REVIEW OF INNOVATION AND COMPETITIVENESS

A JOURNAL OF ECONOMIC AND SOCIAL RESEARCH

5
VOLUME
ISSUE 1
2019

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The print issue is published annually, with continuous publishing of individual articles online.
Annual subscription: 200 HRK.
Journal is published with the help of Ministry of science and education.

Design

Koncept, Pula

Print

Grafika Režanci, Režanci

Copies

50

JOURNAL DOI: 10.32728/ric
ISSUE DOI: 10.32728/ric.2019.51

ISSN (Print): 1849-8795

ISSN (Online): 1849-9015

THE GRAVITY MODEL OF TRADE: A THEORETICAL PERSPECTIVE

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Article info
Paper category: Original Research Paper
Received: 8.6.2018.
Accepted:19.2.2019.
JEl classification: F1, F10
DOI:10.32728/ric.2019.51/2

Keywords
Gravity Model; International Trade; Economic Theory; Comparative Advantage; Heckscher-Ohlin Model; Linder Hypothesis; Border, Distance; Competitiveness

ABSTRACT

Purpose. *The purpose of this study is to trace the theoretical developments of the gravity model of trade. The key question is: what are the dominant features of the development of the gravity trade model?*

Methodology. *This research is conducted by employing a number of methods that include the historical, descriptive and analytical methods. The main contribution of this paper is to trace the historical and theoretical development phases of the gravity model.*

Findings. *This study is a novel attempt in terms of the identification of the four distinctive phases of the development of the gravity model. This work would, therefore, expand the existing literature on the gravity model. We argue that the development of the gravity model is the outcome of many research efforts. A large body of literature has given the model a solid theoretical foundation. But there is no consensus about the proper econometric estimation methods of the model. The gravity model is significant both historically and analytically. It is a useful tool for the analysis of international trade. It has become a popular research device used by the researchers and policy makers around the world. The gravity is regarded as one of the most successful models in the literature of international economics.*

Originality. *The original contributions of this paper lie in streamlining the consistent historical development of the gravity model over a longer period of time-frame, ranging from 1885 to 2018.*

Limitations and Implications. *This work is theoretical aspects of the trade gravity model. Future researchers could overcome the limitations by combining the theoretical and empirical studies in a paper. This paper can help the future researchers in dealing with the broad body of literature of gravity model.*

Acknowledgement. *This study was supported by the National Natural Science Foundation of China (grants No.71673223 & 71473197), and a PhD scholarship from the China Scholarship Council (CSC). The first author would like to thank the CSC for the financial support. He also acknowledges the invaluable research advice and guidance received from Dr. Yoto V. Yotov, professor at the School of Economics of the Lebow College of Business at Drexel University, Philadelphia, USA. The authors are highly grateful to the anonymous reviewers, managing editor, and the editor-in chief for their kind help and critical comments on the earlier drafts of the paper. However, the authors are responsible for the contents and limitations of the study. They declared no conflict of interests.*

1. INTRODUCTION

The gravity equation has long been an institutionalized topic of research in economics. There has been a great deal of studies with regard to the gravity model. The recent works of Anderson and Yotov (2017); Yotov et al. (2016); Helpman (2011); Bernhofen (2013) and Van Bergeijk and Brakman (2010) are the glaring instances of the growing theoretical literature on the gravity model of trade. The model has been widely used in many empirical fields; such as, the international migration (Beine, Bertoli, and Moraga 2016) , tourism (Santana-Gallego, Ledesma-Rodríguez, and Pérez-Rodríguez 2016), health care (Teow et al. 2018), agriculture and livestocks (Atif, Haiyun, and Mahmood 2017, Luo and Tian 2017), international trade (Batra 2006, Edmonds, La Croix, and Li 2008, Irshad et al. 2018, Erdey and Pöstényi 2017, Huot and Kakinaka 2007, Kahouli 2016, Rahman 2010, Narayan and Nguyen 2016, Gashi, Hisarciklilar, and Pugh 2016, Zhou, Li, and Lei 2019, Shahriar, Qian, and Kea 2019, Martínez-Zarzoso and Johannsen 2017, Kohl 2019) , and investment (Pericoli, Pierucci, and Ventura 2014, Liu et al. 2017, Chang 2014). The gravity model has, in this way, become a useful tool of international trade analysis. It is a device to explain international capitals and labor flows. But, the development of the model is not linear due mainly to the lack of theoretical foundations up to 1960s. In a thesis, Starck (2012) addressed the theoretical development of the gravity in respect to the factors that brought gravity modeling into mainstream economics. Starck's 2012 thesis wasn't aimed at identifying the historical developments of the gravity model. The existing review essays, articles and books on the development of the international trade theory would allow one to understand together the development of the gravity model. At present, there is no study that documents the systematic developments of the gravity model in its different historical periods. This study intends to fill the research gap. So, the main purpose of the paper is to trace the theoretical and historical developments of the gravity model of trade. The main contributions of this paper lie in streamlining the consistent historical development of the gravity model over a longer period of time-frame ranging from 1885 to 2018.

