ECONOGRAPHICOLOGY

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CHAPTER 1
Introduction

The rationale of Econographicology revolves around the efficacy of multi-dimensional (MD) graphs as the most effective analytical tool for visualization of any economic phenomena. The main motivation behind the creation of Econographicology is to evaluate graphs evolved so far in economics and to develop new type of graphs to facilitate the study of economics, as well as finance and business. Thereby, the mission of Econographicology is to offer academics, researchers and policy maker's alternative analytical tool in the research and teaching-learning process of economics, finance and bus iness.

The theoretical framework of Econographicology draws very much on graphs design: soft graphs design and hard graphs design. In addition, the research involved is supported by three types of graphs: analytical graphs, descriptive graphs and graphs simulation.

At the inception of Econographicology, the following new types of Physical Spaces are presented: Pyramid Physical Space (P-Physical Space), Diamond Physical Space (D-Physical Space), Multi-Dimensional Physical Space (MD-Physical Space), Infinity Physical Space (I-Physical Space) and Multi-functional Pictorial Physical Space (MFP-Physical Space). These Physical Spaces are constructed based on the traditional 3-D space concept, but they represent 4-D, 5-D, 8-D, 9-D and Infinity-Dimension. The multiple-dimensional representations are to facilitate easy understanding of economic phenomena from a general view.

Organization of the Book

This book is divided into ten chapters: The first chapter will give a short brief about each chapter. The second chapter of this book attempts to study the history of graphical methods apply in economics, introduction to Multi-dimensional physical spaces and the theoretical framework of Econographicology.

Chapter 3: Global Dimension of Regional Integration (GDRI-Model)

The third chapter presents a new model of analysis to study the trend of regional integration from a multi-dimensional perspective. This new model is called the Global Dimension of Regional Integration Model (GDRI-Model). The rational for the creation of this model is the necessity to study regional integration using political, social, economic and technological analysis simultaneously.

There are four basic phases in the implementation of GDRI-Model. The first phase is the design of the multi-input database table. The second phase is the measurement of individual Regional Global Development Indices (X_i), which include the Regional Global Political Development Index (X_1), the Regional Global Social Development Index (X_2), the Regional Economic Political Development Index (X_3), the Regional Global Technological

Development Index (X_4). The third phase is the measurement of the Regional Global Development (RGD) index. The last phase is the measurement of Regional Integration Stage (RIS) index.

The general objective of the GDRI-Model is to offer policy-makers and researchers a new analytical tool to study the evolution and stages of any regional integration process from a multidimensional analysis based on a group of indexes and graphs. The GDRI-Model is not intended to be a forecasting model in any case. However, its application is not limited to a specific group of countries or regions. It is also not constrained by issues of a region or the development stage of any member in the region that is interested in integrating into a single regional trade bloc. The GDRI-Model, in effect, is a simple and flexible scheme, which can be applied to any case of regional integration.

Chapter 4: The Trade Liberalization Evaluation (TLE-Methodology)

The fourth chapter proposes a new trade analysis model to evaluate the trend and stages of trade liberalization of any country. This new trade analysis model is entitled "The Trade Liberalization Evaluation Methodology (TLE-Methodology)". The TLE-Methodology will introduce new indexes and Figures. There are four basic phases in the implementation of TLE-Methodology. The first phase is the design of a multi-input tariff database Table by production sector (agriculture, heavy industry, light industry and services). The second is the measurement of the trade liberalization index by production sector (X_i). It is divided by the agriculture trade liberalization index (X_1), heavy industry trade liberalization index (X_2), light industry trade liberalization index (X_3), and services trade liberalization index (X_4). The third phase is the measurement of the trade liberalization trend (TLT) Index. The last phase is the measurement of the trade liberalization stage (TLS) Index.

The general objective of TLE-Methodology is to offer policy-makers and researchers a new analytical tool to study the trade liberalization trend and stages of any country from a global perspective based on a group of indexes and Figures. The TLE-Methodology is not intended to be a forecasting model in any case. However, its application is not limited to the study of a special group of countries or regions. It is not constrained by issues about the region or the development stages of any country in a region that is interested in integrating into a Free Trade Area. TLE-Methodology, in effect, is a simple and flexible scheme, which can be applied to any case of trade liberalization.

Chapter 5: Korean Unification: A Multi-dimensional Analysis

The chapter fifth analyze the unification between two countries is not a purely economic phenomenon but a multidimensional phenomenon. We evaluate the prospects of unification between South Korea and North Korea from a multidimensional perspective encompassing the political, social, economic and technological dimensions. To do so, we use the Global Dimension of Regional Integration Model developed by Ruiz in the year 2004. Our main finding is a wide and growing gap between the two Koreas in terms of political, social, economic and technological development as well as overall development. This suggests that inter-Korean unification is likely to be a costly and disruptive process.

Chapter 6: A New Multi-Dimensional Framework for Analyzing Regional Integration: Regional Integration Evaluation (RIE) Methodology

The sixth chapter offers an alternative methodology to study regional integration. Researchers from different fields have attempted to explain regional integration using different theories and analytical tools. These theories and analytical tools typically visualize the regional integration process from the perspective of a single discipline, usually economics but also political science, sociology, or technology and science. However, such one-dimensional analytical approach cannot fully capture the richness and complexity of regional integration, which is an inherently multi-dimensional process. To address the problem, we propose a multi-dimensional analytical framework – the regional integration evaluation (RIE) methodology. We apply this methodology for analyzing NAFTA, ASEAN, MERCOSUR and EU.

Chapter 7: The Openness Growth Monitoring Model (OGM-Model)

The seventh chapter presents a new methodology on the study of openness or trade liberalization. The mission of this model is to offer policy-makers and researchers new analytical tools to study the impact and trend of openness in the economy of any country from a new perspective. The OGM-Model, in effect, is a simple and flexible scheme. The general objective of the openness growth monitoring model (OGM-Model) is to analyze the impact of average openness growth on the average income growth in a specific period of time (in the short run). The period under study in this thesis is from 1995 to 2001.

The sixth chapter is divided into three parts. The first part is the literature reviews the literature on analytical methods evaluating openness based on three different approaches focusing on political economy, economic theory, and trade policy. The second part will present a new model of analysis to evaluate the trend, vulnerability and harmonization of openness growth. The relationship between openness growth and income growth is based on a new group of indicator and a new type of graph. This new model of analysis is entitled "The Openness Growth Monitoring Model (OGM-Model)".

The OGM-Model is based on a series of steps in its application to study openness growth and income growth: (i) the degree of openness by production sectors (Oi); (ii) openness average rate ($\bar{O}$); (iii) harmonization of openness (HO); (iv) average openness growth rate ($\Delta\bar{O}$); (v) per-capita gross national income (ΔY); (vi) openness diamond graph; (vii) openness/income growth rate (O:Y) sensitivity analysis chart. The third part of this chapter shows the results obtained from the application of the OGM-Model in different countries and regions.

Chapter 8: The Gross Domestic Product Surface (GDP-Surface)

The eighth chapter focuses on the application of multi-dimensional Cartesian spaces in the graphical visualization of Gross Domestic Product (GDP) historical trend of any country. The main objective to use multi-dimensional Cartesian spaces is to observe all possible changes of many variables (independent variables) which affect the single variable (dependent variable) in the same graph. To observe the GDP historical trend from a multi-dimensional view, this paper proposes the application of the GDP surface approach on

the United States (U.S.) GDP historical trend from 1928 to 2004. Finally, to facilitate the visualization of the GDP surface behavior in different periods of time (per decades, annually, semester, quarterly, monthly, weekly, or daily), It requires the construction of a large number of GDP surfaces and join together, it is to generate a dynamic animation. The dynamic animation of the GDP surfaces will show real time behavior of the GDP historical trend in constant movement from far periods of time until today.

Chapter 9: Beyond the *Ceteris Paribus* Assumption: Modeling Demand and Supply Assuming *Omnia Mobilis*

The ninth chapter is concerned with the application of multi-dimensional graphs in visualizing and modeling total change in a dependent variable in response to changes in any or all of the (many) independent variables affecting it. Previous literature has used the *ceteris paribus* assumption to obtain total change as a cumulative effect of the effect of the individual parts. The multi-dimensional graph applied to demand and supply shows that under the O*mnia Mobilis* (everything is moving) assumption, the quantity sold in the market is a joint function of all the independent variables that affect supply and demand.

Chapter 10: Demand and Supply Surfaces

The tenth chapter shows a new optical visualization of the demand and supply based on the application of surfaces. The idea to show the demand and supply surfaces are to propose the application of MD graphs among academics, economists and policy makers in the study of economics under micro and macro level of analysis in the short and long term. To build the demand and supply surfaces, this research suggest to applying "the Infinity Cartesian Space (I-Cartesian Space)". The idea to apply I-Cartesian Space is to use some of the large number of Cartesian Spaces that offer by Econographicology.

Chapter 11: Is the Market in a Dynamic Imbalanced State?

The eleventh chapter is interested to show graphically how the market is in a dynamic imbalanced state. It is based on the application of the Multi-Functional Pictorial Cartesian Space (MFP-Cartesian Space). The MFP-Cartesian space will generate a multi-dimensional visual effect to observe the market as a whole in a permanent movement state. Therefore, we assume that the market is divided into five sub-markets (goods sub-market –IS curve-, money sub-market -LM curve-, exports sub-market –PE curve-, labor sub-market -IL curve- and technological sub-market –IT curve-). The five sub-markets are moving together simultaneously in the same space and time. Finally, all these sub-markets can find its *"momentum of balance synchronization stage"* together in an unexpected and unlimited period of time. The *"momentum of balance synchronization stage"* is considered as a fleeting momentum originated by the relaxation (or less instability) of all sub-markets. It is depend on the economic, social, political, technological and natural & environment forces behavior.

