity. Since the Probit model gives the probability of trading, exporting, or importing, we excluded this model's coefficients in the final dataset as it does not provide the

semi-elasticity of being an island on trade. Following this discrepancy, we ended up with 848 observations in our sample, as 28 observations from the selected studies coded had used the probability model, not semi-elasticity of the island on trade. A computed t-value was derived with the reported standard error by dividing the island coefficient with the reported standard error.

Furthermore, with reported t-values, we calculated standard errors by dividing the island coefficient with the reported standard error. These are the adjustments that we made on the missing t-values given standard errors and vice versa. 8 studies reported neither t-values nor standard errors in their output results but only reported their significance levels had 219 observations. After the exclusion of these observations, our final dataset includes 629 observations from 48 empirical studies.

:

Table 1: Descriptive and summary statistics of the significant control variables

ISLAND CHARACTERISTICS	**VARIABLE**	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
orige	original effect size	848	-0.05	2.176	-31.4	13.918
origse	original standard error	648	21.748	516.862	-2.813	13152.62
t	t-value	629	1.454	6.018	-21.5	49.3
significance	significance	663	0.02	0.046	0	1
DATA CHARACTERISTICS						
region	regions: developed countries=0; developing countries=1; all/both=2; n/a=3	629	2.128776	0.987638	0	3
nocount	number of countries	613	113.6052	60.54794	5	217
noimporer	no. of importer countries	56	162.8036	59.48733	22	245
noexporter	no. of exporter countries	102	94.86275	66.03165	1	200

cs	dummy 1 if it is a cross-section	629	0.337043	0.473076	0	1
pn	dummy 1 if it is a panel	629	0.655008	0.475744	0	1
ts	dummy 1 if it is a time series	629	0.007949	0.088874	0	1
nobs	no. of Observations	619	45847.72	86947.05	135	449220
disaggregated	dummy 1 if data is disaggregated into sectors	629	0.310016	0.462868	0	1
DEPENDENT VARIABLES						
export	dummy 1 if dependent is export	629	0.5358	0.4991	0	1
import	dummy 1 if dependent is import	629	0.1335	0.3404	0	1
trade	dummy 1 if dependent is trade	629	0.3307	0.4708	0	1
TREATMENT OF ZERO						
Tobit	dummy 1 if tobit model used to account zeros	629	0.0541	0.2263	0	1
Plus one	Dummy 1 if 1 is added to the dependent var	629	0.1447	0.3521	0	1
ppml	dummy 1 if PPML used	629	0.0382	0.1917	0	1
nozeros	dummy1 if zero is not controlled	629	0.6820	0.4661	0	1
heckman	dummy 1 if heckman is used	629	0.0429	0.2029	0	1

TREATMENT OF MRT						
mrt_BB	dummy 1 if MRT control by BB	629	0.0095	0.0973	0	1
couyearfe	Dummy 1 if MRT control by COUNTRY YEAR FIXED EFFECT/DYADIC	629	0.1844	0.3881	0	1
mrt_remote~e	dummy 1 if MRT is controlled by remoteness variable	629	0.1463	0.3537	0	1
No_MRT	dummy 1 if MRT is Not controlled	629	0.6630	0.4731	0	1
PUBLICATION CHARACTERISTICS						
pubage	age since published	629	13.3021	1.909833	11	20
lnpubage	natural log of publication age	629	2.6523	0.124167	2.484907	3.044523
yearcits	Average citation per year	617	10.4949	27.24797	0	127.7
lnyearcits	natural log of average citation per year	617	1.3425	1.235424	0	4.857484

Table 1 provides detailed data coded. In this regard, we coded the mode of estimation technique used as OLS, Tobit instrumental variable, and probit/logit model, how was zero trade treated, endogeneity, and multilateral resistance term controlled in the gravity model. Besides, we captured the number of countries in a sample, a panel data or cross-section, and the period under examination. The median observation of our parameter estimates collected in our samples is eight estimates. Maximum parameter estimates observe from a study in our sample are 84 estimates, and mean estimates observed in our sample are 15 from 56 studies.

Our sample's peer-reviewed journals will be used to test if the peer-reviewed studies publish quality articles without any publication bias and precise estimates. Our sample coded four

categories of publication qualities, including books, MA thesis, Peer-reviewed, and Working Papers. 34 studies with 411 observations are peer-reviewed, and this is a good sample size to investigate our hypothesis that the peer-reviewed studies provide more precise estimates.

To adjust for outliers, we adopt the procedure set by (Hadi, 1992) for detecting outliers in a multivariate dataset. This method of identifying outliers is best as it does not lose power due to swamping and masking problems compared to the classical outlier detection method (Hadi, 1992). Having excluding 8 studies that had not reported either the standard error or t-values from the sample, we ended up with 48 studies with 628 observations. Out of the 628 island coefficient estimates collected, 39 are found to be outliers larger than 3 in absolute terms, although few were once which had estimates of 0.05, 0.301, 0.31, 0.37, and 0.72. The study that yielded the largest outliers, 17 is the working paper study from Moktan, S (2007), which investigates the impact of the trade agreement on exports based on SAARC countries had only 7 countries under examination gravity model. Island coefficients were country-specific, including the Maldives and Sri Lanka making this gravity model biased. The sample number of countries was limited to give a clear representation of all other island countries. Other papers generated outliers, as shown in the Table 2 below:

Table 2: Studies that had contributed outliers

Study	**Freq.**	**Per-cent**	**Cum.**
Hans-Jürgen Engelbrecht & Christopher Pearce (2007)	1	2.56	2.56
Haq, Z., & Meilke, K. (2009).	7	17.95	20.51
Kandogan, Y. (2008).	2	5.13	25.64
Moktan, S. (2007).	17	43.59	69.23
Moktan, S. (2008).	1	2.56	71.79
Monitor, F., & Outlook, R. E. (2004)	6	15.38	87.18
NANDASIRI, K. H. (2008).	2	5.13	92.31
Nordås, H. K. (2007).	1	2.56	94.87
Rose, A. K. (2008).	1	2.56	97.44
Yetman, J. (2002)	1	2.56	100

Total	**39**	**100**	

Some meta-analysts adopted empirical strategy excluding outliers (Lazzaroni and van Bergeijk, 2014; Demena and van Bergeijk, 2017; Demena and Afesorgbor, 2020). While other adopted the analysis of all observations reported by the included primary studies (van Bergeijk et al., 2019; Floridi et al., 2020). Following Moons and van Bergeijk (2017), we include the full sample or observations in our main analysis. To check our main results' sensitivity, we also provide robustness checks on the sub-sample, excluding the identified outliers.

3.3. ***Empirical Approach***

3.3.1 *Funnel plots*

Publication selection bias arises when a larger and significant effect size is reported for publication in some journals. This biasness leads to the overrepresentation of large and significant findings compared to those papers that had little or insignificant statistics (Demena, 2015; Stanley and Doucouliagos, 2012). Publication selection bias can give a wrong impression of an economic variable's effect size if policy formulation can entirely depend on the publication bias articles. This biasness can occur when journals only accept statistically significant articles that conform with their views or the researchers working for a given organization like the world trade organization may use the already assumed results to choose the articles to be published in their journals.

To detect if publication bias is present and provide genuine underlying effect size, we will first use the reported estimates' graphical plots. A funnel plot is a scatterplot with an inverse of a standard error on the y-axis and effect size on the x-axis and looks like an inverted funnel (Demena, 2017). Hence, the lower level has a lot of distribution because the large standard error renders the imprecision widely dispersed. In contrast, the larger sample size usually has small standard errors, and precision is high, and they are concentrated together at the top of the funnel (Nguyen et al., 2020). If the funnel shape is asymmetric, then there is a tendency that some estimates are unreported or discarded, indicating the presence of publication bias (Stanley and Doucouliagos, 2010). In contrast, when the funnel plot is symmetrical may indicate the absence of publication bias (Demena, 2014; Stanley and Doucouliagos, 2012).

A funnel plot is subjective, and it cannot be conclusive to determine the presence of publication bias, which calls for other forms of formal econometric MRA.