The paper is organized as follows. Section 1 is an introduction, followed by section 2 that elucidates the materials and methods as well as draws the hypothesis from the international trade and economic theories. Sections 3 analyzes the historical developmental phases of the gravity model, addresses the key econometric issues and presents the analytical results. Finally, section 4 concludes the paper.

2. MATERIALS AND METHODS

This study is historical, descriptive and analytical in nature. We have largely relied on the secondary materials. For the sake of delimitation of the scope, the paper will focus on the theoretical works of the gravity model for the period, 1885-2018.To

put the analysis into its proper perspectives, some hypotheses are drawn from the international trade theories in the next section.

2.1. Theoretical Background

2.1.1. Theory of Absolute Advantage

Adam Smith articulated the benefits of trade in his theory of absolute advantage. The theory of absolute advantage is an extended version of his doctrine of the division of labor (Smith 1993).

2.1.2. Theory of Comparative Advantage

David Ricardo developed the first comprehensive theory of comparative advantage in his classic book entitled *On the Principles of Political Economy, and Taxation* (1817). He developed the now familiar model with two countries, two goods and single input, labor. According to him, comparative advantage is the main reason for international trade between two countries. Trade between two countries can benefit both countries if each country exports the goods in which it has a comparative advantage. The Ricardian model shows how difference between economies give rise to trade and gains from trade. Ricardo's model remains one of the greatest insights in economics (Krugman and Obstfeld 2002). He developed the theory of comparative advantage to illustrate the benefits of free trade (Helpman 2011). In a research paper, Ruffin (2002), a noted economist observed as follows,

Ricardo's discovery of the law of comparative advantage must rank as one of the most remarkable stories in the history of economic thought (2002: 746).

Furthermore, the concept of revealed comparative advantage is widely applied to measure the competitiveness of trade and commodities. In this regard, Balassa's revealed comparative advantage and Vollrath's export competitiveness are of special impotence (French 2017, Cai and Leung 2008, Béla 1965).

2.1.3. The Specific Factors Model

This model was developed by Paul Samuelson and Ronald Jones (Krugman and Obstfeld 2002). It gives emphasis on the specific factors of productions. The model assumes an economy that produces two goods and that can allocate its supply of labor between the two sectors. Unlike the Ricardian model, however, the specific factors model allows for existence of factors of production besides labor. Whereas labor is a mobile factor that can move between sectors, these other factors are assumed to be

specific. Factors specific to export sectors in each country gain from trade, while factors specific to import-competing sectors lose. Mobile factors that can work in either sector may gain or lose.

2.1.4. The Heckscher-Ohlin (HO) Model

The HO model was considered as the backbone of international trade in the last many decades. It is one of the most influential theoretical constructs in international economics.

The HO model has been one of the fundamental theorems in theory (Fujiwara and Shimomura 2005). This model focuses on differences between countries in their relative factor endowment and differences between on their commodities in the intensities with they use these factors. It emphasizes the interactions between the proportions in which they are used in producing various kinds of goods. Countries usually tend to export the products that are intensive in the factors with which they are abundantly supplied. The model demonstrate that comparative advantage is influenced by the interaction between nation's resources (the relative abundance of factors of productions) and the technology of production. The model is known as the theory of factor-proportions.