CHAPTER 2

Introduction to Econographicology

2.1. The Evolution of Graphical Methods in Economics

Research leading to this chapter shows a strong link between the introduction of graphical method in economics and the development of theories, methods and techniques in statistics and mathematics. In the 18th century, for example, several new graphical methods were developed as a result of some mathematics and statistics research in the same century. These graphical methods include line graphs of time series data (since 1724), curve-fitting and interpolation (1760), measurement of error as a deviation from graphed line (1765), graphical analysis of periodic variation (1779), statistical mapping (1782), bar charts (1756) and printed coordinate paper (1794) (See Beniger and Dorothy, 1978).

The application of graphical methods on the economics analysis, we have renowned economists like William Playfair (2005), Francis Ysidro Edgeworth (1888) and William Stanley Jevons (1862). According to Harro Maas (2005), William Playfair constructed a wonderful collection of plates and graphs at the end of the eighteenth century. In his book entitled Commercial and Political Atlas, Playfair focused on the study of trade cycles. This placed him far ahead of other economists at the time in terms of visualizing socio-economic data.

We would classify the development of the usage of graphical methods in economics into two phases. The first phase is the descriptive graphical method, it is supported by simple tables, histograms, line graphs and scatter-plots. All these types of graphs are based on the visualization of a single economic variable (vertical axis = Y) through a specific period of time (horizontal axis = X) in the first quadrant in the 2-D Cartesian coordinate system (See Figure 1).

The main objective of the descriptive graphical method in economics is to study the behavior of a single economic variable (e.g. exports, imports, unemployment, GDP, inflation rate etc.) within a time frame (per decade, annually, monthly, weekly or daily) based on time-series. In fact, William Playfair may be considered the pioneer and promoter of the descriptive graphical method.

The second phase in the development of graphical methods for economics will be called the “analytical graphical method”. The analytical graphical method in economics features by 2-D and 3-D coordinate systems. According to Harro Maas is William Stanley Jevons who first explored the merits of the graphical method for political economy. Jevons did this through the function called “King-Devenant Law of Demand” that he introduced. This is a case of the use of analytical graphical method in economics, where the form of the graph gives an idea of the possible class of the functions describing the relationship between X and Y variables. However, Jevons termed X and Y variables as variable and variant respectively terminologies that suggest a causal interpretation of the relationship between X and Y.

Additionally, we like to mention also that the uses of the formal graphical method

based on the coordinate system (X,Y) was introduced in 1637 by René Descartes (Lafleur, 1960), whose contributions to different scientific disciplines, of which economics was one, were substantial. The Cartesian coordinate system opened a new era in economic analysis by providing for analysis of a single economic phenomenon based on the relationship between two variables.

However, it is necessary to mention the major contribution of Antoine Augustin Cournot (1838). Cournot derived the first formula for the rule of supply and demand as a function of price on 2-Dimensional view. He was, in fact, also the first economist to draw the supply and demand curves on a graph. Cournot believed that economists must utilize graphs only to establish probable limits and express less stable facts in more absolute terms. He further held that the practical use of mathematics in economics involves not only strict numerical precision, but also graphical visualization. Besides Cournot and Jevons, other innovator economists that contributed to the analytical graph system in economics over time are Leon Walras (with general equilibrium), Alfred Marshall (with partial equilibrium) and Joseph Schumpeter (with Business Cycles) (McClelland, 1975).

In the 20th century the use and application of the analytical graphical method among economists were often based on sophisticated mathematical and graphical techniques introduced during the development of new economic models. In particular, calculus, trigonometry, geometry and statistical and forecasting methods started to be employed by economists in constructing their graphs during that time. In addition, 2-D and 3-D Cartesian coordinate systems were also a part of complex economics research (Avondo-Bodino, 1963).

Consequently, the application of sophisticated mathematical and graphical techniques can be seen in the development of the following economic models and theories: welfare theory (Hicks, 1939), IS-LM curve (Hansen, 1938), development of static and dynamic analysis (Samuelson, 1947), econometrics (Klein, 1956), Phillips curve (Phillips, 1958), Okun law (Okun, 1975), economic growth theory (Solow, 1956), game theory (Nash, 1950), introduction of dynamic models and econometrics (Tinbergen, 1937), monetary theory (Friedman, 1948), and rational expectations theory (Barro, 1976).

The rapid development of the analytical graphical method has been facilitated by high technology and sophisticated analysis instruments such as the electronic calculator and the computer. The development of analysis instruments in economics took place into two stages. The first stage involved the "basic computational instruments", where electronic calculators were used to compute basic mathematical expressions (e.g. long arithmetic operations, logarithm, exponents and squares). This took place between the 1950's and 1960's.

The second stage called "advance computational instruments" took place in the middle of the 1980's. This is when high speed and storage-capacity computers using sophisticated software were introduced for the first time. The use of sophisticated software enables easy information management, application of difficult simulations as well as the creation of high resolution graphs under 3-D Cartesian coordinate system. The analysis instruments undoubtedly contributed substantially to the development and research in economics. Therefore, high computational instruments, backed by sophisticated hardware and software, are utilized to create graphical representations with high resolution and accuracy.

In fact, the descriptive graphical method and analytical graphical method can be

categorized according to functions or dimensions. In terms of function, these two graphical methods are either descriptive or analytical. In terms of dimension, these two graphical methods can be either 2-D, 3-D and Multi-Dimensional coordinates systems. Therefore, the descriptive graphical method shows arbitrary information that is used to observe the historical data behavior from a simple perspective. On the other hand, the analytical graphical method is available to generate time-series graphs, cross-section graphs and scatter diagrams to show the trends and relationships between two or more variables from a multi-dimensional and dynamic perspective.

Based on five hundred (500) papers published in twenty one (21) reputable economics journals1 between 1940's and 2006 (JSTOR, 2008), it can be observed that the common types of graphical representations applied in the study of social sciences, especially in economics, were of the 2-D Cartesian coordinate system. It is found that 99% of these papers applied 2-D Cartesian coordinate system, and only 1% of them applied 3-D Cartesian coordinate system. In view of this scenario, a new, multi-dimensional Cartesian coordinate system is introduced here. This new type of Cartesian coordinate system is based on the Pyramid Cartesian Space (P-Cartesian Space), Diamond Cartesian Space (D-Cartesian Space), Multi-Dimensional Cartesian Space (MD-Cartesian Space), Infinity Cartesian Space (I-Cartesian Space) and Multi-Functional Pictorial Cartesian Space (MFP-Cartesian Space). Being multi-dimensional, it enables economists to analyze economic phenomena from multiple perspectives in time and space.

2.2. Introduction to Multi-dimensional Cartesian Spaces in Economics

This paper is concerned about the application of Multi-Dimensional (MD) Physical Spaces in the process to visualize complex economic phenomena behavior through different periods of time in the same graphical space. Therefore, this paper will suggest the review of the "n-Dimensional Space" to support the uses of MD Physical Spaces in economics. The initial idea about n-dimensional space was originated by greeks thinkers, philosophers and mathematians such as Socrates, Platos, Aristotles, Heraclitus and Euclid (father of the geometry). The great contribution of Euclid in geometry was the design of the plane geometry under the 2-Dimensional Euclidean geometry and the solid geometry under the 3-Dimensional Euclidean geometry.

However, the n-dimensional space can be defined as a mental refraction through the optical visualization and brain stimulation by several lines in a logic order by length, width, height and colors to represent the behavior of simple or complex phenomena in different periods of time in the same graphical space. The study of n-dimensional space can be clasiffied by 2-Dimensional space, 3-Dimensional space and MD-Physical Spaces. Usually, the study of n-dimensional space is based on the application of the "coordinate system". The role of coordinate system is crucial in the analysis of n-dimensional space because it can show clearly the location and interaction between two or more variables: exogeneous variable (s) and endogeneous variable (s) on the same graphical space.

It is perhaps fitting to mention here that the 2-Dimensional Cartesian coordinate system was introduced in 1637 by René Descartes (Lafleur, 1960), whose contributions to different scientific disciplines, of which economics was one, were substantial. The 2-Dimensional Cartesian coordinate system opened a new era in economic analysis by providing for the

analysis of a single economic phenomenon. In fact, the 2-Dimensional Cartesian coordinate system is available to visualize the relationship between the exogenous variable (under the vertical axis = Y-coordinate) and the endogenous variable (under the horizontal axis = X-coordinate) in the first quadrant in the Cartesian coordinate system (See Figure 1). Or the observation of the trend of a single economic variable (e.g. exports, imports, unemployment, GDP, inflation rate etc.) within a time frame (per decade, annually, monthly, weekly or daily), it is based on the uses of histograms, line graphs and scatter-plots.