3.3.2 *Statistical analysis - MRA*

As indicated above, the funnel plot is a visual examination and, thus, subjective and unconvincing (Demena and van Bergeijk, 2017). Following existing meta-analysis, a more powerful econometric/statistical approach would be the meta-regression model (Demena and van Bergeijk, 2017; Demena and Afesorgbor, 2020). This follows as in the equation:

$$Effect_{ij} = \beta_o + \beta_1 SE_{ij} + \varepsilon_{ij} \quad (3)$$

The $effect_{ij}$ represents the reported island effect to the trade of *the semi-elasticity estimate reported from the j^{th} study, and SE represents* the reported or calculated standard error. β_1 is the publication selection bias, while the constant β_o is the publication correction genuine effect size of the island. In the case of no publication bias presence, the standard error tends toward precision, i.e., towards zero, the expected island effect size tends toward genuine effect size (β_o) (see e.g., Doucouliagos and Stanley, 2013). In contrast, with publication bias, the island effect size is directly proportional to the standard error/variance when other things are kept constant (Stanley and Doucouliagos, 2012). ε_{ij} follows the usual error term.

Since the accompanying standard errors of effect sizes have different standard errors, equation 3 may suffer from heteroskedasticity; hence OLS should not be applied (Stanley and Doucouliagos, 2012). Hence correcting heteroskedasticity will provide us with the weighted least square (WLS) using the inverse of the variance as in the equation (i.e., dividing equation 3 by $1/SE^2$:

$$\frac{effect}{se^2} = \frac{\beta o}{se^2} + \frac{\beta 1 se}{se^2} + \frac{\varepsilon ij}{se^2} \quad \ldots\ldots (4)$$

Since $\frac{effect}{se} = t - value$

Equation 4 becomes

$$t = \beta o(\frac{1}{se}) + \beta 1 + v_{ij}$$

$\ldots\ldots (5)$

From equation 5, we can now run the meta-regression analysis (MRA) using WLS. The constant term of estimation of equation 5 gives the test for publication bias in the literature known as the Funnel asymmetry test (FAT). Whereas the slope of equation 5 gives the genuine underlying meta-effect of the island on trade both in magnitude and sign-precision effect (PET).

Our null hypothesis is that there is no publication selection bias in these selected studies.

H_0: $\beta 1 = 0$

Suppose the results find that the MRA coefficient is statistically different from zero. In that case, it is now evident that there is a problem of publication bias. If the $\beta 1 > 0$, then there is a tendency to report upward bias. There will be many published articles that an island is geographically advantageous to trade despite other critics of the island being small or remote from the primary market.

Similarly, we can explain the precision effect test (PET) from the same model, the MRA coefficient of the standard error inverse. Hypothesizing

H_0: $\beta_0 = 0$

In this case, i.e., If we fail to reject this null hypothesis, then we can conclude that being an island does not have a statistical advantage or disadvantage to trade. In contrast, i.e., if we reject the null hypothesis, then the magnitude of this coefficient gives a genuine effect size after the publication bias has been controlled.

In addition to investigating our full sample meta-data, we will also conduct a sub-sample analysis considering peer-reviewed studies only to test whether the peer-review process affected the publication bias and the island's underlying effect differently. In this regard, we will restrict our analysis, including estimates reported by the peer-reviewed studies only.

However, before concluding the empirical strategy, it is important to consider the nature of within- and between-study correlations or dependencies to avoid potential bias in the estimated MRA. Regarding within-study correlation, we have extracted multiple estimates for a given study, and thus these estimates are unlikely to be independent statistically (Demena and van Bergeijk, 2017). Applying this, we first use the ordinary least squares (OLS) clustered standard error analysis after the transformation of the WLS model. Further, Stanley and Doucouliagos (2012) recommended using a fixed effect to control the within-study correlation that occurs in most cases in primary studies may experiment with various econometric specifications to self-select specific findings. The latter is important to account for the authors' prejudices (Demena and Afesorgbor, 2020). Beyond the within-study correlations, the between-study dependency is another empirical concern. Multiple included studies can be provided by the same researchers and hence unlikely to have statistical independence. We investigate the presence of between-study statistical correlation using the Breusch-Pagan Lagrange multiplier (BP-LM). The test suggested the statistical dependency of the included empirical studies to be 550.49 (p-value < 0.001) and Chi-squared with one degree of freedom.

Consequently, we apply the multi-level mixed model (MEM). Our preferred model is MEM as it accounts for both within- and between-study correlations. MEM's importance in a

most recent meta-analysis (e.g., Demena and van Bergeijk, 2017; van Bergeijk et al., 2019; Demena and Afesorgbor, 2020; Floridi et al., 2020). As a result, our empirical strategy uses clustered OLS (CDA) and fixed effects only as baseline regressions, and we infer the results of the MEM in answering our research questions.

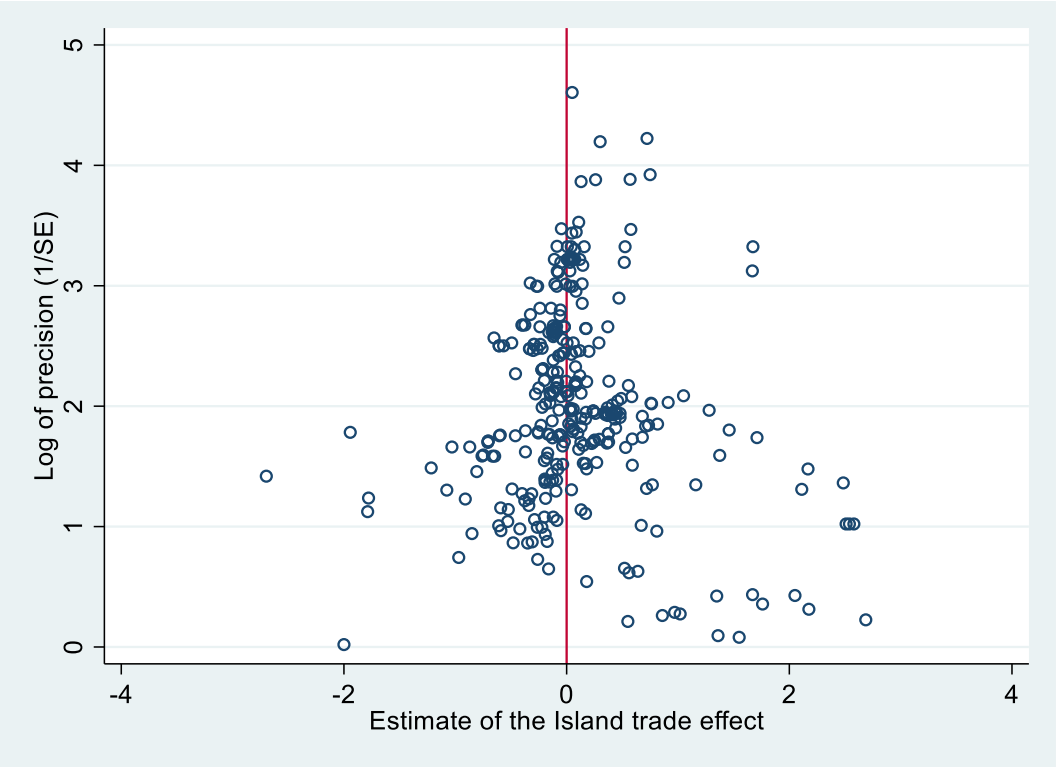
CHAPTER 4: Findings and Discussion

4.1. *Funnel plots*

Figure 5 shows the funnel plot for all studies that were included while estimating the island trade effect. It appears that most observations are positively skewed, such that there is a higher possibility for the positive island trade effect papers to be published as compared to those with negative island trade effects. All studies (*after excluding the 8 studies without neither t-value nor standard error with 219 observation)* included in figure 5 suggest the presence of publication selection bias with 262 observations reporting negative island trade effect while 366 observations were reporting positive island trade effect. And the next question is to explore if peer-reviewed studies exhibit a similar or different publication bias pattern.

Figure 5: Funnel plot for all-studies (N=628 from 48 studies).

Figure 6: Funnel plot for peer-reviewed studies (N=359 from 31 studies).