2.1.5. Monopolistic Competition Model

Paul Krugman adopts the Dixit and Stiglitz (1977) model of monopolistic competition whereby a consumer's utility is positively related to a number of varieties of manufactured products and each variety is produced subject to the increasing returns to scale that results when an element of fixed costs is added to labor cost that are proportional to outputs. Krugman's 1979 paper assumes that each country produces many varieties of a single type of good, whereas elements of inter-sectoral trade are introduced in his 1980 paper by letting each country produce two kinds of products, with many varieties of each kind (Krugman, 1979; Krugman, 1980). Trade may be divided into two varieties in the model of monopolistic competition. Within an industry two-way trade in differentiated products is called intra-industry trade; trade that exchanges the products of one industry for the products of another is called inter-industry trade. Intra-industry trade shows economies of scale, interindustry trade reflects comparative advantage. Intra-industry trade does not generate the strong effects on income distribution as interindustry trade. Helpman (1987) produced a pioneering work which for the first time confronted the monopolistic competition model with data and showed that its main predictions were consistent with manufacturing trade between advanced industrial economies.

2.1.6. 'New Trade' Theory

Many of the contentious problems raised by Ricardo continue to resonate in the twenty-first century. His ideas and innovative propositions remain valid in the contemporary economic systems (Peach, 2007; King, 2013) . We are also witnessing the revival of the Ricardian trade theory led by the work of Eaton and Kortum (2002). The Eaton-Kortum model is a kind of Ricardian many country many good trade models with bilateral trade costs. There are different lines of explanations and modeling of the 'new trade' theory (Alvarez and Lucas, 2007; Naito, 2017). But the innovative idea is a two-parameter probabilistic model that creates the requirement of inputs for producing each good. One of the remarkable features of the model is that it enables us to analyze the effects of trade openness and liberalization on the extensive margins of trade. The role of firms in trade is on the rise. Several economists provides a link between firm-level and aggregate observations that allows for a general equilibrium examination of the effect of aggregate shocks on individual firms (Eaton, Kortum, and Hramarz, 2011). The world trade is currently characterized by two factors: the rise of interindustry trade and technologically sophisticated multinational firms (Melitz and Trefler, 2012).

3. ANALYSIS AND DISCUSSION

3.1.Development of the Gravity Model

This section is organized to provide a theoretical perspective on the developments of the gravity model. The developments of the gravity model can be discussed systematically in several developmental phases:

- 1885-1962: The Historical Roots of The Gravity Equation
- 1962-1966: The Beginning of the Traditional Gravity Model
- 1966-2003: The Theoretical Foundations of the Gravity Model
- 2003- 2017: The Revival of the Gravity Model

The next section elaborates the historical developmental phases of the gravity model.

3.1.1. 1885-1962: The Historical Roots of the Gravity Equation

The motivation of the gravity was drawn from Newton's Law of Universal Gravitation proposed in 1687. According to Newton, an object in the globe attracts any other particle thanks to a force that is proportional directly to the product of their masses and inversely proportional to the square of the distance between them. In that context, an early cogent formation was the 1885 publication of Regenstein's paper titled *The Laws of Migration*. He tried to explain how the 'currents' of migration

are driven by the 'absorption of center of commerce and industry' but grow less with the distance proportionately'. Afterwards Linder (1961) and Samuelson (Samuelson, 1948, 1949). advanced their concepts known as 'Linder hypothesis and 'Factors-price equalization' respectively that were useful in the building of trade theories (Bergstrand, 1990a; Choi, 2002; Mcpherson, Redfearn, and Tiesla, 2000). They were basically concerned with the gains from trade.

3.1.2. 1862-1966: Beginning of the Traditional Gravity Model

A group of Dutch economists led by Tinbergen was the first to formulate the mathematical equation of gravity-type model and applied it in an empirical setting. Tinbergen pioneered the gravity equation in his seminal work entitled *Shaping the World Economy* (1962). He supervised the PhD thesis of Linnemann (1966). In the literature, Tinbergen is credited as the first author to econometrically identify what has now become a benchmark traditional gravity model for studying international trade flows. He was the first 1969 Nobel laureate for his outstanding contributions in the world economy. In fact, his work has become the standard text of reference to the early version of the traditional gravity equation (Van Bergeijk and Brakman, 2010). Tinbergen's work is also important in spurring more publications by his students. Pöyhönen (1963) Pulliainen (1963) and Linnemann (1966) worked to further develop the theoretical foundations of the gravity equation. There are some interesting questions that are not covered in this paper. What made Tinbergen decide to use an equation from physics? Did he think it was an adequate and realistic representation of international trade or was it just a pragmatic and convenient model? Was he criticized by peers for presenting a model with any theoretical foundation? How did the community of economists respond to such an a-theoretical model? These questions could profitably become the objects of further scientific inquiries to the historians of economic thoughts and analyses.