In the case of 3-Dimensional Cartesian coordinate system (X,Y,Z) support the construction of surfaces and 3-D manifolds, it is based on the uses of three coordinate system follow by "X-coordinate" (or exogenous variable), "Y-coordinate" (or exogeneous variable) and the "Z-coordinate" (or endogeneous variable). Usually, the 3-Dimensional Cartesian coordinate system work under the Euclidean geometry theoretical framework. The main objective of the 3-Dimensions Cartesian coordinate system (See Figure 2) in economics is to study the behavior of two exogenous variables (X,Y) can affect directly on the endogenous variable

Figure 1
2-Dimensional Cartesian Plane

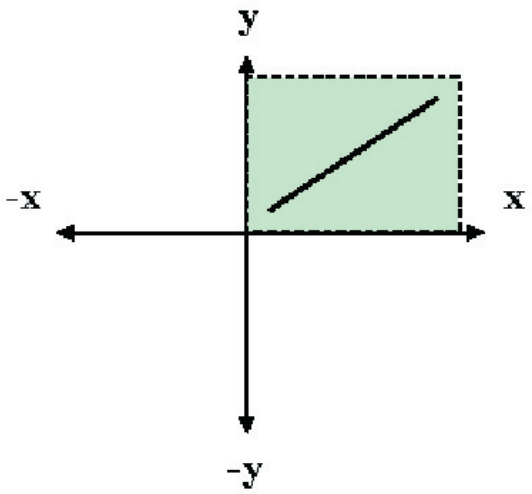
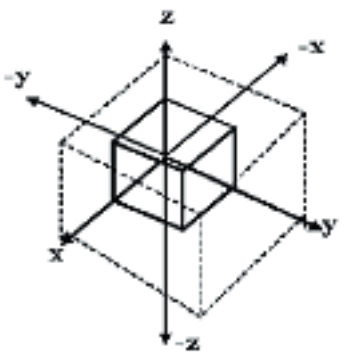


Figure2
3-Dimensional Cartesian Plane



Finally, the construction of Multi-dimensional Physical Spaces are based on the traditional 3-Dimensional space concept, but they can represent 4-Dimensional, 5-Dimensional, 8-Dimensional, 9-Dimensional until Infinity-Dimensional spaces. The Multi-Dimensional Physical Spaces can facilitate the easy understanding of complex economic phenomena under the visualization of large amount of exogenous variables can affect directly on the endogenous variable (s).

2.2.1. How Multi-Dimensional Spaces work ?

The idea about how the Multi-Dimensional Spaces work can be explained by Multi-Dimensional (MD) Physical Spaces. We can find that the 2-Dimensional space show certain limitations to generate a multi dimensional optical visual effect on complex economic scenarios behavior simoustaneosly in the same graphical space. Therefore, the Multi-dimensional Physical Spaces leads an alternative graphical modeling to generate this multi dimensional optical visual effect than 2-Dimensional space cannot be offered to economics. However, in the study of n-dimensional space need to be mentioned the great contribution of Euclid's. Whom introduce the 3-Dimensional space based on the Euclidean space (Cartesian space or n-space) represented by Rn or En under n-dimensions and n-vectors. Usually, the Euclidean space is formed by (X1, X2, X3,...,Xn) where n is equal to ∞... This section of the paper will remind that the Euclidean space is given to us the mathematical theoretical framework, but non-exist any graphical modeling to visualize the n-dimensional space.

In other hand, Minkowski's (Einstein, 1952) introduce the idea about the 4-dimensional space or the "world". The world according to Minkowski's it is originated by the application of 3-Dimensional continuum (or space). The difference between the 4-dimensional space and 3-Dimensional space graphical model is that the first graphical model replace (X,Y,Z) by (X1,X2,X3,X4), thus X1 = X; X2 = Y; X3=Z and X4 = $\sqrt{-1}$. The X4 is based on the application of the Lorenz transformation axiom. The four-dimensional space by Minkowski's also never offer a specific graphical modeling or alternative Cartesian coordinate system to help visualize the 4-dimensional space, it is only offer a mathematical theoretical framework to discribe the idea about 4-Dimensional space.

Moreover, this paper will offer an alternative Multi-Dimensional graphical modeling to economics under the application of Multi-Dimensional Physical Spaces in the generation of n-dimensions, sub-dimensions, micro-dimensions, nano-dimensions and ji-dimensions into the 3-Dimensional continuun (space). Our main assumption is that into the 3-Dimensional continuum (space) exist infinity number of n-dimensions, sub-dimensions, micro-dimensions, nano-dimensions and ji-dimensions. We assume that each n-dimension, sub-dimension, micro-dimension, nano-dimension and ji-dimension into the 3-Dimensional space are moving in different levels of speed. Therefore, the MD-Physical Spaces can show clearly a large number of exogenous variables can affect directly on the endogenous variable (s) in the same graphical space. To generate this multi-dimensional effect, we need to consider the application of "n-dimensions, sub-dimensions, micro-dimensions, nano-dimensions and ji-dimensions" criteria into the Multi-Dimensional Physical spaces theoretical framework.

Therefore, the idea of 4-Dimensional space or "world" was mentioned by Minkowski's is possible to be drawed by MD-Physical Spaces, because all these Physical Spaces offer u-dimensions, sub-dimensions, micro-dimensions, nano-dimensions and ji-dimensions

coordinates systems. Our idea about 4-Dimensional space or "world" is totally different from Minkowski's point of view, because the "world" is formed by infinity number of n-dimensions, sub-dimensions, micro-dimensions, nano-dimensions and ji-dimensions into the 3-Dimensional space.

2.2.2. The Application of MD-Physical Spaces in Economics

Usually, the graphical modeling apply in economics until today is based on the 2-Dimensional space. The 2-Dimensional space is based on the uses of Cartesian Plane coordinate system (X,Y). Basically, the 2-Dimensional space applications in economics play three basic roles: First role is to show the relationship between two variables (X,Y). Second role is the visualization of historical data in different periods of time in absolute values. And third role is to compare the changes of values between two periods of time, it is based on the growth rates trend (relative values). Therefore, the 2-Dimensional space is available to generate simple graphs easy to visualize and understand a basic economic phenomenon. Based on one thousand (1000) papers published in twenty-one (20) reputable economics journals1 between 1940's and 2008 (JSTOR and Direct-Sciences, 2008), it can be observed that the common types of dimensional spaces applied in the study of economics, were of the 2-Dimensional Cartesian plane coordinate system. 99.50% of these papers applied the 2-Dimensional Cartesian plane coordinate system, and only 0.50% of them applied the 3-D Cartesian coordinate system.

The uses of 3-Dimensional space in economics is based on the uses of the 3-Dimensional Cartesian plane coordinate system (X,Y,Z). The uses of 3-Dimensional space is not so popular among economists and reseearchers according to our research results. Recently, few economists start to use 3-Dimensional Cartesian plane coordinate system to elaborate surfaces or 3-Dimensional mainfolds to visualize multi-variable economic data behavior. In view of this, a new, multi-dimensional (MD) Physical Spaces coordinate system is introduced here. The idea is to generate a multi dimensional optical visual effect to visualize complex economic phenomena. We can observe that into the MD-Physical Spaces can keep a large number of exogenous variables are moving in different speed levels can affect directly on the endogenous variable (s) behavior in the same graphical space. This new type of Multi-dimensional Physical Spaces coordinate systems are based on the Pyramid Physical Space (P-Physical Space), Diamond Physical Space (D-Physical Space), 4-Dimensional Physical Space, 5-Dimensional Physical Space, Infinity Physical Space (I-Physical Space) and Multi-variable Pictorial Physical Space (MP-Physical Space). Being multi-dimensional, it enables economists, academics and policy makers to analyze economic phenomena from multiple perspectives in time and space.

2.3. Introduction to Multi-Dimensional (MD) Physical Spaces

The new set of Multi-Dimensional (MD) Physical Spaces are following by:

2.3.1. The Pyramidal Physical Space (P-Physical Space)

The P-Physical space (See Ruiz, 2004) is a fixed point consisting of five axes ([X1:n, X2:n, X3:n, X4:n], Yn) or (Xi:n , Yn), where the quadrant "i" can be 1, 2, 3 or 4. Therefore the axis value "n" can be any number from 0…+∞. The P-Physical Space fixed point represents

four independent variables “X1:n”, ”X2:n”, “X3:n” and “X4:n” and one dependent variable “Yn” respectively. Each “Xi:n” variable (X1:n, X2:n, X3:n, X4:n) and “Yn” variable has its individual axis. Representing the dependent variable, the fifth axis, “Yn” is positioned in the center of the graph (in the center of the other four axes). “Yn” has a positive value. It is the convergent point of all the other four axes X1:n, X2:n, X3:n and X4:n. In other words, all “Xi:n” axes converge at the “Yn” axis. This type of graph only works with positive values in its P-Physical Space (See Figure 3 and Prototype 1).

In the case of the P-Physical Space fixed point, all variables “Xi:n” and “Yn” are on the positive side of their respective axes. In other words, if the value of any or all “Xi: n” changes, then the value of “Yn” can be modified at any time. Therefore, we have two possible scenarios:

i) Scenario A - If the value of any or all Xi:n decreases then “Yn” moves down.

ii) Scenario B - If the value of any or all Xi:n increases then “Yn” rises.