To answer the peer-reviewed publication bias pattern, Figure 6 gives the funnel plot, excluding estimates collected from non-peer-reviewed studies. It appears that the distribution of both Figures 5 and 6 is similar, except the latter is thinner due to a smaller number of observations. There is still a tendency that peer-reviewed studies to report more positive island trade effects. Out of the 359 peer-reviewed observations from the 31 studies, 178 observations had a negative island trade effect size, while 181 observations had a positive island trade effect.

Robert and Stanley (2005) resolved publication bias quickly and crudely by finding the top percentile (Demena and Afesorgbor, 2020:71). Out of the 628 observations for all studies, the top 10% of these studies (62 observations) had a mean effect size of 0.1139, with a standard deviation of 0.0468. Similarly, the average top 11% funnel plot of the peer-reviewed studies (top 35 peer-reviewed observations) had a mean island effect size of 0.1866 with a standard deviation of 0.0572. this value will be compared with the value of genuine effect size. Since the funnel plot graph is more subjective, we need to corroborate our funnel plot analyses with econometric models.

4.2. *Genuine effects and publication bias*

We need to provide a genuine effect size of all the previous studies that had estimated the island trade effect; a simple average and weighted average was first considered. Tables 3 and 4 give the weighted and unweighted effect sizes on the island's position on trade for all studies and peer-reviewed studies. For all studies, the simple average had a negative and statistically significant

effect size of -0.050. This value of -0.05 means that based on the simple average for all studies, being an island country leads to a reduction in trade by 4.88%. We emphasize the accurate estimates using the inverse-variance weighted average to assign more weights to more precise estimates. In doing so, the island-trade effect showed a complete reversal in the sign of the effect, suggesting the island provides a positive and significant effect on trade flows. Upon assigning more weights to precise estimates, being an island country led to an increase in trade by 9.64% when all studies were considered. When we based our conclusion on the top 10% of the funnel plot stated above, the average was 0.1139 (12.06%) for all studies, and these results are inconsistent to make a conclusive decision of impact of the island to trade

Table 3: Estimates of the average impact of island on trade – all studies

Method	Effect size	S.E	95% confidence interval	
Simple average effect [a]	-0.050	0.074	-0.197	0.097
Weighted average [b]	0.092	0.022	0.050	0.146

Note: [a] arithmetic mean of the island effect on trade. [b] inverse variance as weight.

Table 4: Estimates of the average impact of island on trade – peer-reviewed

Method	Effect size	S.E	95% confidence interval	
Simple average effect [a]	0.052	0.093	-0.131	0.236
Weighted average [b]	0.086	0.031	0.025	0.146

Note: [a] arithmetic mean of the island effect on trade. [b] inverse variance as weight.

Considering peer-reviewed studies alone, Table 4 shows the weighted and unweighted effect sizes on the impact of being an island to trade. Peer-reviewed studies based on simple average had a mean of 0.052 while the weighted average had a mean of 0.086. the main difference with the all-study estimates, the latter had positive and significant effects from both the simple and weighted average approaches. Comparing this with the averaged top 10% of the funnel plot, for peer-reviewed studies had an effect size of 0.1866, we could say that being an island renders a

country to engage more in international trade by 20.51% with the assumption that there is no publication bias. If there is publication bias, the conclusion on weighted and simple average will not be statistically correct, and we need to control for publication bias by running FAT-PET analysis (Stanley and Doucouliagos, 2012).

Bivariate funnel asymmetric test (FAT) and precision effect test (PET) meta-regression analysis (MRA) is an econometric measure that after controlling for the publication bias. This approach gives the precise or genuine estimate for the island trade effect using the all-study approach. As indicated in our empirical approach, our interpretation based on the MEM approach controls both within and between study dependencies. This FAT-PET-MRA validates the subjectiveness of the funnel plot of publication biasness approach and uses a formal econometric approach to investigate the true genuine effect size of the impact of the island to trade after accounting for potential publication bias. There is a need to give more weight to precise estimates, and as stated in chapter 3, we applied inverse of variance in running the bivariate FAT-PET MRA.

Table 5: Bivariate MRA (FAT and PET): genuine effect and publication –all studies

All studies						
	(1)		**(2)**		**(3)**	
Variables	**CDA**		**Fixed effects**		**MEM**	
	Coefficient	*t*-value	Coefficie	t-value	Coefficient	*t*-value
Bias (FAT)	-0.751	-1.17	-1.738	-1.56	-2.820***	-3.53
Genuine effect	0.156	1.67	0.239**	2.54	0.217***	10.33
Observations	628		628		628	
Studies	48		48		48	

*Note: ***/**/* indicates statistical significance at the 1/5/10% level, respectively. t-values are reported from cluster-robust standard errors. Column (1): CDA – clustered data analysis with study level clustered standard errors; Column 2 (FE) is the fixed-effect estimation clustered at the study level; and Column 3 (MEM) is the mixed-effects multilevel estimated through the restricted maximum likelihood. The dependent variable is t-values. All results use inverse variance as weight.*

From Table 5, we run the weighted bivariate MRA (FAT-PET) for all studies.

To answer the research question if there was a publication bias in publishing the empirical studies, we sort to rely on the empirical evidence from funnel plots and the results from FAT meta-regression analysis in Table 5 using MEM as a preferred model as it accounts for the variation of both within and between these studies that were included in the analysis (Stanley and Doucouliagos, 2012; Demena and Afesorgbor, 2020). In contrast with the positive publication bias, as seen from the funnel plot in Figure 4 above, FAT analysis for all studies had a negative

publication bias. The mixed-effect multilevel model showed a negative publication bias, which was statistically significantly different from zero. Its magnitude is -2.820, meaning that the publication bias can be categorized as severe as this value is greater than 2 in absolute terms (Demena 2017). The CDA and FE had a negative publication bias, but they were not statistically significant, with their magnitude lower than MEM.

After controlling for the publication bias, the genuine underlying effect for all studies shows that being an island has a statistically significant positive effect on trading. CDA had a genuine effect of 0.156, which is statistically insignificant, and the fixed effects after controlling for publication bias have a genuine impact of 0.239, which is statistically significant at 5%. Based on the MEM after controlling for the publication bias, the underlying genuine effect size of being an island to trade is 0.217, meaning that being an island increases trade by 24.23% and statistically significant at 1%. Comparing MEM results for PET of 0.217 or 24.23% with the weighted average of 0.052 (5.34%) and the top 10% funnel plot of 0.1139 (12.06%) shows that truly, the publication bias reduced the island trade effect size.

Table 6: Bivariate MRA (FAT and PET): genuine effect and publication – peer-reviewed studies

Peer-reviewed studies						
	(1)		**(2)**		**(3)**	
Variables	**CDA**		**Fixed effects**		**MEM**	
	Coefficient	*t*-value	Coefficient	t-value	Coefficient	*t*-value
Bias (FAT)	-1.536*	-1.89	-1.849	-1.67	-2.167**	-2.51
Genuine effect	0.240	2.54	0.272**	2.43	0.223***	6.95
Observations	359		359		359	
Studies	31		31		31	

Note: See Table 6. All results use inverse variance as weight.

With only peer-reviewed studies, does it give more precise estimates with less publication bias? From Table 5, publication bias ranged from CDA value of -1.536, statistically significant at 10%, to MEM value of -2.167, which is statistically significant at 5%. The magnitude of publication biasness is still substantial but comparing this with all studies, peer-reviewed studies are more precise as the magnitude of publication bias is slightly low. However, they are not statistically different from each other.

Upon controlling the publication bias, the genuine effect size of being an island to trade still gives a positive effect ranging from 0.223 to 0.272. and statistically significantly different from zero. The fixed effects estimate gives lower genuine island effect size value of 0.272 and statistically

significant at 5% and higher genuine effect sizes than the MEM. CDA genuine effect is not statistically significant with a value of 0.240.

We can now conclude a severe negative publication bias of -2.820 for all studies and -2.167 in peer-reviewed studies. After controlling for the publication bias, the genuine effect size gave a positive effect size consistent with the weighted average. This genuine effect size of being an island had a statistically significant positive effect of 0.217 for all studies. The genuine effect size, considering only peer-reviewed studies is not statistically different from the one of all studies, with a statistically significant value of 0.223.

