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A biography of Paul Krugman: contributions to Geography and Trade*

José M. Gaspar†

Abstract

This work consists of a short survey on the academic work of Paul Robin Krugman. It seeks to shed light on his mains contributions to economic theory, mainly those due to which he was awarded with the Nobel Prize in Economics in 2008. His legacy in academia can be assessed through the recognition of his work in the identification of international trade patterns and the explanation on why spatial imbalances in the distribution of economic activities arise in an increasingly globalized economy. Through these contributions to trade theory and economic geography, Krugman is often credited as being one of the pioneering researchers in the *New Trade Theory* and the founding father (together with Masahisa Fujita) of the *New Economic Geography.*

Keywords: Paul Krugman; new trade theory; new economic geography
JEL codes: R10, R12, R23

1 Introduction

In this paper, I assess the main contributions to Economic Geography and Trade of the 2008's recipient of the Nobel Prize in Economics, Paul Krugman. In a nutshell, the

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recognition of Paul Krugman's contributions to economic theory associated with his work in the identification of international trade patterns and his contributions to the field of economic geography (particularly, *New Economic Geography*).

Through the integration of economies of scale into general equilibrium models, Paul Krugman deepened the understanding of both the determinants of trade and the location of production in an increasingly globalized economy. His research findings explained how the consumer's desire for variety and choice enabled countries to achieve the economies of scale required for profitable trade in similar products. This led to later research culminating in his seminal works from 1991,[1] which are considered by many as the pioneering works of the *New Economic Geography* (NEG),[2] a new field at the time within the economics profession which seeks to explain the riddle of uneven spatial development, in particular the tendency towards the geographical agglomeration of economic activities as a consequence of increasing economic integration.

A prolific writer, Paul Krugman published more than 20 books and 200 papers in professional journals. Among his writings were regular magazine columns in *Slate* (1996–1999) and *Fortune* (1997–1999), and from 1999 he was an op-ed columnist for *The New York Times*. His books include the essay collection *The Great Unraveling* (2003); economics textbooks such as *Geography and Trade* (1991), *The Spatial Economy* (1999) and *International Economics: Theory and Policy* (1988); and nonacademic best sellers such as *The Return of Depression Economics* (1999) and *The Conscience of a Liberal* (2007). In addition to the Nobel Prize, Krugman received many honours, including the 1991 John Bates Clark medal, awarded to young economists under age 40.

In this brief biography, I seek to shed light on Krugman's his mains contributions to economic theory, mainly those due to which he was awarded with the Nobel Prize in Economics in 2008. That said, I shall focus on his academic work and opt to leave out considerations and descriptions on his political life, since it is my belief that public opinion on his views is far from consensual and many would prefer to consider Paul Krugman as ideologically controversial. It is argued by many that contests towards his merit in earning the Nobel Prize are a result of Krugman's lack of discretion and his active political stance.

[1] His most cited paper to date in the *Journal of Political Economy*, called 'Increasing returns and Economic Geography', and his very famous monograph called 'Geography and Trade'.

[2] This view is not consensual as "the birth" of NEG is viewed by many scholar as the product of the collaboration between both Paul Krugman and Masahisa Fujita.

I would not disagree on this point. However, this commonly leads people to overlook his academic and intellectual contributions. Going fully and thoroughly through all of Krugman's papers and publications, and considering how economic theory has evolved and built upon much of his work, I for one cannot claim that the Nobel Prize is not well deserved.

As a remark, I should apologize for any suspicion that this biography takes a bias towards Krugman's contributions concerning economic geography. This would in fact somewhat reflect my idiosyncrasies as someone who has economic geography as a preferred field of interest within economics.

In what regards NEG, another disclaimer is warranted. Although Paul Krugman is often considered the *founding father* of NEG, this review in no way disregards the importance of Masahisa Fujita, whose contributions tracing back to 1988, together with his early collaborations with Paul Krugman, deems the pair as the pioneering prominent researchers in the field.