Consequently, any change in the values of any or all “Xi:n” will affect “Yn” directly. (See figure 1). The function used by the P-Physical Space fixed point is expressed by $Yn = f(Xi: n)$, where $Xi : n < + \infty$ and $Yn < + \infty$ (See Table 1). Therefore, the P-Physical Space all variables “xi:n” and “yn” are either on the positive side of respective axes together. In other words, if all or some “xi:n” change(s), then the value of “yn” can be modified any time. Therefore, we have two possible scenarios: first scenario, if all or some xi:n move from outside to inside, then “yn” move down. Second scenario, if all or some xi:n move from inside to outside, then “yn” move up. Therefore, any change in some or all “xi:n” will affect “yn” directly. (See Figure 3 and Prototype 1). The function to be used by the P-Cartesian Space is following by: yn = f(x1:n , x2:n , x3:n , x4:n)

PROTOTYPE 1

The Pyramid Physical Space (P-Physical Space) Prototype

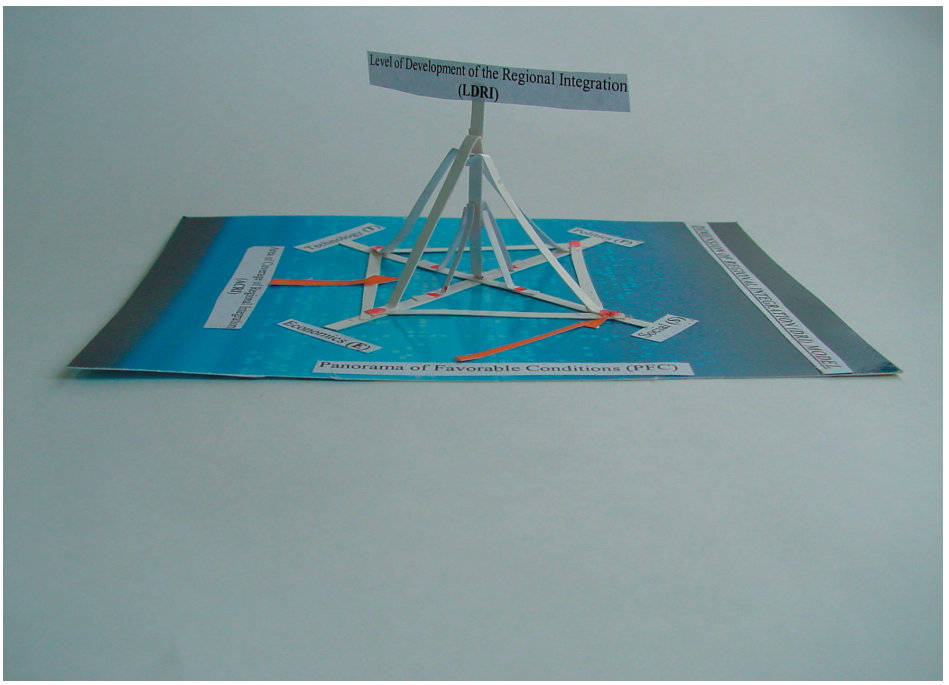
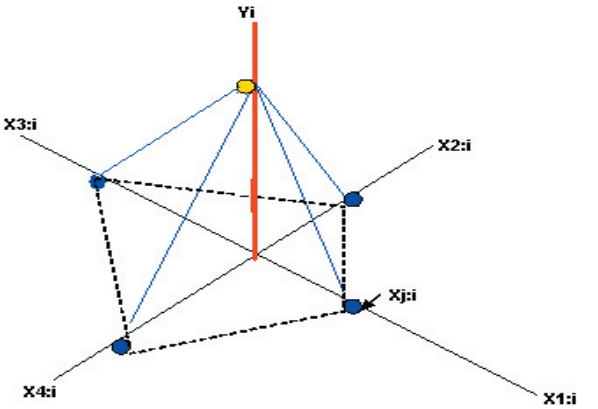
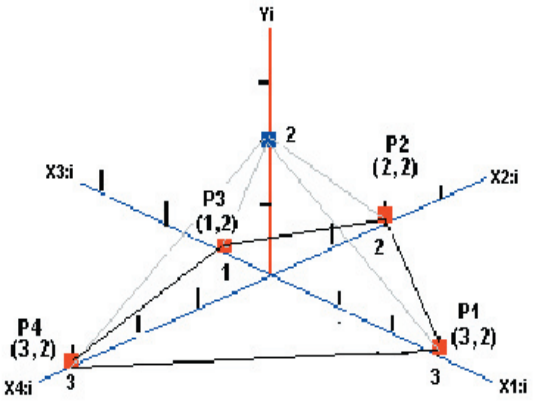


FIGURE 3
Pyramid Physical Space



(Xj:i , Yi)	X1:i	X2:i	X3:i	X4:i
Yi	P1 = (3,2)	P2 = (2,2)	P3 = (1,2)	P4 = (3,2)



2.3.2. The Diamond Physical Space (D-Physical Space)

The Diamond Physical Space (See Ruiz and Yap, 2006.a.) is based on the 3-D Physical plane. The D-Physical Space fixed point has two levels of analysis. Each level of analysis is represented by ([XL:i:n], YL:n), where "L" represents the level of analysis, in this case either Level One or Level Two; "i" represents the quadrant level of analysis (in this case, quadrant 1, 2, 3 or 4) and the axis value "n" is any number from 1 to ∞...

It is important to mention at this juncture that the first level has five axes represented by ([X1:1:n, X1:2:n, X1:3:n, X1:4:n], Y1:n), four independent variables "X1:1:n","X1:2:n", "X1:3:n" and "X1:4:n" and one dependent variable "YL:n" respectively. The second level of analysis is represented by ([X2:1:n, X2:2:n, X2:3:n, X2:4:n], Y2:n). We assume that interdependency does not exist between Level One and Level Two of analysis. The common issue between these two levels of analysis is that both levels use the same axes in "XL:i:n" in the D-Physical Space. However, Level One of the analysis cannot affect Level Two of the analysis, and vice versa. If we draw different levels of analysis in the D-Physical Space, we can visualize and compare two different scenarios in the same D-Physical Space at the same

time (See Figure 4 and Prototype 2). It is crucial to mention at this point that the fifth and sixth axis (Y1:n and Y2:n) is positioned in the center of the D-Physical Space (among the other four "XL:i:n"). We assume that both "YL:n" or (Y1:n, Y2:n) use only positive values. The final result, if the two levels of analysis are joined, is a diamond-shaped figure. The Function to be applied in the D-Physical Space (See Table 1) is represented by Y1:n = f(X1:i:n) and Y2:n = f(X2:i:n).

PROTOTYPE 2
Diamond Physical Space (D-Physical Space) Prototype

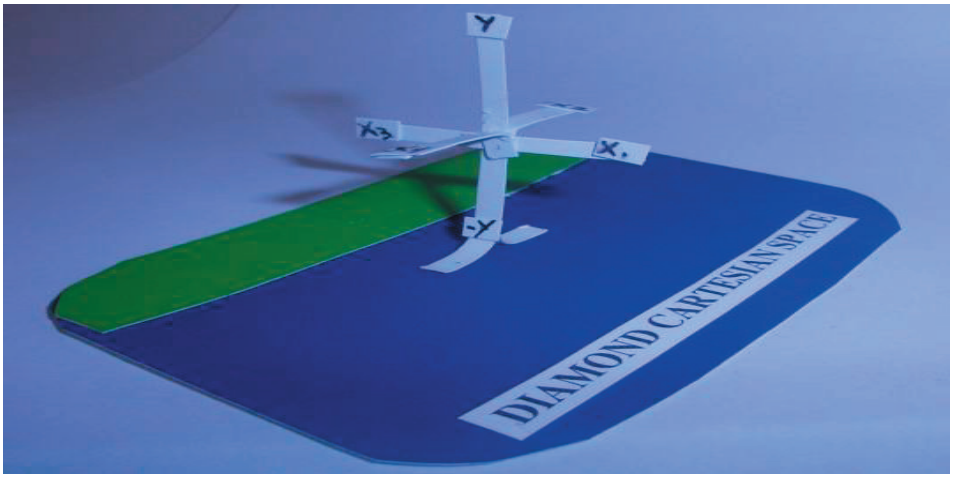
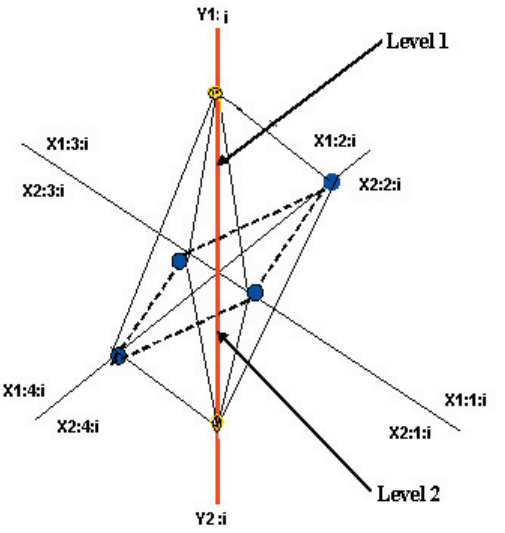
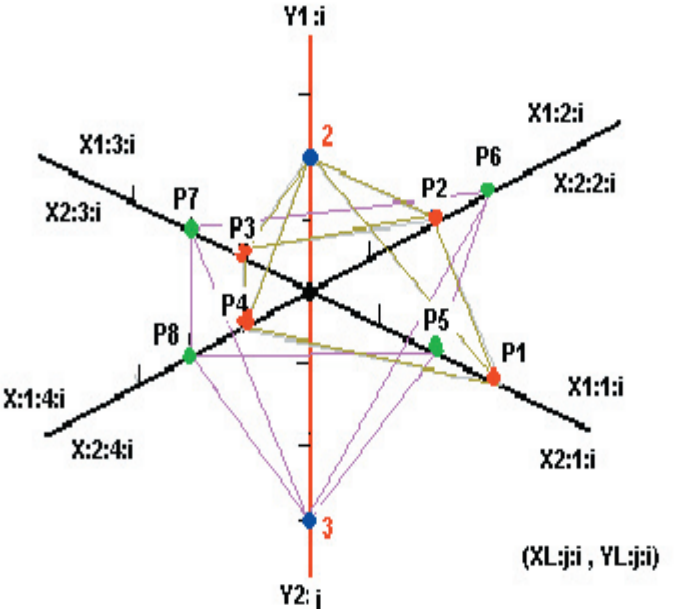