4.3. Further analyses and robustness checks

To test if our main findings stated above are robust, we undertook a further check by excluding the potential outliers identified using the procedure stipulated by Hadi, (1994) from our sample. Since our conclusion above finds presence of severe negative and statistically significant publication bias in all studies as well as peer-reviewed journals, we run FAT-PET meta-regression analysis after removing the outliers. If the results are resistant to outliers, then our conclusion is robust to outliers. Furthermore, the genuine effect if upon removing outliers in our sample the findings doesn't change, we could too conclude that the genuine effect of being island to trade is positive as stated above. Since outliers had a possibility of disguised effects upon inclusion, we limit the analysis here, excluding these outliers. From all studies, there were 39 outliers observed from 1 study, while the peer-reviewed studies had 18 observed outliers from 1 study too. The detail of these outliers was shown in Table 2

Figure 7:All Studies excluding outliers

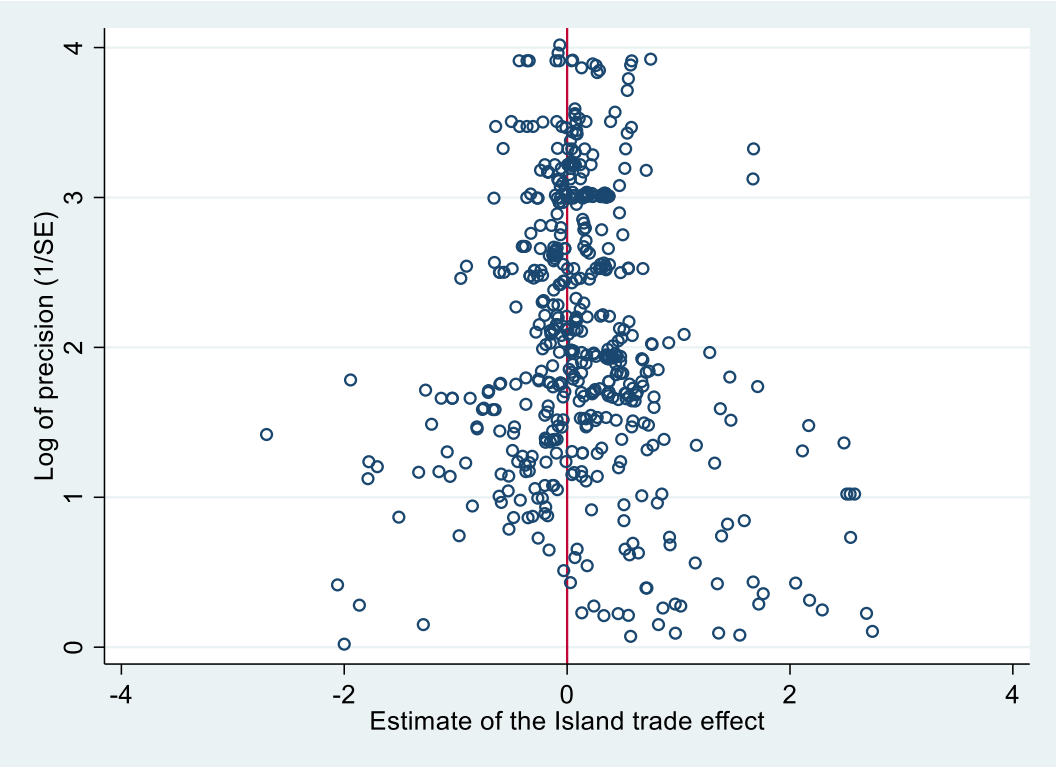
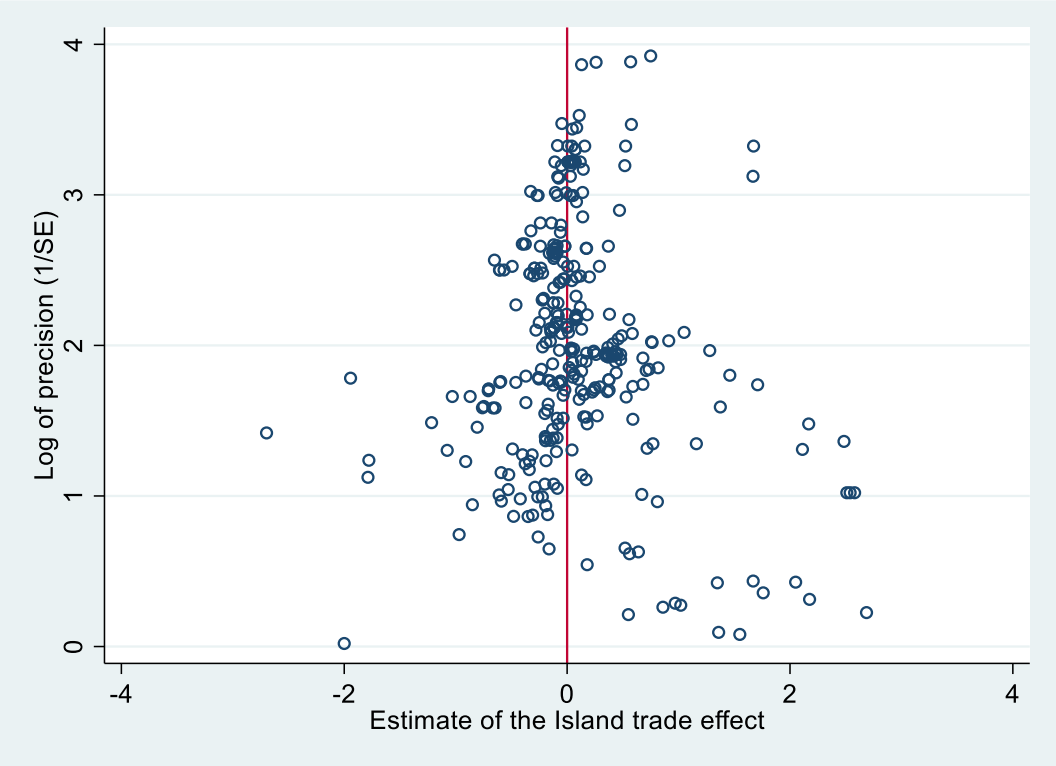


Figure 8: Peer-Reviewed Studies excluding outliers



The funnel plots after outliers have been removed for all studies, and the peer-reviewed studies alone are presented as follows in Figures 7 and 8. The two observation which seems to be far-right after outliers are removed is from a study by Ghani, G. M. (2007) using a sample of 175 countries investigated if the organization of Islamic Conference (OIC) members reduces trade or not between the period of 1948 and 1999 had coefficient of island variable ranging at -0.052 to 1.67 but the robust standard error was as low as 0.036. These values did not qualify to be outliers based on the Hadi 1994 detection criterion.

There was a rather symmetric distribution on the funnel plots Figure 7 for all studies but the peer-reviewed studies Figure 8 have a positive publication bias as more distribution are seen on the right-hand side. To go beyond the visual judgmental, we run FAT-PET meta-regression analysis as shown below.