However, Linnemann (1966) used the gravity in an extensive empirical analysis. His book is a major breakthrough in terms of empirical calculations of aggregate trade flows and remains a classic reference source.

The traditional gravity equation is as follows:

$$Trade_{ij} = \alpha . \frac{GDP_i . GDP_j}{Distance_{ij}} \quad (1)$$

Where, $Trade_{ij}$ is the value of the bilateral trade between country i and j, GDP_i and GDP_j are country i and j's respective national incomes. Distance is a measure of the bilateral distance between the two countries and is a constant of proportionality. Taking logarithms of the gravity model equation as in (1) we get the linear form of the model and the corresponding estimable equation as:

$$\log(Trade_{ij}) = \alpha + \beta_1 \log(GDP_i . GDP_j) + \beta_2 \log(Distance) + u_{ij} \quad (2)$$

Where α, β_1 and β_2 are coefficients to be estimated. The error term, u_{ij}, captures any other shocks, events, and unobserved factors that may affect bilateral trade between the two countries.

Equation (2) is the core gravity equation where bilateral trade is predicted to be a positive function of income and negative function of distance.

3.1.3. 1966-2003: The Theoretical Foundations of the Gravity Model

Anderson was the first economist who formed the theoretical economic foundation for the gravity equation under the assumptions of product differentiation by place of origin and Constant Elasticity of Substitution (CES) expenditures. Anderson's ground-breaking study was based on the Armington assumption (1969). Incorporating the product differentiation approach, Anderson derived the gravity equation which explains the presence of income variables in the model. Some early contributions to gravity literature are the outstanding papers of Bergstrand (Bergstrand, 1990a; Bergstrand, 1985, 1989). He was the second author to provide the microeconomic bases of the gravity model. He developed a relationship between trade theory and bilateral trade, and included the supply side of the economy explicitly. During this period, some authors have contributed remarkably to the development of trade theory (Brakman and Garretsen, 2009; Helpman and Krugman, 1985; Krugman and Obstfeld, 2002; Helpman, 1984; Helpman, Melitz, and Rubinstein, 2008). Based on the research on eighteen industrial countries, Helpman (1987) established a linkage between the monopolistic competition model and gravity model. The gravity approach thus was gradually gaining its economic foundations. In a paper Kabir, Salim, and Al-Mawali (2017) discussed the development and application of the gravity model into the four broad themes: 1) generalized gravity model; 2) intra-industry trade; 3) homogeneous and heterogenous products and 4) structural gravity model.

Deardorff (1998) revealed that the gravity model was consistent with a large number of trade models such as HO model, increasing returns to scales, Ricardian model and so on. Evenett and Keller (2002) showed that only two important theories namely, HO model and increasing returns to scale are enough to explain the success of the gravity equation. In the meantime, McCallum (1995) published an influential paper that used the gravity equation to estimate the influence of national borders on the Canada-U.S. regional trade patterns using data on interprovincial and international trade by Canadian provinces for the period 1988-1990.

McCallum (1995) showed that, other things being equal, the estimated interprovincial trade was more than 20 times larger than trade between the Cana-

dian provinces and the US states. Since the seminal publications of McCallum (1995) and Helliwell (1997), the economists have wondered how borders could generate a home bias in consumption. The 'border effect' has thus been one of the most discussed topics for investigations (Carter and Goemans, 2018; Feenstra, 2002; Magerman, Studnicka, and Van Hove, 2016). There are a great deal of analyses and works centering on the question of border effects that are familiar in the literature as the 'McCullum Border Puzzle.' A study analyzed the border effects on the extensive and intensive margin of trade to solve the distance puzzle and concludes that the distance puzzle remains unsolved (Cheong, Kwak, and Tang, 2015).