FIGURE 4
Diamond Physical Space



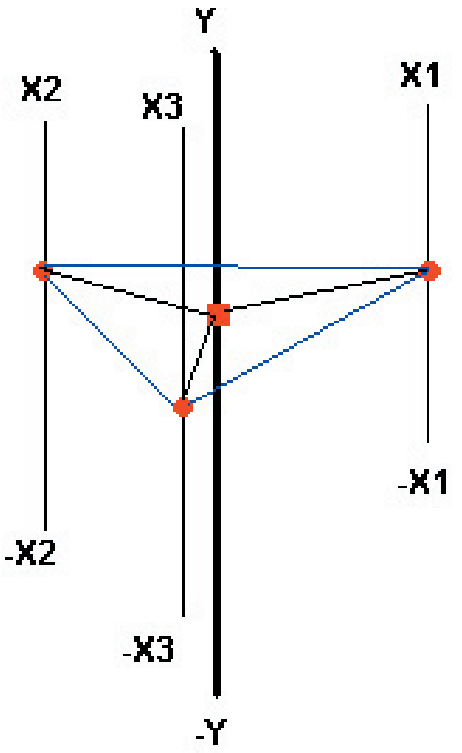
$(X_{L:i}, Y_{L:i})$	X11 = 3	X12 = 2	X13 = 1	X14 = 1
Y1: i = 2	P1 = (3,2)	P2= (2,2)	P3 = (1,2)	P4= (1,2)
	X21 = 2	X22 = 3	X23 = 2	X24 = 2
Y2: i = 3	P5 = (2,3)	P6 = (3,3)	P7 = (2,3)	P8 = (2,3)



2.3.3. The 4-Dimensional Physical Space

The 4-D Physical Space consists of three axes ([X1:n, X2:n, X3:n], Yn). The quadrant represented by "i" can be 1, 2, or 3 and the axis value "n" is any number from 0 to ∞... The 4-D Physical Space represents three independent variables "X1:n", "X2:n", "X3:n" and one dependent variable "Yn" respectively. Each "Xi:n" variable (X1:n, X2:n, X3:n) and "Yn" variable has its individual axis which is a vertical line with both positive and negative values. The positive and negative values are represented by ([(X1:n or -X1:n), (X2:n or -X2:n), (X3:n or -X3:n)], (Yn or -Yn)] on the 4-D Physical Space (See Figure 5). Representing the dependent variable, the fourth axis, "Yn" is positioned in the center of the 4-D Physical Space (among the other three axes). "Yn" has a positive value and negative value. It is the convergent point of all the other three axes (X1:n, X2:n and X3:n). In other words, all "Xi:n" axes converge at the "Yn" axis. The result is a figure represented by a pyramid of three surfaces. The function to be used by the 4-D Physical Space (See Table 1) is equal to Yn = f(Xi:n), where Xi:n < +∞ and -∞ < Yn < +∞.

FIGURE 5
The 4-D Physical Space



2.3.4. The 5-Dimensional Physical Space

The 5-D Physical Space (See Ruiz, 2005) consists of five axes ([X1:n, X2:n, X3:n, X4:n], Yn). The quadrant represented by "i" can be 1, 2, 3 or 4 and the axis value "n" is any number from 0…+∞. The 5-D Physical Space represents four independent variables "X1:n", "X2:n", "X3:n" and "X4:n" and one dependent variable "Yn" respectively. Each "Xi:n" variable (X1:n, X2:n, X3:n, X4:n) and "Yn" variable has its individual axis which

is a vertical line with both positive and negative values. The positive and negative values are represented by ([(X1:n or -X1:n), (X2:n or -X2:n), (X3:n or -X3:n) (X4:n or -X4:n)], (Yn or –Yn)] on the 5-D Physical Space (See Figure 6 and Prototype 3). Representing the dependent variable, the fifth axis, "Yn" is positioned in the center of the 5-D Physical Space (among the other four axes). "Yn" has a positive value and negative value. It is the convergent point of all the other four axes (X1:n, X2:n, X3:n and X4:n). In other words, all "Xi:n" axes converge at the "Yn" axis. The result is a figure represented by a pyramid that can be reshaped into two cubes or one cube. The function to be used by the 5-D Physical Space (See Table 1) is equal to Yn = f(Xi:n), where X i:n < +∞ and -∞ < Yn < +∞.

PROTOTYPE 3
The 5-Dimensional Physical Space (5D-Physical Space) Prototype

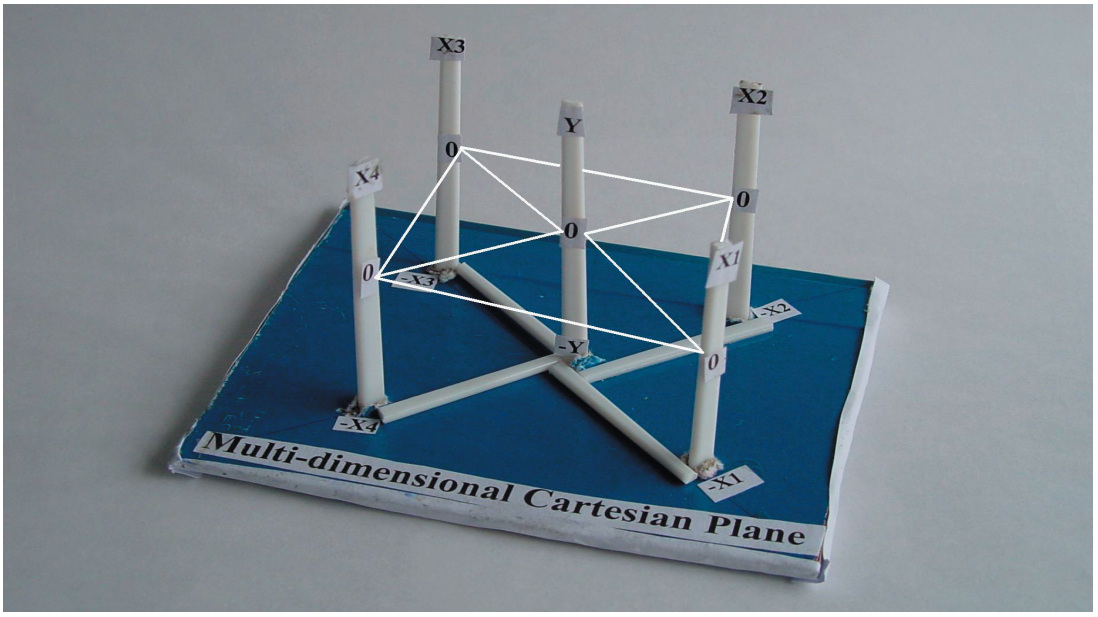
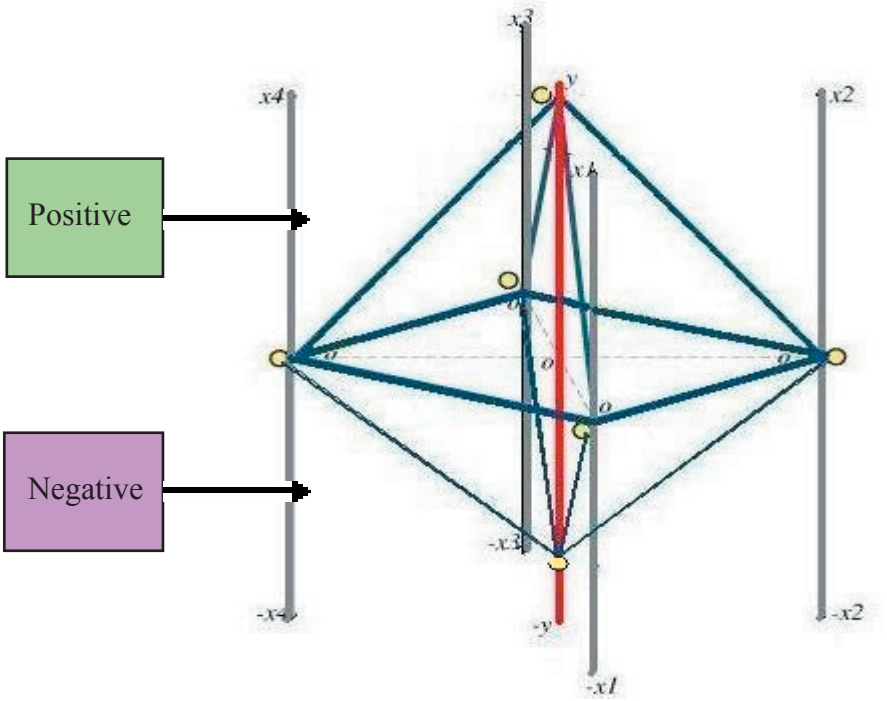
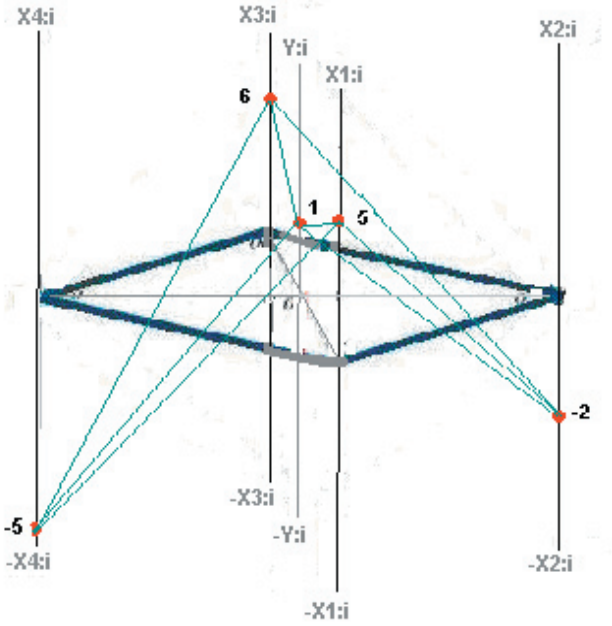