Table 7:Robustness checks- Bivariate MRA: excluding outliers – all studies

All studies						
	(1)		**(2)**		**(3)**	
Variables	**CDA**		**Fixed effects**		**MEM**	
	Coefficient	*t*-value	Coefficient	*t*-value	Coefficient	*t*-value
Bias (FAT)	-0.055	-0.07	-0.269	-0.20	-1.100*	-1.98
Genuine effect	0.093	0.89	0.111	0.97	0.119***	4.62
Observations	589		589		589	
Studies	47		47		47	

*Note: ***/**/* indicates statistical significance at the 1/5/10% level, respectively. t-values are reported from cluster-robust standard errors. Column (1): CDA – clustered data analysis with study level clustered standard errors; Column 2 (FE) is the fixed-effect estimation clustered at the study level; and Column 3 (MEM) is the mixed-effects multilevel estimated through the restricted maximum likelihood.*

Table 8:Robustness checks- Bivariate MRA: excluding outliers – peer-reviewed studies

All studies						
	(1)		**(2)**		**(3)**	
Variables	**CDA**		**Fixed effects**		**MEM**	
	Coefficient	*t*-value	Coefficient	t-value	Coefficient	*t*-value
Bias (FAT)	-1.377	-1.47	-0.286	-0.29	-1.002*	-1.91
Genuine effect	0.213**	2.00	0.102	1.02	0.144***	3.52

Observations	341	341	341
Studies	30	30	30

*Note: ***/**/* indicates statistical significance at the 1/5/10% level, respectively. t-values are reported from cluster-robust standard errors. Column (1): CDA – clustered data analysis with study level clustered standard errors; Column 2 (FE) is the fixed-effect estimation clustered at the study level; and Column 3 (MEM) is the mixed-effects multilevel estimated through the restricted maximum likelihood.*

From table 7 above, the bivariate MRA after excluding outliers from all studies results in a reduction in publication bias from severe publication bias to substantial publication bias, as the magnitude now is below 2 but consistently at least 1 in our preferred model, MEM. Publication bias is still negative, supporting the findings from the FAT-PET-MRA without controlling for outliers. Using CDA and FE, the publication bias was statistically insignificant with a little-to-modest magnitude. Still, MEM had a statistically significant negative publication bias with a magnitude of -1.100 at a 10% level of significance. Using MEM, genuine effects size of being Island for all studies after controlling for publication bias and outliers had an effect size of 0.119, meaning that being an island result to an increase in trade by 12.64%, this value being statistically significant at 1%. CDA and FE, too, had a positive, genuine effect size of 0.093 and 0.111, respectively, although they are statistically insignificant.

FAT-analysis for the peer-reviewed studies left us with 31 studies after excluding outliers. The publication bias as seen in table 8 is still negative, with a magnitude of substantial than severe with outliers' inclusion. CDA and FE had a negative publication bias of -1.377 and -0.286, respectively, both of which are statistically insignificant. The MEM had a statistically negative publication bias of a little-to-modest magnitude of 1.002 significant at 10%.

The genuine effect still confirms that the island positively impacts international trade when controlling the negative publication bias. CDA had a genuine effect of 0.213, which is statistically significant at 5%, while the FE resulted in a genuine effect of 0.102 despite being statistically insignificant. We based our conclusion with MEM had a genuinely positive effect of 0.144, meaning that being an island result to an increase in trade by 15.49%, this value being statistically significant at 1%. Peer-reviewed studies provide more precise estimates as the publication bias compared to those of all studies are slightly lower.

CHAPTER 5: Conclusion

Policymakers have been in a dilemma as to what is the position of being an island to trade. In this paper, we tried to resolve the divergence evidenced by firstly, checking if there is publication bias for this control variable and the genuine effect of island countries on trade after adjusting publication bias. 61% of the collected studies showed that the island had a positive impact on trading, as shown in Table 1. Of the high proportion of literature findings supporting that island countries trade more, is this proportion tainted with publication bias? We gather 628 observations of island's effect sizes from 48 studies with a full set of pertinent information of t-values that we later used for analysis.

We exhaustively explore the issue of publication bias using funnel plots and FAT meta-regression analysis. We conducted a PET meta-analysis to determine if peer-reviewed studies give a more precise and genuine effect size of being an island to trade or even they too suffer from publication bias? Apart from a distance being a proxy for all transport costs, geographical locations like being a landlocked country and sharing a common border or island have either positive or negative cost factors in trade. Upon controlling for the publication bias, if present, what is the genuine island effect of trading?

With the weighted average for all studies, we found a positive and significant island's effect size to trade with a value of 0.092. Weighted peer-reviewed studies had a weighted positive, statistically substantial of 0.086. Bivariate FAT-PET meta-regression analysis (MRA) was run to econometrically evaluate the extent of publication bias and what was the genuine effect after controlling for publication bias. The FAT-analysis reported a tendency to publish studies that had negative but statistically significant results. Despite the negative publication bias, there was still a higher tendency for the positive and genuine effect articles to be published between 2000 to 2009. Peer-reviewed journals too suffer from publication bias, and policy-makers cannot depend on these alone in decision making. This negative publication bias has underestimated the island effect size to trade, thereby, and conservative policy-makers have failed to capitalize on their capability to trade more. The underlying genuine island effect of trading after publication bias-adjusted was 0.217 for all studies and 0.223 for peer-reviewed studies. This means that being an island country has its advantage of increased engagement in international trade by 24.23% when all studies in a sample are considered and 24.98% when only peer-reviewed studies in the sample are considered

With the advancement and improved knowledge in the gravity model, there is a need to carry out the heterogeneity test. Some model adjustments that needs to be the control for zero trade, endogeneity issues, distance measurement, and multilateral resistance terms. Having

adjusted for the heterogeneity, we could conclude that the genuine effect of being an island to trade is positive and with a said magnitude. The potential source of heterogeneity is an area that needs to have further analysis, as we did not cover it in this paper.

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APPENDIX

APPENDIX 1:Studies included in the meta-analysis

ID	study	reviewed	title	year	outlet
1	Rose, A. K., & Engel, C. (2000).	WP	Currency unions and international integration	2000	National Bureau of Economic Research.
2	Rose, Andrew K. (2001)	PR	Common currency areas in practice	2001	
3	Limao and Venables (2001)	PR	Infrastructure, geographical disadvantage, transport costs, and trade.	2001	The World Bank Economic Review
4	Reuven Glick and Rose A. (2002)	Not PR	Does a currency union affect trade?	2002	European Economic Review
5	Yetman, J. (2002)	PR	Currency Unions and Capital Flows	2002	Pacific Economic Review
6	Clarete etal (2003)	PR	Asian regionalism and its effects on trade in the 1980s and 1990s	2003	Journal of Asian Economics
7	Inmaculada Martinez-Zarzoso (2003)	PR	Gravity Model: An Application to Trade Between Regional Blocs	2003	Atlantic Economic Journal
8	Alho, K. E. (2003)	WP	THE IMPACT OF REGIONALISM ON TRADE IN EUROPE	2003	The Research Institute of the Finnish Economy (ETLA)
9	Estevadeordal et al (2003)	PR	THE RISE AND FALL OF WORLD TRADE, 1870–1944	2003	THE QUARTERLY JOURNAL OF ECONOMICS
10	Ghosh, S., & Yamarik, S. (2004)	PR	Are regional trading arrangements trade creating? An application of extreme bounds analysis	2004	JOURNAL OF INTERNATIONAL ECONOMICS

11	Monitor, F., & Outlook, R. E. (2004)	PR	Exchange Rate Volatility and Trade Flows--Some New Evidence	2004	IMF JOURNAL ISSUE
12	Nordås & Piermartini (2004)	WP	Infrastructure and trade.	2004	WORLD TRADE ORGANISATION WORKING PAPER
13	Eichengreen, Rhee & Tong(2004)	WP	The impact of China on the exports of other Asian countries	2004	National Bureau of Economic Research.
14	Rose, Andrew K. (2004)	PR	Do We Really Know That the WTO Increases Trade?	2004	American Economic Review
15	Hans-Jürgen Engelbrecht & Christopher Pearce (2007)	PR	Do We Really Know That the WTO Increases Trade?	2004	American Economic Review
16	Goldstein, J., Rivers, D., & Tomz, M. (2005).	WP	Membership Has Its Privileges: The Impact of GATT on International Trade	2005	Standford institute of economic policy research (SIEPR)
17	Yamarik and Ghosh (2005)	PR	A sensitivity analysis of the gravity model	2005	The International Trade Journal
18	Dee and Gali(2005)	PR	The Trade and Investment Effects of Preferential Trading Arrangements	2005	national Bureau of Economic Research.
19	Wilson Et al (2005)	PR	Assessing the benefits of trade facilitation	2005	World Economy in Wiley Online Library
20	Naya and Plummer (2006)	PR	A Quantitative Survey of the Economics of ASEAN-US Free Trade Agreements	2006	ASEAN Economic Bulletin
21	Lee Koo and Park (2006)	PR	Are Exports of China, Japan and Korea Diverted in the Major Regional Trading Blocks? *	2006	Asia-Pacific Economic Association (APEA)