The rest of this work is organized as follows: Section 2 contains a brief biography of Krugman's personal life and a detailed assessment of his academic career; in Section 3 I summarize Krugman's main contributions to economic theory and thought; Section 4 concludes.

2 Academic biography

Paul Robin Krugman got his B.A. in economics from Yale University in 1974 and his Ph.D from Massachusetts Institute of Technology (MIT) in 1977. His thesis's title is "Essays on flexible exchange rates" and was written under the supervision of the late eminent economist Rüdiger Dornbusch (1942-2002), whom Krugman has always held in high appraisal. During his attendance at MIT, he was part of a group of students sent to Portugal to work for the Central Bank of Portugal in 1976, in the aftermath of the "25th April Revolution" in 1974. The following year he moved back to the United States to work as an assistant professor at Yale University until June, 1980. He also worked as a visiting assistant professor in MIT from 1979 to 1980. Thereafter he became associate professor at that same institute until 1984. He also worked at the Council of Economic Advisers as an international policy economist between 1982 and 1983. From 1984 until 2000 he held positions as Professor both at MIT and at Stanford University, and has also taught at the London School of Economics. Since 2000, he has been Professor of economics and international affairs at the Woodrow Wilson School of Public and International Affairs

at Princeton University.

Paul Krugman has also other important affiliations to add to his impressive resume. For instance, he has long been a research associate at the National Bureau of Economic Research (since 1979). He has also belonged to the board of advisors at the Institute of International Economics ever since 1986. He is a fellow at the Econometric Society, the American Academy of Arts and Science, and a member of the Group of Thirty international economic body.

As mentioned previously, Paul Krugman is considered a very prolific and accomplished writer, having worked as a columnist at the magazines *Slate* (1996-1999) and *Fortune* (1997-1999). As of late, he has been an op-ed columnist for *The New York Times*, where he maintains his own personal blog entitled "The Conscience of a Liberal".

Krugman's main research areas, which have made him stand out in the academic community, are international economics, with a focus in trade and international finance, and economic geography. He is ranked by the Research Papers in Economics (RePEc) as one of the world's most influential economists. In 1985, he published the book entitled *Market Structure and Foreign* Trade*,* with his co-author Elhanan Helpman. One of his most well known published books includes the standard undergraduate text book on international economics entitled *International Economics: Theory and Policy* published in 1988, which was co-written with Maurice Obstfeld. He is author of other famous books, such as: *Market Structure and Trade Policy* (1989), co-written with Elhanan Helpman; *Rethinking International Trade* (1990); and *The* Age *of Diminished Expectations* (1990). His monograph entitled *Geography and Trade*, published in 1991, is considered to be the precursor work that launched the field of New Economic Geography, along with his seminal paper (Krugman, 1991a). Since then, he has published a series of other books, namely: *Currencies and Crises* in 1992; *Peddling Prosperity* in 1994; *Development, Geography and Economic Theory* in 1995; *The Self-Organizing Economy* and *Pop Internalism* in 1996; and *The Accidental Theorist* in 1998. In 1999 he published *The Return of Depression Economics*, a book that explores depression economics through the lenses of the 1997 Asian financial crisis and Japan's "Lost Decade". This book would give rise to *The Return of Depression Economics and the Crisis of 2008*, an updated version of the previous which includes the liquidity crisis created in 2008 by misguided austerity measures, and draws a parallel between the latter and the Great Depression. In 1999, along with Masahisa Fujita and Anthony J. Venables, Krugman published that which is arguably the most important textbook for New Economic Geography theorists: *The Spatial Economy.* In 2003, he published the book *The Great Unraveling*: *Losing Our*

Way in the New Century, which criticized the administration of United States president George W. Bush. In 2004, he published *Microeconomics* with co-author fellow economist Robin Wells. In this book, Krugman and Wells take a story-driven approach that focuses on real world economics at work. The book offers the trademark clarity and engaging writing style that distinguish Krugman's work. In *The Conscience of a Liberal* (2007), which later gave name to Krugman's blog in *The New York Times*, Krugman studies the past 80 years of American history in the context of economic inequality.