FIGURE 6
The 5-Dimensional Physical Space (5-D Physical Space)



(Xj:i , Y:i)	(X1:i or -X1:i)	(X2:i or -X2:i)	(X3:i , -X3:i)	(X4:i , -X4:i)
(Y1:i or -Y1:i)	(5,1)	(-2,1)	(6,1)	(-5,1)

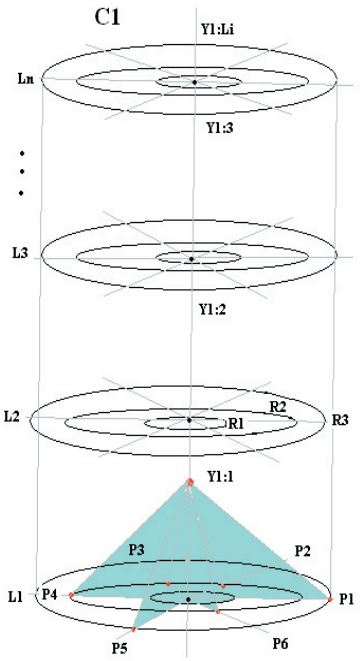


2.3.5. The Infinity Physical Space (I-Physical Space)

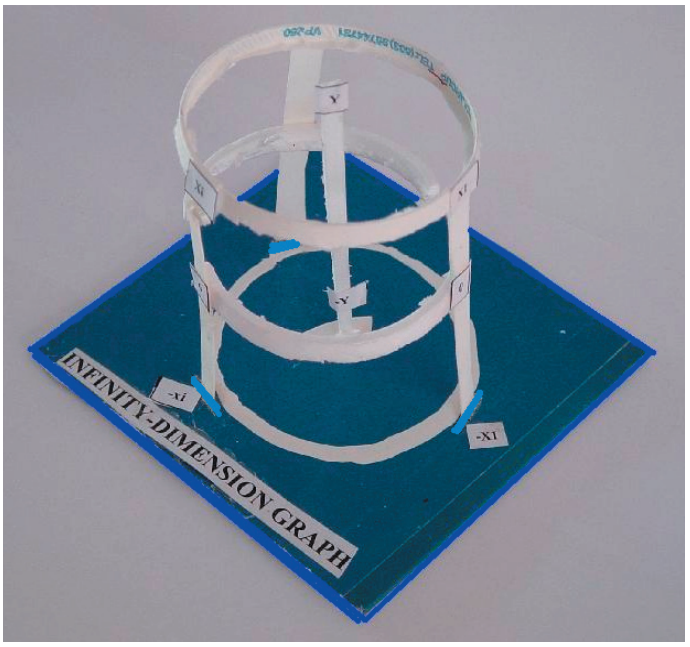
The Infinity Physical Space (I-Physical Space) (Ruiz, 2006.c.) shows a series of n number of sub-cylinders "C" located in the same general cylinder, each sub-cylinder in the same cylinder is fixed by its Level "L" respectively. Where L = {1, 2, 3, . . . , k}, k → ∞… with different "n" values between 1 and ∞... To plot into the different sub-cylinders in the same general cylinder, it is based on the sub-cylinder location, position and ratio. Where XC:L:n is the independent variable in "n" value in sub-cylinder "C" at level "L" lying in position PC:L:n with value RC:L:n. The position is based on PC:L:n $0^{\circ} \leq$ PC:L:n$< 360^{\circ}$, is the position of XC:L:n in cylinder "C" at level "L". And finally the Ratios location under the RC:L:n is the radius corresponding to the XC:L:n in cylinder "C" at level "L". Finally, the YC:L:n is the dependent variable at level "L". The values of the independent variables XC:L:n affecting YC:L:n simultaneously. The Infinity Physical Space function is given below by: $YC:L:n = f(XC:L:n, PC:L:n, RC:L:n)$ $n = 1, \ldots \infty$

For example, the value of a specific independent variable at time point 1, say X1:1:1 is plotted as R1:1:1 the radius pictured lying on a flat surface at angle P1:1:1 is measured from 0° line used for its reference line. The points from the end of the radii are joined to meet in a single point on the top of each sub-cylinder at height Y1:1, the level "L". The diameter of the sub-cylinder is twice the maximum radius (See Figure 7 and Prototype 4).

FIGURE 7
The Infinity Physical Space (I-Physical Space)



PROTOTYPE 4
The Infinity Physical Space (I-Cartesian Space) Prototype



2.3.6. The Multi-Functional Pictorial Physical Space (MFP-Physical Space)

The Multi-Functional Pictorial Physical Space (MFP-Physical Space) (See Figure 8 and Prototype 5) is formed by infinity number of general axes (A0, A1 ,…, An …), perimeter levels (L0, L1 ,…, Ln …) and windows refraction (W0, W1,…,Wn…). Each window refraction is based on join its sub-x axis value (XA:n-L:n) with its sub-y axis value (YA: n-L:n) respectively. Therefore, the window refraction (W0, W1…Wn…) is follow by the coordinate system (XA:n-L:n,YA:n-L:n). Where "n" represents different values between 0 and ∞…. All windows refraction on the same general axis (A0, A1 ,…, An …) will be joined together under the symbol "®". The window refraction "®" will inter-connect all windows refraction (W0, W1 ,…, Wn …) on the same general axis (A0, A1 ,…, An …) but in different perimeter levels (L0, L1 ,…, Ln …). Moreover, the MFP-Physical space (Ruiz, 2006.b.) coordinate system is following by (See Expression 1):

(1.) Perimeter level P0 ® Perimeter level P1 ® … ® Perimeter level Pn

General Axis 0 (A0): W0-0 = (x0-0:n,y0-0:n) ® W0-1 = (x0-1:n,y0-1:n) ®…® W0-n = (x0-PL:n , y0-L:n)

General Axis 1 (A1): W1-0 = (x1-0:n,y1-0:n) ® W1-1 = (x1-1:n,y1-1:n) ®…® W1-n = (x1-L:n , y1-L:n)

General Axis 2 (A2): W2-0 = (x2-0:n,y2-0:n) ® W2-1 = (x2-1:n,y2-1:n) ®…® W2-n = (x2-L:n , y2-L:n)

General Axis 3 (A3): W3-0 = (x3-0:n,y3-0:n) ® W3-1= (x3-1:n,y3-1:n) ®…® W3-n = (x3-L:n, y3-L:n)

General Axis 4 (A4): W4-0 = (x4-0:n,y4-0:n) ® W4-1= (x4-1:n,y4-1:n) ®… ® W4-n = (x4-L:n,y4-L:n)

General Axis 5 (A5): W5-0 = (x5-0:n,y5-0:n) ® W5-1 = (x5-1:n,y5-1:n)®… ® W5-n = (x5-L:n , y5-L:n)

. . . .

General Axis n (An): WA:n-L:n = (xA:n-L:n, yA:n-L:n) ® ……..® W A:n-L:n = (xA:n-L:n, yA:n-L:n)

Finally, the MFP-Physical space shows a large number of different functions are inter-connected and located in different windows refraction (W0, W1 ,…, Wn …), perimeter levels (L1, L2 ,…, Ln …) and general axes (A1, A2 ,…, An …) respectively, it is following by Expression 2:

(2.) Perimeter level P0 ® Perimeter level P1 ® … ® Perimeter level Pn

General Axis 0 (A0): y0-0:n = f(x0-0:n) ® y0-1:n = f(x0-1:n) ®…….® y0-L:n = f(x0-L:n)

General Axis 1 (A1): y1-0:n = f(x1-0:n) ® y1-1:n = f(x1-1:n) ®…….® y1-L:n = f(x1-L:n)

General Axis 2 (A2): y2-0:n = f(x2-0:n) ® y2-1:n = f(x2-1:n) ®……...® y2- L:n = f(x2- L:n)

General Axis 3 (A3): y3-0:n = f(x3-0:n) ® y3-1:n = f(x3-1:n) ®…….® y3-L:nj = f(x3-L:n)