22	Hapsari and Mangunsong (2006)	WP	Determinants of AFTA members' trade flows and potential for trade diversion	2006	Asia-Pacific Research and Training Network on Trade (ARTNeT)
23	Derosa D. and Gilbert J. (2006)	PR	estimates from gravity and CGE model	2006	Peterson institute
24	Bora, B., & Liu, X. (2006)	Not PR	Evaluating the impact of the WTO Information Technology Agreement.	2006	Kennesaw university
25	Felbermayr, G. J., & Kohler, W. (2006)	PR	Exploring the intensive and extensive margins of world trade.	2006	Review of World Economics
26	Klein, M. W., & Shambaugh, J. C. (2006)	PR	Fixed exchange rates and trade.	2006	Journal of international Economics
27	Amita Batra (2006)	PR	India's Global Trade Potential: The Gravity Model Approach	2006	Global economic Review
28	Kucera, D., & Sarna, R. (2006)	PR	Trade Union Rights, Democracy, and Exports: A Gravity Model Approach*	2006	Review of International economics
29	Ram, Y., & Prasad, B. C. (2007)	PR	Assessing Fiji's Global Trade Potential using the Gravity Model Approach	2007	School of Economics, University of the South Pacific.
30	Tomz, M., Goldstein, J. L., & Rivers, D. (2007)	PR	Do We Really Know That the WTO Increases Trade? Comment	2007	American Economic Review
31	Ghani, G. M. (2007)	PR	Does OIC membership reduce trade?	2007	Journal of Economic Cooperation among Islamic Countries

32	Rose, A. K. (2007).	PR	The foreign service and foreign trade: embassies as export promotion.	2007	World Economy
33	Adam, C., & Cobham, D. (2007).	PR	Modelling multilateral trade resistance in a gravity model with exchange rate regimes.	2007	In Centre for dynamic macroeconomic analysis conference paper
34	Soloaga, I., & Montenegro, C. E. (2007).	Not PR	NAFTA's impacts on third countries: recent evidence with a gravity model approach.	2007	JOURNAL OF ECONOMICS LITERATURE
35	Yener Kandogan (2007)	PR	Sensitivity of International Blocs' Trade Effect to Alternative Specifications of the Gravity Equation	2007	Journal of Applied Economics
36	Blyde, J., & Sinyavskaya, N. (2007)	PR	The Impact of Liberalizing Trade in Services on Trade in Goods: An Empirical Investigation	2007	Review of Development economics
37	Moktan, S. (2007).	Not PR	The Impact of Trade Agreements on Exports: Empirical Evidence from SAARC Countries.	2007	ResearchGate (Graduate School of International Development (Japan: Nagoya University))
38	Márquez-Ramos et al (2007)	PR	The Role of Distance in Gravity Regressions: Is There Really a Missing Globalization Puzzle?	2007	journal of economic analysis and Policy
39	Nordås, H. K. (2007).	PR	Time as a trade barrier: Implications for low-income countries.	2007	OECD Economic Studies
40	Yu, M. (2007).	WP	Trade globalization and political liberalization	2007	Econstor

41	Balding, C. (2010).	PR	Joining the World Trade Organization: What is the Impact?	2008	Wiley Online Library
42	Edmonds, C., La Croix, S., & Li, Y. (2008).	PR	China trade: Busting gravity's bounds	2008	JOURNAL OF ASIAN ECONOMICS
43	Kandogan, Y. (2008).	PR	Consistent estimates of regional blocs' trade effects.	2008	Review of International Economics
44	Moktan, S. (2008).	Not PR	Evaluating the Intra–regional Exports and Trade Creation and Trade Diversion Effects of Trade Agreements in SAARC Countries.	2008	South Asia Economic Journal
45	NANDASIRI, K. H. (2008).	MA THESIS	Impact of regional trading blocs and free trading agreements on bilateral trade: An application of Gravity model in international trade.	2008	CORE OUTLET
46	Hicks, R., & Kim, S. Y. (2008)	Draft	Not all PTAs are Equal: Credible Commitment through PTAs and their Effects on Trade	2008	ResearchGate
47	João, C. L. (2008).	PR	The determinants of Colombian exports: An empirical analysis using the gravity model.	2008	Revista Desarrollo y Sociedad
48	Malhotra, N., & Stoyanov, A. (2008).	WP	Analyzing the Agricultural Trade Impacts of the Canada-Chile Free Trade Agreement	2008	university of Minnesota Library
49	Rose, A. K. (2008).	WP	The Olympic Effect Andrew K. Rose and Mark M. Spiegel. Economist.	2008	journal of economic literature
50	Chang, K., Hayakawa, K., & Lee, H. (2008).	PR	The Influence of Cultural Factors on Trade in Agricultural Products*	2008	journal of Korean Economy

51	Le, H. (2009).	MA THESIS	Assessing impact of ISO 9000 certification on international trade.	2009	Clemson University
52	Grant, J. H., & Boys, K. A. (2009).	WP	Does the World Trade Organization Promote Trade? An Empirical Assessment of Agricultural and Non-Agricultural Trade Flows	2009	university of Minnesota Library
53	Yusuf, S., & Nabeshima, K. (2009).	PR	Tiger economies under threat: a comparative analysis of Malaysia's industrial prospects and policy options.	2009	The World Bank.
54	Haq, Z., & Meilke, K. (2009).	PR	The role of income in trading-differentiated agri-food products: The case of Canada, the United States, and selected EU countries.	2009	Canadian Journal of Agricultural Economics
55	Iwanow, T., & Kirkpatrick, C. (2009).	PR	Trade facilitation and manufactured exports: Is Africa different?	2009	World Development
56	Olper, A., & Raimondi, V. (2009).	PR	Patterns and Determinants of International Trade Costs in the Food Industry	2009	JOURNAL OF AGRICULTURAL ECONOMICS

Note: WP – working papers, PR – peer-reviewed.

APPENDIX 2: List of excluded studies

NO.	Literature Title	First Author	Year	Justification for exclusion
1	A Spatial interaction model with spatial dependence for trade flows in Oceania: a preliminary analysis	Marie LEBRETON (2009).	2009	excluded as it does not have island variable on its gravity model output
2	Trade and the Spillovers of Transnational Terrorism	José de Sousa (2009).	2009	excluded as it does not have island variable as it explains trade and spillover effects of transnational terrorism

3	Are exports of China, Japan, and Republic of Korea diverted in the major regional trading blocs?	Lee, H. H., Park, E., & Koo, C. M (2009)	2009	exclude as it was captured in doubted to include in the year 2008
4	Trade Barriers or Trade Catalysts? The Effects of Phytosanitary Measures on U.S. Fresh Fruit and Vegetable Imports	Vuko Karov (2009).	2009	excluded as it only talks of US imports of fruits and vegetables policies that affected them and no island variable included in the model
5	Trade-based Diffusion of Labor Rights: A Panel Study, 1986–2002	BRIAN GREENHILL (2009).	2009	excluded as it does not have island variable
6	Understanding bilateral FDI flows in developing Asia	Rabin Hattari	2009	excluded as it does not have island variable in its model and topic is on FDI and not trade
7	Credible Commitment through PTAs and their Effects on Trade: A Study of Asia's Reciprocal Trade Agreements	Kim, S. Y. (2009, September).	2009	excluded as it was included in the year 2008
8	Monetary Policy Transmission Mechanism in Vanuatu	T. K. Jayaraman (2009)	2009	excluded as its topic is on monetary policy and not trade
9	Economic Integration in the Indian Subcontinent A study of Macroeconomic Interdependence	*T. K. Jayaraman (2009)*	2009	excluded as it does not apply the gravity model as well as no island variable
10	The Role of International Investment Agreements in Attracting Foreign Direct Investment to Developing Countries	UNCTAD POLICY SERIES	2009	excluded as it does not apply the gravity model as well as no island variable
11	Exit During Crisis: How Openness, Migration, and Economic Crisis Affect Democratization	Joseph Wright (2009)	2009	excluded as its topic is on democratization and not trade and its gravity model does not have the island variable
12	Developing Indicators for Regional Economic Integration and Cooperation	*Giovanni Capannelli. (2009).*	2009	excluded as there is no island variable and they are developing regional integration indicators not trade
13	Increasing the Net Benefits from Fisheries and Associated Sectors in Seychelles	Campling*, L., (2009).*	2009	excluded as it does not apply the gravity model as well as no island variable
14	Pacific islands countries trade: role of remoteness on cost	LISA BORGATTI. (2008).	2008	DOUBTED To include as it does not have island variable but can we use remoteness as representative of island?
15	Differentiated Agri-Food Product Trade and the Linder Effect	Zahoor Ul Haq. (2008).	2008	doubt to include as it has island variable investigating Linder effect on agricultural and beverage food trade