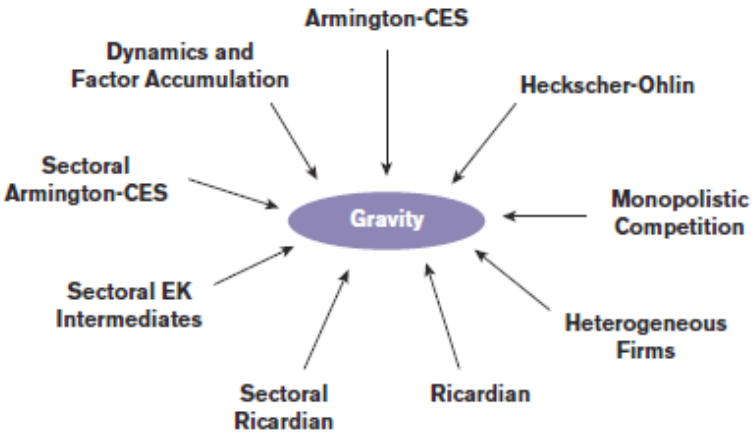
3.1.4. 2003- 2017: The Revival of the Gravity Model

This period has generated renewed interest in the gravity model. There has been a proliferation of studies using the gravity model. Why have the researchers been interested in application of the model?

In this regard, several factors could be accounted. **First**, Anderson and van Wincoop (2003) provided an apparent solution to the problem of McCallum border puzzle. According to their study, the gravity equation estimated by McCallum is suffering from omitted variable bias. They used the same dataset used by McCallum to establish their arguments, and Anderson and van Wincoop (2003) thus developed a more consistent and efficient model by adding the multiple resistance factors and applied it to solve the famous McCallum border puzzle. The gravity model is the main tool to link trade barriers and costs. Research indicated how trade costs affect and therefore act as a source of comparative advantage or disadvantage (Milner and McGowan, 2013). **Second**, there is a resurgence of gravity theory and applied works. Hundreds of papers and books have used the gravity model to study and quantify the effects of various determinants of international trade. Even for the first time, gravity equation got treated and discussed in a separate chapter of a textbook (Feenstra, 2004). Various types of models are emerging in the literature in accordance with the nature of data and estimation methods. For instance, the dynamic gravity model is proposed in the presence of panel data (Olivero and Yotov, 2012). In addition, Head and Mayer (2015) studied the estimation procedures, technical questions and theoretical interpretations of the gravity model and described the success of gravity model as 'workhorse, toolkit and cookbook'. As a result of the previous studies the model, in no way, is an intellectually 'orphan' rather is now connected to the rich family of economic theory (Anderson and Yotov, 2017; Anderson, 2004; Anderson and van Wincoop, 2004; Feenstra, Markusen, and Rose, 2001; Helpman, Melitz, and Rubinstein, 2008; Bergstrand 1985). According to Yotov et al. (2016) there are at least five remarkable arguments that may explain the great success and popularity of the gravity model.

1) Intuitive Model: The gravity model of trade is very intuitive. It resembles Newton's Law of Gravity.
2) Strong Theoretical Foundations: The gravity model of trade is a structural construction with strong theoretical foundations (Figure 1.) This property makes the gravity framework particularly appropriate for counterfactual analysis, such as quantifying the effects of trade policy.

Figure 1.: Gravity model's strong theoretical foundations



Source: adapted from Yotov et al. (2016: 12).

3) General Equilibrium: The gravity model represents a realistic general equilibrium system. That general equilibrium environment simultaneously accommodates multiple countries, multiple sectors, and even firms.
4) Flexible Structure: The gravity model is a flexible approach. The flexible structure of the gravity can be integrated within a wide class of broader general equilibrium frameworks in order to study the links between trade and labor markets, investments, environments, climate change etc.
5) Predictive Power: Social science research and economic modeling have four basic purposes: exploration, description, explanation, and prediction (Ethridge, 2004; Babbie, 2007) . One of the most attractive characteristics of the gravity model is its predictive capacity. Empirical nature of gravity equations of trade flows consistently delivers a remarkable fit between 60 and 90 percent with aggregate data as well as sectoral data for both goods and services (Van Bergeijk and Brakman, 2010).