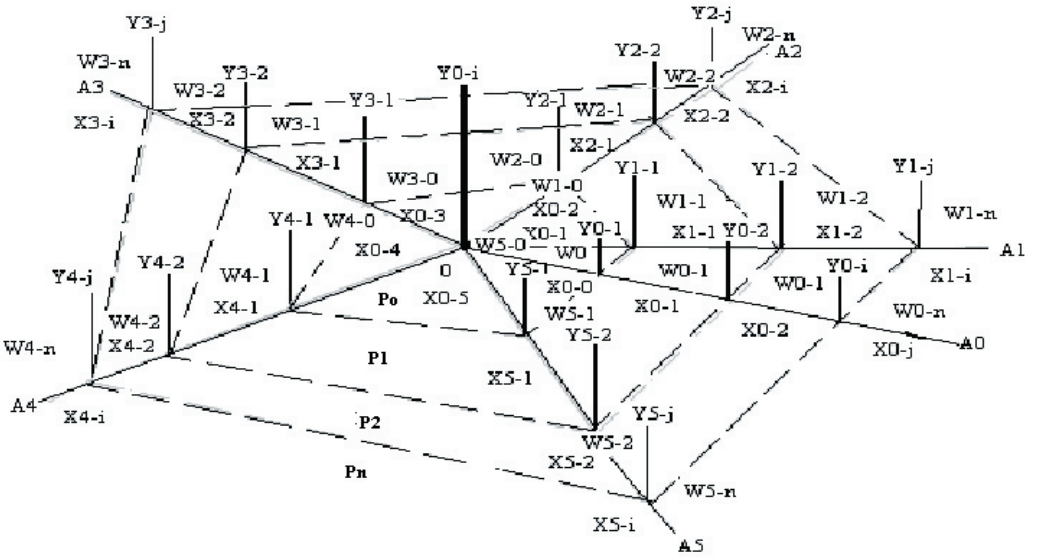
General Axis 4 (A4): y4-0:n = f(x4-0:n) ® y4-1:n = f(x4-1:n) ®…….. ® y4-L:n = f(x4-L:n)

General Axis 5 (A5): y5-0:n = f(x5-0:n) ® y5-1:n = f(x5-1:n)®…….® y5-L:n = f(x5-L:n)

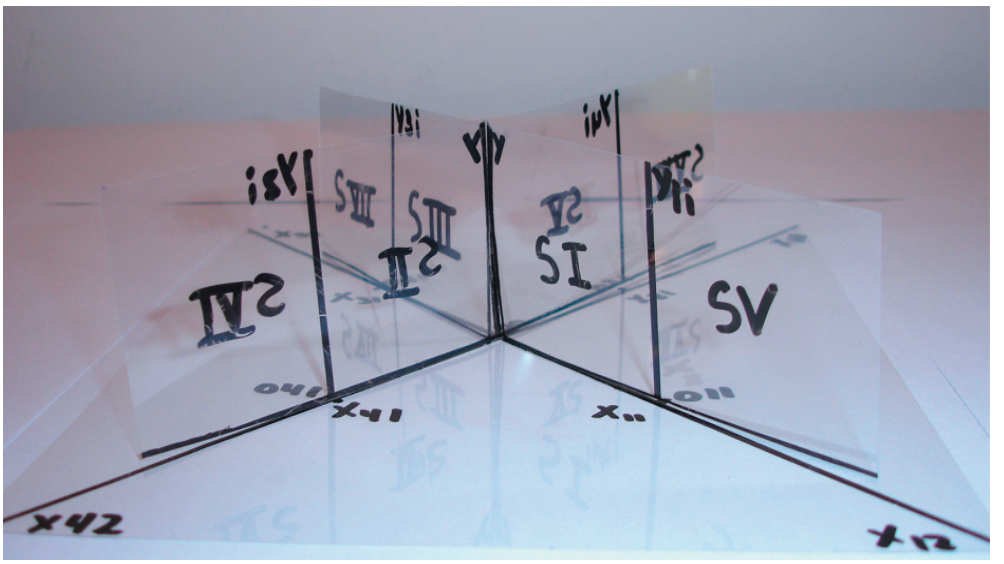
. . . .

General Axis n (An): yA:n-L:n = f(xA:n-L:n,) ® ……® yA:n-L:n = f(xA:n-L:n)

FIGURE 8
Multi-Functional Pictorial (MFP) Physical Space



PROTOTYPE 5
Multi-Functional Pictorial (MFP) Physical Space



2.3.7. The Cubes Physical Space (Cubes-Physical Space)

The Cubes Physical Space (Cubes-Physical Space) is formed by infinity number of general axes (A0, A1 ,…, An). Where each axis shows different levels (L0, L1 ,…, Ln), perimeters (P0, P1, P2…Pn), and Cubes with different sizes and colors (C0/β, C1/β… Cn/β). Therefore, the coordinate system of the Cubes-Physical space is represented by SA:L:P:C = (Ai, Lj, Pk, Cs/β) respectively. Where i, j, k and s represents different values between 0 and ∞…. And β represent the different colors of each cube in different levels (L0, L1 ,…, Ln). All the cubes with different sizes and colors in the same axis under the same level (L0, L1 ,…, Ln) and different perimeters (P0, P1, P2…Pn) will be joined together, it is based on the

application of the concept is called “macroeconomics links structures” represented by the symbol “@”. Moreover, the Cubes-Physical space coordinate system is following by (See Expression 1 and Figure 9):

(1.) Level P0 @……. @ Level Pn

A0: S0:0:0:C(α/β) = (A0,L0, P0, Cα/β) @ ……. .. @ S0:0:λ:C(α/β) = (A0,L0, Pλ, Cα/β)
@ @
S0:1:0:C(α/β) = (A0,L1, P0, Cα/β) @ ……... @ S0:1:λ:C(α/β) = (A0,L1, Pλ, Cα/β)
@ @
. .
. .
. .
@ @
S0:θ:λ:C(α/β) = (A0,Lθ, Pλ, Cα/β) @ ……... @ S0:1:λ:C(α/β) = (A0,L1, Pλ, Cα/β)
@ @
A1: S1:0:0:C(α/β) = (A1,L0, P0, Cα/β) @ ……. .. @ S1:0:λ:C(α/β) = (A1,L0, Pλ, Cα/β)
@ @
S1:1:1:C(α/β) = (A1,L1, P0, Cα/β) @ ……... @ S1:θ:λ:C(α/β) = (A1,L1, Pλ, Cα/β)
@ @
. .
. .
. .
@ @
S1:θ:λ:C(α/β) = (A1,Lθ, Pλ, Cα/β) @ ……... @ S1:θ:λ:C(α/β) = (A1,Lθ, Pλ, Cα/β)
@ @
An: Sn:0:0:C(α/β) = (An,L0, P0, Cα/β) @ ……. .. @ Sn:0:λ:C(α/β) = (An,L0, Pλ, Cα/β)
@ @
Sn:1:1:C(α/β) = (An,L1, P0, Cα/β) @ ……... @ Sn:1:λ:C(α/β) = (An,L1, Pλ, Cα/β)
@ @
. .
. .
. .
@ @
Sθ: λ: C: α/β = (An,Lθ, Pλ, Cα/β) @ ……... @ Sn+1:θ+1:λ+1:C:α+1/β = (An+1,Lθ+1, Pλ+1, Cα+1/β)

Finally, the Cubes-Physical space shows a general function, where the dependent variable is identify by The National Economy Base “Ne” . The Ne is the final result from

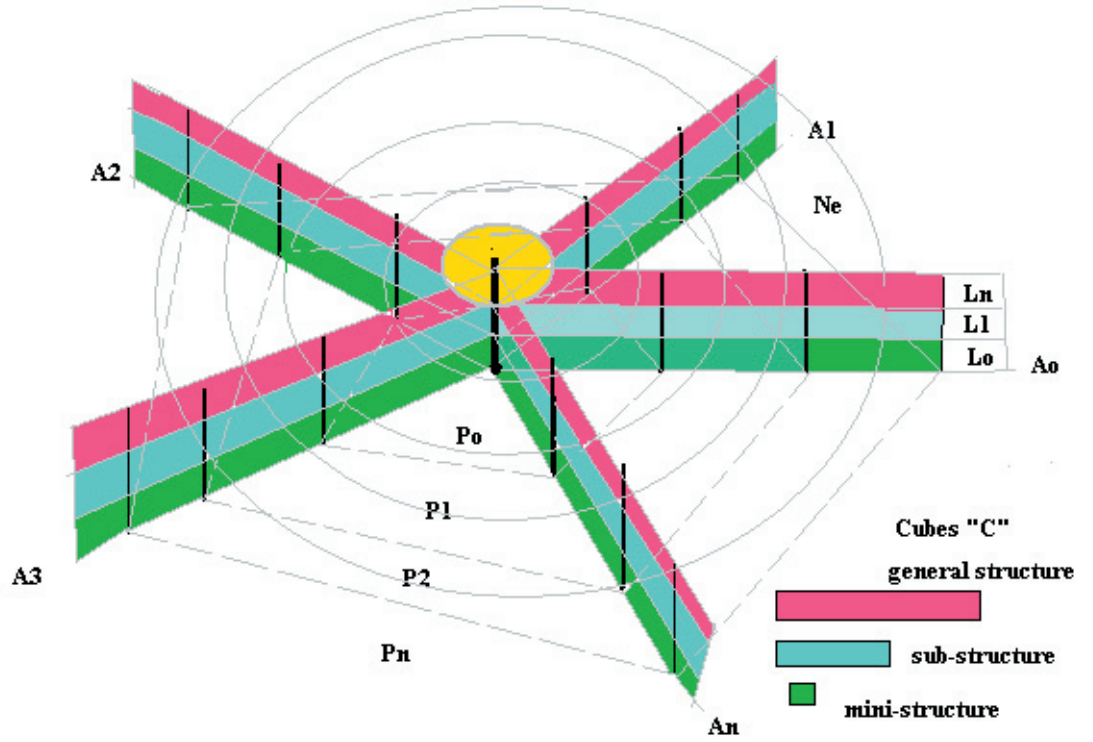
TABLE 1
Differences between 2-D, 3-D and MD-Physical Spaces