Where Paul Krugman really stands out is in his academic research, whose portfolio includes more than 200 publications in renowned scientific journals and edited volumes. His professional reputation among academics rests largely on work international trade and finance, to such an extent that he is considered to be one of the founders of the "New Trade Theory" (NTT), a major rethinking of international trade. It is in recognition of this work that the American Economic Association awarded him with the John Bates Clark in 1991, given to economists under age 40. It was in that same year that he was honored with the George Eccles Prize for Excellence in Economic Writing. Later in 1995, he was awarded with the Adam Smith Award when he was still at Stanford University. In 2001, Krugman, Fujita and Venables won the Nikkei Prize for Excellent Books in Economic Science due to their monograph (Fujita *et al.*, 1999). An year later, Krugman won the William Alonso Memorial Prize for Innovative Work in Regional Science, awarded by the North American Regional Science Council. But the culmination of his lifework came with the greatest appraisal to a prominent economist, when he became the recipient of the Nobel Prize in Economics in 2008, a recognition for his contributions to international trade and economic geography.

3 Main contributions to economic thought

This section highlights two distinct but connected contributions: Paul Krugman's development of the New Trade Theory (NTT) and his work on the New Economic Geography (NEG). International trade has a long history in economics, and for the bulk of the field's history, patterns of trade have been explained by factor endowments and comparative advantage. These theories provided good explanations for trade patterns in the first half of the 20th century. In the modern world, however, comparative advantages seem less and less relevant. Today, most trade takes place between countries with similar technologies and similar factor endowments; similar goods (though not perfect substitutes) are often both exported and imported by the same country. Krugman published two

seminal papers in 1979 and 1980 that made sense of the fact that many countries export automobiles and televisions, but they also import them. Moreover, countries with very similar endowments of capital and labor traded more intensively than those with very dissimilar endowments, something that the Heckscher-Ohlin theory could also not adequately explain.

Krugman used a framework similar to Chamberlin's model (1933) of monopolistic competition, where every firm sells a horizontally differentiated good. Consumers like variety, so that even if they live in the Japan, they may still occasionally prefer cars made in Germany. These ingredients came together and provided a framework than can match the world's trade patterns better than the 19th century framework of David Ricardo, or the mid-20th century models of Eli Heckscher, Bertil Ohlin and Paul Samuelson. Paul Krugman's trade models became the standard in the economics profession both because they were more realistic and because they were elegant pieces of mathematical modeling. His models' combination of realism, elegance and tractability meant that they could provide the underpinnings for thousands of subsequent papers on trade, economic growth, political economy and especially economic geography. His paper "Increasing Returns and Economic Geography" (1991a), published in the *Journal of Political Economy*, was cited over 900 times. It was the first article to provide a clear, internally consistent mathematically rigorous framework for thinking simultaneously about trade and the location of people and firms across space.

In the field of economic geography, whose main concern is the study of migration flows of individuals and firms across the geographic landscape, it has been long recognized that economies of scale are decisive for the location of economic activity, namely by theorists such as Harris, Myrdal and Hirschmann. In spite of this, these insights were not supported by parsimonious models, especially models of general equilibrium. This would have to wait until 1991 (a), date of the seminal article by Krugman that marked the surge of the New Economic Geography. However, the seeds of NEG can already be found in Krugman's article from 1979 which, in its final section, argues that pattern of migration can be analyzed within the same framework as the NTT.

3.1 Economies of scale and international trade

Paul Krugman's academic career and success arguably rests on the same grand project he confidently launched just a year after earning his doctorate degree in 1978. He later wrote

that, from that point on: "I basically knew what I was going to do with my professional life" (Krugman, 2008). He realised that the Dixit-Stiglitz (1977) model of monopolistic competition could help him introduce economies of scale into trade theory and beyond.