16	A gravity analysis of global dairy products trade	ZAHOOR UL HAQ. (2008).	2008	doubt to include as it has only dairy trade at global level with island variable as exogenous
17	Are Exports of China, Japan and Korea Diverted in the Major Regional Trading Blocs	Hyun-Hoon Lee (2008)	2008	doubt to include as it researches on only exports from China, Korea and Japan to their RTA members
18	On the Role of Distance for Bilateral Trade	Peter Egger (2008).	2008	excluded AS it does not have island as part of exogenous variable while investigating role of distance in bilateral trade
19	Expanding trade within Africa: the impact of trade facilitation	Dominique Njinkeu (2008)	2008	excluded as it does not have island as exogenous variable
20	Small island states development challenges	MARK McGILLIVRAY (2008).	2008	excluded as it does not have island variable and did not apply the gravity model
21	Causal Relationships Between Current Account Imbalances and Budget Deficits in Pacific Island Countries	T.K. Jayaraman (2008).	2008	excluded as it does not talk about trade but capital account and deficit in pacific islands
22	Intra-African Trade Obstacles: The Role of Business Environment	Bruno Powo Fosso (2008).	2008	excluded as it does not have island variable
23	The Determinants of Cross-Border Investment: A Value-Chain Analysis	Claudia Canals (2008).	2008	excluded as it investigates value-chain analysis and not trade
24	Regionalization of Trade and Regionalism in Trade Policy	Georg Koopman (2008).	2008	excluded as it does not have island variable
25	North, South and distance in the gravity model	Jacques Melitz	2007	Estimated using gravity model but no Island variable
26	Pacific Island's Bilateral trade: The role of remoteness and of transport costs	Lisa Borgata	2007	Estimated using gravity model but no Island variable
27	Using gravity to move Arming ton An empirical approach to the small initial trade share problem in general equilibrium models	Marijke Kuiper	2007	Estimated using gravity model but no Island variable
28	The "Peace Dividend," SAFTA, and Pakistan–India Trade	Eugenia Baroncelli-Chapter 3	2007	No gravity, No island. CHECK PAGE 67
29	SHARING GRAVITY: GRAVITY ESTIMATES OF TRADE SHARES IN AGRI-FOOD	Marijke Kuiper	2007	Estimated using gravity model but no Island variable
30	The wise use of dummies in gravity models: export potentials in the Europe region	Juan M. Ruiz	2007	Estimated using gravity model but no Island variable

31	Determinants of trade and investment in Southeast Asia: an application of the gravity trade model	Kawana Hemkamon	2007	Estimated using gravity model but no Island variable
32	History, regionalism, and CARICOM trade: A gravity model analysis	H. Mikael Sanberg	2006	Estimated using gravity model but no Island variable
33	Does the Gravity Model Explain India's Direction of Trade? A Panel Data Approach	Ranajoy Battarachaya	2006	Estimated using gravity model but no Island variable
34	Trade frictions and welfare in the gravity model: how much of the iceberg melts?	E.J Balistretri	2006	Estimated using gravity model but no Island variable
35	Regional Trade Integration and Spatial Effects in the Euro-Mediterranean Zone	Moallemi, Mozhgan (2005).	2005	excluded as it does not have island variable
36	An exclusive country club: the effects of the GATT on trade, 1950–94	JOANNE GOWA (2005).	2005	excluded as its gravity model output does not give the result of island variable
37	The Effects of Financial Crises on International Trade	Takatoshi Ito (2005).	2005	doubt to include as it investigates effects of financial crisis on trade and have island variable
38	The Variety and Quality of a Nation's Exports	DAVIDH UMME (2005).	2005	excluded as it does not incorporate island variable and no gravity model used
39	Possibilities and Challenges for Financial Integration in East Asia: Lessons from a Comparative Regional Perspective	Kwan S. Kim (2005).	2005	excluded as it does not have island variable and it majors on financial crisis
40	Preferential trade agreements and China's trade	Calla Wiemer (2004).	2004	it has the island variable in its gravity model but the islands are separated as imported and exporter
41	Transshipment in the United States	Soamiely Andriamananjara (2004).	2004	excluded as it does not have island variable in transshipment trade from US
42	How Do Institutions Affect International Relations? Standing, Embeddedness, and the GATT/WTO	Michael Tomz (2004).	2004	although it does not directly talk about trade but the institutions handling trade, the effects of being a member and the model has the island variable
43	Official Dollarization/Euroization: Motives, Features and Policy Implications of Current Cases	Adalbert Winkler (2004)	2004	excluded as it does not talk about trade but currency and no island nor gravity model
44	Essays on financial crisis	Zihui, Ma (2004).	2004	its topic majors on financial crisis and not trade hence

				excluded and did not employ gravity model
45	Regionalism in global trade	Das, D. K. (2004). Regionalism in global trade. Edward Elgar Publishing.	2004	it does not have island variable in its model only mentioning of islands in text
46	Trade Flows and Spatial Effects: The Gravity Model Revisited	Porojan, A. (2001).	2001	excluded as it does not have island variable in its gravity model of trade flows
47	National Money as a Barrier to International Trade: The Real Case for Currency Union	ANDREW K. ROSE. (2001).	2001	excluded as it does not have island variable
48	Purchasing Power Parity Tests in Cointegrated Panels	Pedroni, P. (2001).	2001	this paper majors on purchasing power parity measure and not trade hence excluded
49	Monetary Union in West Africa (ECOWAS)	Masson, Paul R. (2001).	2001	excluded as it does not have island variable and paper topic is on monetary union in ECOWAS
50	Technological Changes in the Transportation Sector Effects on US Food and Agricultural Trade	William Coyle (2000).	2000	excluded as it does not have island variable
51	How taxing is corruption on international investors	Wei, Shang Jin (2000).	2000	excluded it does not have island variable
52	Estimating the Impact of Time-Invariant Variables on FDI with Fixed Effects	Ronald B. Davies Delia Ionascu (2000).	2000	excluded as it investigates FDI and not trade
53	100—Economic development, fluctuations, planning	Preston, P. W. (2000).	2000	excluded it gives only abstracts of 100 articles hence not included
54	Trade facilitation, regulatory quality and export performance.	Iwanow, T., & Kirkpatrick, C. (2007).	2007	Excluded as it had no island variable in their model
55	Pacific islands' bilateral trade: the role of remoteness and of transport costs	Borgatti, L. (2008).	2008	Excluded as it does not have the island in the model but the countries under examination are pacific islands
56	Exchange rate regimes and trade.	Adam, C., & Cobham, D. (2007).	2007	Excluded as it only had island in the model but they dropped it while running regressions with landlocked variable
57	*Three essays on the impact of preferential trade agreements on development, trade, and investment*	Medvedev, D. E. (2007).	2007	Excluded as it qualitatively explains the island while another essay does not have island variable in their model output

58	*Estimating the Impact of Time-Invariant Variables on FDI with Fixed Effects*. Department of Economics, Copenhagen Business School.	Ionascu, R. B. D. D., Kristjánsdóttir, H., & Davies, R. B. (2000).	2000	Excluded as it investigates the effects of being island to FDI which is not trade