3.2. Econometric Techniques and Methods of the Gravity Model

The econometric specification of the gravity model is a debatable topic in the literature. There is no uniformity of consensus about the econometric specification

of the gravity model (Egger, 2002; Kalirajan, 2008; Nuroğlu and Kunst, 2013; Matyas, 1997; Baltagi, Egger, and Pfaffermayr, 2015; Bergstrand, Egger, and Larch, 2013). The advantages of using panel data are well known. First, the much larger sample size in comparison with cross-sectional or time-series studies increases the precision of regression estimates. Second, it can circumvent omitted variable bias and heterogeneity problems that often arise in cross-sectional investigations. The omission of important variables could lead to the biased results and misleading conclusions (Pesaran, 2015; Wooldridge, 2005; Wooldridge, 2002). Therefore, the researchers are suggested to apply the panel data for estimation of the gravity model of international trade (Baltagi, Egger, and Pfaffermary, 2015; Egger, 2002; Egger and Staub, 2015). In the next section, we will address the key econometric and the methodological aspects of the gravity model.

3.2.1. Linear Methods

Zero trade flows are a problematic issue in gravity model. The logarithm of zero is not defined. Therefore, truncations and censoring methods are proposed in the literature to address the problems of zero flows in trade datasets. There are some biases and problems in these procedures of estimation. The loss of information is a big problem. This happens due to the inefficiency of the estimation techniques. It may lead to biased estimation for the omission of data(Baldwin and Harrigan, 2011; Burger, van Oort, and Linders, 2009; Martin and Pham, 2015). In their paper, Westerlund and Wilhelmsson (2011) stated that the elimination of trade flows leads to sample selection bias. In case of commodity or sectoral trade, the prevalence of 'zero' is a common issue in the estimation of gravity model (Burger, van Oort, and Linders, 2009; Martin and Pham, 2015). However, a panel data model permits recognizing how the relevant variables evolve through time and identifying the specific time or country effects. So, there should be more efforts for methodological improvements with a view to incorporating the dynamic panel data methods.

3.2.2. Nonlinear Methods

Among the nonlinear methods the most frequently used are nonlinear least squares (NLS), Feasible Generalized Least Square (FGLS), the Heckman Sample Selection Model, Gamma Pseudo Maximum Likelihood (GMPL) and Poisson Pseudo Maximum Likelihood (PPML). Silva and Tenreyro (2006) explored the limitations of the NLS, and suggested to apply PPML model for robust estimation. Gómez-Herrera (2012) argued for the application of Heckman Sample Selection Model to avoid the inconsistent estimation of the gravity parameters. This is a two-step estimation method. In the first step, a probit model is estimated to define whether two countries trade or not. In the second step, the expected values of trade, conditional on that

country trading, are estimated using Ordinary Least Squares (OLS). Several studies suggested PPML and Heckman Selection models to ensure the robustness of results or estimations in the presence of zero trade flows (Álvarez et al. 2018, Haq, Meilke, and Cranfield 2012). Siliverstovs and Schumacher (2007) provides empirical evidence in favor of the Poisson Quasi Maximum Likelihood (PQML) methods instead of the traditional OLS. So, it can be argued that a wide range of research methods are employed to estimate the gravity parameters. Table 1. shows that each method has its own advantages and disadvantages.

Table 1.: Advantages and disadvantages of various estimation methods

Method	Advantages	Disadvantages
OLS	-Simple	-Loss of information due to the removal of zero trade flows -Biased coefficient
Tobit	-Simple -It deals with the problems of zero trade flows	-Lack of theoretical foundation
Panel fixed effects	-Simple - It controls for unobserved heterogeneity	-Loss of information -Elimination of zero trade flows Sample selection bias
Heckman model	-Different set of variables and coefficients to determine the probability of censoring and the value of the dependent variable - No multicollinearity problems - It provides a rationale for zero trade flows	-It may be difficult to find an identification restriction -Exclusion variables are required
Poisson Pseudo Maximum Likelihood (PPML)	- It deals with the zero trade flows problem. -unbiased estimates in the presence of heteroskedasticity - All observations are weighted equally - The mean is always positive	-It may present limited-dependent variable bias when a significant part of the observation.
Nonlinear Least Square	- It deals with the zero trade flows problem	-It assigns more weight to observations with a larger variance (inefficiency). -Not robust to heteroskedasticity - Sample selection bias
Feasible Generalized Least Square (FGLS)	- It deals with the zero trade flows problem - It is robust to heteroskedasticity	-The variance covariance matrix should be estimated first

Source: Gómez-Herrera, 2013.