Increasing returns and economies of scale had long posed awkward problems for theorists. If larger firms face lower costs, then in principle one firm should supply the entire market. However, in the Dixit-Stiglitz model, this "monopolistic" logic is offset by a countervailing force: consumers' love for variety. People gain higher utility from having more products of different varieties than more of the same variety. This creates the incentive for firms to produce a large variety of products. However, the production of a new variety has setup costs, which leads to declining average costs as a larger quantity of the variety is produced and places a limit on the number of varieties the market can profitably supply. The market is therefore carved up among competing firms, each offering a differentiated product. Notwithstanding being highly stylized, this setup nonetheless gave Krugman a tool with which he could open a long-closed "black box". Krugman used this tool to save economics from counter-factual doctrines. According to one of the discipline's founding doctrines, countries gain from specialization and exchange, concentrating on what they do best and importing the rest. But the Dixit-Stiglitz model, with its subtly differentiated firms competing for variety-loving consumers, lent itself to explaining why, e.g., Germany would import French cars and France would import German cars. Krugman's model showed that when trade barriers fall, firms gain access to bigger markets, allowing them to expand production and obtain economies of scale. However, openness also exposes them to competition from rival foreign firms, paring their margins. Some firms may exit the markets due to losses, but between the domestic survivors and the foreign entrants, consumers still have more goods to choose from. Thus the gains from trade arise not from specialization, but from scale economies, fiercer competition and the ability to obtain a greater variety of products.

With his paper from 1979, Krugman showed that when consumer preferences exhibit love for variety, or "Dixit-Stiglitz preferences", and production costs are such that average cost is decreasing in the production scale (economies of scale), trade patterns consistent with real-world data can be generated. In the final section of his paper, he discusses the implications of impediments to trade between two countries when labour is interregionally mobile. Such considerations would be the precursors to the Core-Periphery model (Krugman, 1991a).

Building on the previous analysis, a vast literature has developed exploring the im-

plications of returns to scale and monopolistic competition for trade patterns in richer model settings.

The decrease in transportation costs has been an important cause for the growth of trade. In spite of this, most trade models were astoundingly silent in this regard. In another seminal contribution, Krugman (1980) extended his 1979 model by incorporating transportation costs. For the sake of convenience, these were modeled as *iceberg costs*, meaning that a fraction of the goods shipped abroad "melts away" in transit. This allowed Krugman to identify the *home market effect*, according to which firms tend to concentrate more than proportionally in large markets. The intuition is that, by concentrating production in the largest market, scale economies can be realized due to increasing returns and transport costs are minimized.

After the papers from 1979 and 1980, the way in which increasing returns and monopolistic competition interacted with the traditional factor-proportions mechanism remained unknown. Integrated models of inter-industry and intra-industry trade in differentiated goods were provided by Krugman (1981) and by Helpman and Krugman (1985), among other distinguished contributions. Integration of concepts from both the new and old trade theory was important inasmuch as it led to empirically verifiable predictions about cross-country differences in trade patterns. Other developments incorporated and extended in Helpman and Krugman's 1985 monograph involved theories of international trade in knowledge-intensive production sectors dominated by multinational firms, where such firms appear as the market response to R&D costs.

New Trade Theory has deeply affected trade policy. First, the theory yields accurate predictions about the impact of trade liberalization on trade patterns, the location of output and factor remunerations. Second, it can be used for welfare analysis. Since realistic models become too complex to be handled and estimated by econometric models, a vast literature on calibrated numerical models has emerged. The model by Baldwin and Krugman (1988) is routinely used by institutions such as the World Bank in order to assess the effects of the World Trade Organization's rounds of trade liberalization.