APPENDIX 3: Studies included in the meta-analysis: Overview of the evidence base

ID	study	Pub Type	no.countries	nobs	Data start	Data end	No. Est	Mean Est	sdev
1	Rose, A. K., & Engel, C. (2000).	WP	210	4493	1995	1995	1	0.140	
2	Rose, Andrew K. (2001)	WP	210	31101	1970	1995	1	0.040	
3	Limao and Venables (2001)	PR	103	4516	1990	1990	26	0.148	0.265
4	Reuven Glick and Rose A. (2002)	PR	217	219558	1948	1997	1	0.050	
5	Yetman, J. (2002)	PR	217	219558	1948	1997	1	0.050	
6	Clarete etal (2003)	PR	83		1990	1990	12	0.089	0.046
7	Inmaculada Martinez-Zarzoso (2003)	PR	47	1449	1999	1999	10	-0.115	0.187
8	Alho, K. E. (2003)	WP	27		1999	1999	2	0.063	0.143
9	Estevadeordal et al (2003)	PR	40	808	1870	1939	6	-0.127	0.014
10	Ghosh, S., & Yamarik, S. (2004)	PR	186	14522	1970	1995	1	-0.047	
11	Monitor, F., & Outlook, R. E. (2004)	PR	124	8531	1975	2000	30	-0.434	3.270

12	Nordås & Piermartini (2004)	WP	138	1304		2000	84	0.005	0.503
13	Eichengreen, Rhee & Tong(2004)	WP	193	14399	1990	2002	17	-0.316	0.181
14	Rose, Andrew K. (2004)	PR	175	114615	1948	1999	4	-0.235	0.431
15	Goldstein, J., Rivers, D., & Tomz, M. (2005).	WP	175	234597	1948	1999	4	-0.235	0.530
16	Yamarik and Ghosh (2005)	PR	186	14522	1975	1995	3	0.023	0.099
17	Dee and Gali(2005)	WP	116	373520	1970	1997	16	0.218	2.159
18	Wilson Et al (2005)	PR	75	7904	2000	2001	3	-0.248	0.023
19	Naya and Plummer (2006)	PR	178	183328	1948	1998	9	0.025	0.231
20	Lee Koo and Park (2006)	PR	140	137	2003	2003	12	-0.395	0.230
21	Hapsari and Mangunsong (2006)	WP	19	1131	1988	2003	5	0.166	0.324
22	Derosa D. and Gilbert J. (2006)	PR	178	61000	1962	1999	30	0.201	0.246
23	Bora, B., & Liu, X. (2006)	WP	217	147319	1988	2003	4	1.065	2.641
24	Felbermayr, G. J., & Kohler, W. (2006)	PR	178	102823	1950	1997	2	-1.456	0.689

25	Klein, M. W., & Shambaugh, J. C. (2006)	PR	181	168868	1973	1999	4	0.241	1.408
26	Amita Batra (2006)	PR		5801	2000	2000	10	0.071	0.039
27	Kucera, D., & Sarna, R. (2006)	PR	162	10995	1993	1999	10	0.193	0.353
28	Ram, Y., & Prasad, B. C. (2007)	Book		4796	2000	2000	12	0.108	0.048
29	Tomz, M., Goldstein, J. L., & Rivers, D. (2007)	PR	175	234597	1948	1999	4	-0.235	0.530
30	Ghani, G. M. (2007)	PR	175	55912	1948	1999	12	0.420	0.612
31	Rose, A. K. (2007).	PR		4123	2002	2003	4	-0.253	0.015
32	Adam, C., & Cobham, D. (2007).	WP	165	18692	1973	2004	13	-0.022	0.048
33	Soloaga, I., & Montenegro, C. E. (2007).	WP	130			1980	44	0.143	0.142
34	Yener Kandogan (2007)	PR	99	53488	1992	1999	6	0.387	0.251
35	Hans-Jürgen Engelbrecht & Christopher Pearce (2007)	PR	46	23952	1965	1997	5	-4.948	#####

36	Blyde, J., & Sinyavskaya, N. (2007)	PR	62	24451	1980	1999	73	-0.118	0.429
37	Moktan, S. (2007).	WP	7	420	1996	2005	48	-2.381	6.601
38	Márquez-Ramos et al (2007)	PR	65	3347	1999	1999	40	0.218	0.482
39	Nordås, H. K. (2007).	WP	192	835	1996	2004	48	0.130	1.216
40	Yu, M. (2007).	WP	134	45792	1974	1998	4	0.343	0.160
41	Le, H. (2009).	MA THESIS	147	191959	2004	2004	40	0.251	0.098
42	Grant, J. H., & Boys, K. A. (2009).	WP		361777	1980	2004	19	0.270	0.037
43	Yusuf, S., & Nabeshima, K. (2009).	WP	9	7456	1990	2006	3	-0.740	0.328
44	Haq, Z., & Meilke, K. (2009).	PR	52	1359	1990	2000	18	2.701	3.876
45	Iwanow, T., & Kirkpatrick, C. (2009).	PR	124	7825	2003	2004	9	0.177	0.186
46	Olper, A., & Raimondi, V. (2009).	PR	70	2571	1976	2000	4	-0.412	0.206
47	Balding, C. (2010).	PR	177	419910	1950	1999	8	-0.027	0.384
48	Edmonds, C., La Croix, S., & Li, Y. (2008).	PR	157	179919	1985	2002	4	-1.055	1.115

49	Kandogan, Y. (2008).	PR	99		1992	2005	10	0.604	0.385
50	Moktan, S. (2008).	PR	7	882	1985	2005	8	1.186	1.034
51	NANDASIRI, K. H. (2008).	MA THESIS	184	9832	1998	1998	52	0.453	0.160
52	Hicks, R., & Kim, S. Y. (2008)	WP	161	97727	1970	2003	6	-0.042	0.200
53	João, C. L. (2008).	PR	168	1152	1991	2005	2	-0.020	0.000
54	Malhotra, N., & Stoyanov, A. (2008).	WP	197	29496	1988	2005	8	-0.214	0.269
55	Rose, A. K. (2008).	WP	196	449220	1950	2006	6	-0.338	1.741
56	Chang, K., Hayakawa, K., & Lee, H. (2008).	PR	118	13806	2002	2004	30	-0.316	0.235

APPENDIX 4: DESCRIPTIVE STATISTICS OF EFFECT SIZE OF ISLAND TO TRADE

	ALL OBSERVATIONS		**EXCLUDING OUTLIERS**		**weighted all studies**		**weighted all studies Excluding outliers**		**median per study**	
Variable	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean	Obs	Mean
REGIONS										
developed countries	44	1.056	37	0.083	44	0.254	37	0.192	2	0.960
developing countries	183	-0.528	121	0.164	139	0.078	121	0.129	4	0.139
ALL/both categories	161	0.031	132	0.166	138	0.001	132	0.010	15	0.034
uncategorized	460	0.006	299	0.053	307	0.133	299	0.117	35	0.010
DATA TYPE										
cross-sectional data	360	0.115	211	0.176	212	0.146	211	0.147	12	0.115
Panel data	483	-0.176	374	0.060	411	0.067	374	0.058	42	0.045

time series data	5	0.203	4	0.241	5	0.060	4	0.076	2	0.028
MODEL										
OLS	583	-0.060	436	0.090	456	0.081	436	0.079	38	0.023
TOBIT	90	0.154	28	0.143	28	0.065	28	0.065	4	0.252
PPML	24	-0.300	23	-0.139	24	-0.160	23	-0.133	0	0.000
RE	39	0.070	8	-0.449	8	-0.067	8	-0.067	4	-0.185
FGLS	34	0.465	32	0.473	34	0.436	32	0.470	1	0.465
HECKMANN	27	1.859	20	0.341	27	0.271	20	0.211	2	1.224
OTHERS	51	-1.626	42	0.052	51	-0.037	42	-0.022	7	-0.101
PUBLICATION										
NOT PEER-REVIEWED	437	-0.146	248	0.171	269	0.098	248	0.102	22	0.070
PEER-REVIEWED	411	0.052	341	0.053	359	0.086	341	0.072	34	0.053
DISAGGREGATED DATA										
all data	530	-0.094	407	0.183	433	0.154	407	0.152	39	0.084
data disaggregated into sectors/products	318	0.024	182	-0.075	195	-0.160	182	-0.158	17	0.004
DEPENDENT VARIABLE										
exports	365	-0.056	308	0.176	337	0.112	308	0.113	20	0.162
imports	235	0.081	82	0.022	84	0.132	82	0.092	12	0.039