Table 2.: Result matrix of the gravity model development

Serial	Author and work	Serial	Author and work
First phase: 1885-1962			
1	Ravenstein (1885)	4	Samuelson (1949)
2	Ravenstein (1889)	5	Linder (1961)
3	Samuelson (1948)		
Second Phase: 1962-1966			
1	Tinbergen (1962)	3	Linnemann (1966)
2	Pöyhönen (1963)		
Third Phase: 1966-2003			
1	Anderson (1979)	11	Engels and Rogers (1996)
2	Krugman (1979)	12	Matyas (1997)
3	Krugman (1980)	13	Helliwell (1997)
4	Bergstrand (1985)	14	Deardorff (1998)
5	Helpman and Krugman (1985)	15	Harris and Matyas (1998)
6	Bikker (1987)	16	Matyas (1998)
7	Helpman (1987)	17	Egger (2000)
8	Bergstrand (1989)	18	Feenstra, Markusen, and Rose (2001)
9	Bergstrand (1990b)	19	Egger (2002)
10	McCallum (1995)	20	Evenett and Keller (2002)
Fourth Phase: 2003-2018			
1	Anderson and van Wincoop (2003a)	17	Head, Mayer, and Ries (2010)
2	Feenstra (2004)	18	Olivero and Yotov (2012)
3	Lai and Zhu (2004)	19	Starck (2012)
4	Brun et al. (2005)	20	Gómez-Herrera (2012)
5	Silva and Tenreyro (2006)	21	Bernhofen (2013)
6	Kalirajan (2007)	22	Head and Mayer (2014)
7	Melitz (2007)	23	Costinot and Rodríguez-Clare (2014)
8	Helpman, Melitz, and Rubinstein (2008)	24	Bergstrand, Larch, and Yotov (2015)
9	Melitz (2008)	25	Baltagi and Egger (2015)
10	Henderson and Millimet (2008)	26	Baltagi, Egger, and Pfaffermary (2015)
11	Kalirajan (2008)	27	Egger and Staub (2015)
12	Chaney (2008)	28	Yotov et al. (2016)
13	Baier and Bergstrand (2009)	29	Anderson, Vesselovsky, and Yotov (2016)
14	Anderson (2010)	30	Sheperd (2016)
15	Lawless (2010)	31	Anderson and Yotov (2017)
16	Van Bergeijk and Brakman (2010)	32	Chaney (2018)

Source: Authors' own elaboration.

Table 2. presents the streamlined result matrix that summarizes the theoretical development trends and historical evolutions of the gravity model. The matrix shows the development of the gravity model is a gradual outcome of endless research efforts.

4. CONCLUSION

The aim of the paper has been to trace the historical and theoretical developments of the gravity model of trade. As seen above, we have contributed in a couple of ways. First, it provides an extensive literature review which includes the seminal works in the field of trade gravity model. In this regard, Tables 1. and 2. address the key econometric issues and present the development of the gravity model. Second, the paper distinguishes four phases of the developments of the gravity model and describes the main research works in these distinctive phases.

We have made two central arguments in this paper. First, the developments of the gravity model could be seen as a gradual outcome of a great deal of research efforts during a longer period of time. The contributions of many researchers have given the model a solid theoretical foundation. Second, there is no universal unity of consensus on the econometric specification of the gravity model. Different analysts and economists have employed the different econometric techniques and research methods to achieve their research goals. The properties of econometric estimations and methodologies make the gravity theory an interesting topic of research and inquiry. Further research is strongly recommended to explore the new dimensions of the gravity model. Last but not least, the future of the gravity model will largely depend on how it could be adaptable to the changing environments and trade flows along with its new analytical approach to the emerging datasets as well as the methodological innovations. This study would help future researchers in dealing with the broad body of literature on the gravity trade model.

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Journal DOI: 10.32728/ric
ISSUE DOI: 10.32728/ric.2019.51

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