3.2 New Economic Geography

The reason why it took so long for economists to come up with a explanations on how economic spacial imbalances may arise hinged on the technical impossibilities imposed by dominant paradigms based constant returns to scale. Starret (1978), with his "Spatial Impossibility Theorem", provides one of the best accounts of the limitations inherent to

the assumption of constant returns. The theorem states that in an Arrow-Debreu (1954) economy under constant returns to scale, with a finite number of agents and locations, homogeneous space and costly transportation, there is no competitive equilibrium involving inter-locational trade (transportation). By homogeneous space it is meant that both preferences and the set of production technologies are independent of location. So, in other words, if economic activities are perfectly divisible, there is a competitive equilibrium such that each location is autarkic and hence no inter-locational trade occurs.

In order to explain spatial inequalities and regional specialization, one must thus violate at least one of the assumptions stated in the Theorem. As such, economic theory has witnessed the emergence of models of comparative advantages, models of agglomeration externalities, and models of imperfect competition. The first type of models cannot account for the existence of full-fledged agglomerations and very high spatial imbalances. The second type works under the framework of constant returns and perfect competition. This means that models with agglomeration externalities fail to give an explanation for the microeconomic interactions that give rise to those spatial externalities. Moreover, such externalities seem to be relevant in the small but not as essential in the large. The last class of models pertain to imperfect competition and in this regard, as Krugman noted, monopolistic models of monopolistic competition *à la* Dixit-Stiglitz are particularly tractable and useful.

With models of imperfect competition, pricing decisions by firms depend on the spatial distribution of both consumers and other firms. Models of monopolistic competition are specially attractive. One reason is that, since there is no strategic interaction between firms, the common problem of existence of equilibrium which occurs frequently in oligopolistic competition, is not an issue in this case. Another reason pertains to the higher tractability of monopolistic competition. Since the framework implies increasing returns to scale at the plant level, and transportation is costly, location decisions are not trivial. Hence, both ingredients are essential to any model that aims to explain spatial imbalances. A particular case is the Dixit-Stiglitz monopolistic competition model, already described.

Price competition is known to be a strong dispersion force. However, product differentiation alleviates price competition and hence allows firms to locate where it has access to a bigger market and higher demand, and where transport costs are lower. The other principle at work was already mentioned: the home market effect; whereby large markets are relatively more attractive to firms. But this view assumes that the market size is

exogenous, i.e., that consumers are not allowed to migrate between regions. The path-breaking contribution to tackle this issue is the Core-Periphery (CP) model by Krugman (1991a), which marked the birth of the New Economic Geography (NEG).

It is important to note that Paul Krugman was not the first to consider a monopolistically competitive sector to study the space economy. Fujita (1988) had already provided microfoundations for pecuniary externalities by considering product differentiation and firm-level scale economies to explain the endogenous formation of internal city structures.[3] However, these contributions allowed to account for intra-regional imbalances, i.e., within a single city or region, but not for inter-regional imbalances (across different cities of regions).[4]

The Core-Periphery model begins with the same basic elements as NTT: monopolistic competition, increasing returns, and love for variety. To these elements, Krugman adds free migration of (skilled) workers across space and industries and emphasizes on the role of transportation costs (of the iceberg type). The problem analyzed is how population and economic activity will be allocated between the two regions. Will there be a concentration of manufacturing in one region? Will the population be split between an industrialized *core* and an agricultural periphery*?* The paper provides economists with a clear framework that can make sense of where we all live. Firms and workers are pulled toward the same location to reduce transportation costs of shipping goods (centripetal force). Conversely, populations are pulled apart by the desire to be close to natural inputs (centrifugal force), like farming land. Next, I shall provide a more detailed description of the mechanics of the CP model at work.

The starting point of the CP model is that the migration of some workers affects the global welfare and thus changes the relative attractiveness of both origin and destination regions. These effects can be seen as externalities because workers are *myopic* and do not take them into account in their decisions. The basic layout of the CP model comprises two regions, and two sectors: one operating under monopolistic competition *à la* Dixit-Stiglitz and the other operating under perfect competition; and two factors of

[3]Prior to that, Fujita and Ogawa (1982) studied multiple urban structures in a model with positive inter-firm spillovers.

[4]Later, the cross-fertilization between Paul Krugman and Masahisa Fujita's ideas led to some of the major early contributions in NEG.

production. One factor is regionally immobile and is used as an input in the agricultural sector. The other is regionally mobile and is used as input in the industrial sector. There is a cumulative process whereby market size and *cost of living effect* work in a way that promotes agglomeration of industry in one region. As this region becomes bigger, so does the market, thus attracting more industry (the home market effect at work). This circular causation of forward linkages and backward linkages, noted by Krugman (1991a), generates a centripetal force. On the other hand, a more concentrated market enhances price competition, thus working as a dispersion force: the *market crowding effect*. This is also called a centrifugal force. All things considered, the key factor for determining the spatial distribution of industry is the level of transportation costs. Hence, contrary to the neoclassical model that predicts only convergence, the CP model accounts for both convergence and divergence.

When we consider areas where factor mobility is more reduced than in the United States, such as the Euro Area, regional imbalances are much harder to explain through the intrinsic mechanisms of the CP model. Krugman and Venables (1995) and Venables (1996) introduced the idea of vertical linkages as a source of agglomeration and dispersion forces. The main idea is basically that agglomeration of a sector in a region occurs because there is a vertically linked sector that is already agglomerated in that region. The forces at work in this framework are different compared to the original CP model. There is also a market expansion effect but in this case it is due to higher income (higher wages since labor supply is inelastic) that leads to higher consumer demand. However, if wages are too high, some firms will want to relocate their production to the periphery, so there is also a dispersion force. The advantage of this framework is that a self-perpetuating agglomeration process may not be, in fact, perpetual. Instead, economic integration yields a bell-shaped curve of spatial development. As such, this model accounts for the possibility of re-industrialization of the periphery after a period of gradual desertification.

Krugman's contribution from 1991 has also allowed to provide insights on city formation and urban systems. The seminal paper by Fujita and Krugman (1995) was a precursor to the explanation on how urban and agricultural land use patterns emerge endogenously. Their framework closely relates to that of the original CP model, albeit with some differences. The setting allows for a summary of the classic von Thünen model and of the Dixit-Stiglitz-Samuelson model used in NEG. Their main result is that, provided that population size does not exceed a certain threshold, a monocentric economy is a spatial equilibrium.

Krugman's paper from 1993 deepened Core-Periphery analysis by extending the original CP model to a multi-regional setup displayed in a racetrack economy.

New Economic Geography has had such an impact, that it reached the *proper* economic geographer's community[5], whose reactions towards Krugman's contributions to the field were many times harsh and with a tone of reprehension.[6] Nonetheless, the fact that the field was able to cross over the boundaries of the realm of economic theory only constitutes more evidence on the impact Paul Krugman has had on the general scientific community.

4 Concluding remarks

With the integration of economies of scale into explicit general equilibrium models, Paul Krugman has deepened our understanding of the determinants of trade and the spatial location of economic activities. His seminal papers from 1979 and 1980 were essential to the development of the New Trade Theory. His paper published in 1991(a) inspired the new approach to economic geography to the extent of giving rise to a new field within the economics profession, the New Economic Geography. His published monographs with either Elhanan Helpman, or with Masahisa Fujita and Anthony Venables, demonstrate the richness of the new theories.

In neither of his contributions did Krugman claim great originality for his ideas or great realism. His achievement was to formalize insights that many people had previously had informally. Ideas that had fluttered in and out of people's grasp for decades, he was able to pin down in an unprecedented parsimonious way.

> Sometimes a good economist, like a good columnist, succeeds not by making a point before everyone else, but by making it better than anyone else. (*The Economist*, 2008)

[5]The term *proper* here is used to identify this community as being solely comprised of geographers.

[6]Krugman has subsequently been engaged in debates with economic geographers (see e.g. Krugman, 2010). Notwithstanding, throughout his career he has always been aware of the methodological limitations of NEG (see Krugman, 1996; Fujita and Krugman, 2004).

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