Dimension	Coordinates	Spatial Factors	Function
2-Dimensional	(X,Y)	(X,Y)	$Y = f(X)$
3-Dimensional	(X,Y,Z)	(X,Y,Z)	$Z = f(X,Y)$
Pyramid Physical Space (P-Physical Space)	(Xi:n , Yn)	i = {1, 2, 3, 4} n = {1, 2, 3…+∞}	$Yn= f(X i :n)$ $Xi : n < + \infty$ $Yn < + \infty$
Diamond Physical Space (D-Physical Space)	(X L :i :n , YL:n)	L = {1,2} i = {1,2,3,4} n = {1, 2,…+∞}	$YL:j:n =f(X L: j : n)$
4-D Physical Space	(Xi:n ,Yn) $-\infty< X i : n <+\infty$ $-\infty<Yn <+\infty$	i = {1, 2, 3} n = {1, 2, …+∞}	$Yn = f(X i : n)$ $X i : n < +\infty$ $-\infty < Yn < +\infty$
	(Xi:n ,Yn)	i = {1,2,3,4}	$Yn = f(X i : n)$
5-D Physical Space	$-\infty< X i:n <+\infty$ $-\infty<Yn <+\infty$	n = {1, 2…+∞}	$X i :n < +\infty$ $-\infty < Yn < +\infty$
Infinity Physical Space (I-Physical Space)	[(XC:L:n ,PCLn, RC:L:n) , YC:L:n]	n = {0,1, 2,3…+∞ c = {1,2} L = {0,1, 2,3…+∞} R= {0,1,2,…,360o}	$YCLn=f(XC:L:n,$ PC:L:n , RC:L:n)
Multi-Pictorial Physical Plane (MP-Physical Pace)	(XA:n-L:n,YA:n-L:n)	A = {1, 2, 3…+∞} n = {1, 2, 3…+∞} L = {1, 2, 3…+∞}	$YA:n-L:n =$ $f(XA:n-L:n)$
The Cubes Physical Space (Cubes-Physical Space	(Ai, Lj, Pk, Cs/β) L = {1, 2, 3…+∞} K = {1, 2, 3…+∞} S = {1, 2, 3…+∞}	A = {1, 2, 3…+∞}	$SA:L:P:C = f(Ai, Lj,$ Pk, Cs/β)

ten macroeconomic structures. It is based on link of all macroeconomics structures (S0, S1 ,…, Sn) under different axes (A1, A2 ,…, An), levels (L1, L2 ,…, Ln), perimeters (P0, P1, P2…Pn) and Cubes with different sizes and colors (C0/β, C1/β… Cn/β) in the same Cubes-Cartesian space respectively, it is follow by See Expression 2:

(2.) /ΔNe/ = [/ΔAo/ @ /ΔA1 / @ …@ /ΔAn/]

FIGURE 9
The Cubes-Physical Space Coordinate System



2.4. Introduction to Econographicology

The Econographicology is originated for the necessity to generate an alternative and specialized multidimensional graphical method for economics, business and finance. Econographicology main objective is focused on the uses and develop of new Cartesian spaces (Cartesian coordinate system) to build multi-dimensional graphs. Therefore, Econographicology will maximize the uses of multi-dimensional graphs to minimize difficulties in the process of meta-database storage and multi-variable data behavior visualization.

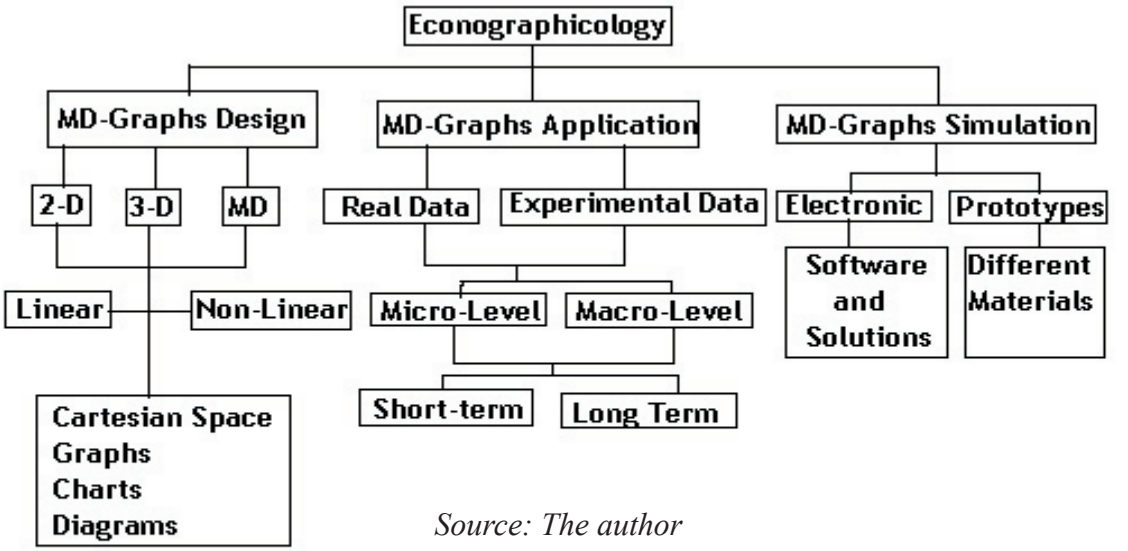
The Econographicology is defined as a multi-dimensional graphical method to facilitate the meta-database storage and multi-variable data behavior visualization. Econographicology also involves the study of graphical methods applied in economics until our days, R&D of new graphical methods and finally the application of new graphical methods in economics, as well as finance and business.

The Econographicology is divided into three large research areas are MD-graphs de-

sign, MD-graphs application and MD-graphs simulations. The MD-graphs design research area can be 2-D, 3-D and MD Cartesian coordinate system under linear and non-linear graph systems, the same section is divided into four sub-sections are Cartesian spaces, graphs, charts and diagrams design. The MD-graphs application research area are used two types of data, there are real and experimental data under micro and macro-level analysis in the short and long run (see Diagram 1).

The last section is the MD-graphs simulations research area, it is divided in two sections are electronic and prototypes. In the case of the electronic area is based on the application and uses of software and solutions. The idea to include prototypes in the MD-graphs simulations in the study of economics is to facilitate the easy understanding in the teaching-learning-research process of multi-variable data analysis (see Diagram 1).

DIAGRAM 1
Econographicology Research Areas



Source: The author

2.5. Concluding Remarks

First, this chapter concludes that into the 3-Dimensional space exist n-dimensions, sub-dimensions, micro-dimensions, nano-dimensions and ji-dimensions. These different dimensions are moving in different levels of speed in the same graphical space and time.
Second, I conclude that the 2-Dimensional space shows certain limitations to visualize complex economic phenomena simultaneously in the same graphical space and time. Therefore, the Multi-Dimensional Physical Spaces are available to expand a multi dimensional optical effect to visualize different complex economic phenomena in the same graphical space and time according to this research.

Finally, the Econographicology attempts to be an alternative graphical method focus to support the meta-database storage and visualization of multi-variables data behavior, as well as finance and business. The main idea to build Econographicology is to offer a new multi-dimensional graphs based on the application of alternative Multi-Dimensional Cartesian coordinate systems can facilitate the study of any economic, finance and business

phenomena under macro-level and micro-level of analysis in the short and long run. In summation, the Econographicology also will play important role in the research and teaching-learning process of economics through a series of new graphs methods and techniques that can be used by academics, researchers, economist and policy makers.

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Notes

[1] American Economic Review; Canadian Journal of Economics; Econometrica; Economica; Economic History Review; Economic Journal; International Economic Review; Journal of Economic History; Journal of Economic Literature; Journal of Political Economy; Oxford Economic Papers; Quarterly Journal of Economics; Review of Economic Studies; Review of Economics and Statistics; Canadian Journal of Economics and Political Science; Journal of Economic Abstracts; Contributions to Canadian Economics; Journal of Labor Economics; Journal of Applied Econometrics; Journal of Economic Perspectives; Publications of the American Economic Association; Brookings Papers on Economic Activity. Microeconomics and American Economic Association Quarterly.

SECTION 1

Application of the Pyramid Physical Space

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CHAPTER 3

The Global Dimension of Regional Integration Model (GDRI-Model)

3.1. Introduction

Over the past 70 years, the field of research on regional integration has changed dramatically, with the discovery and implementation of new theories, models and techniques. In this thesis, the study of regional integration is approached from a few different perspectives, namely, economic, political, social and technological analysis. In addition, the orientation of these perspectives in the context of regional integration is also accounted for.

Evaluating regional integration and its benefits is not an easy task. The nature of the subject matter constitutes part of the problem in this regard (Devlin and Ffrench-Davis, 1998). Much of the study related to Regional Integration has so far been done from the economic perspective. According to Winters (1999), the study of regional integration from the economic perspective is typically evaluated in light of the probable scenario in the absence of such an approach to the study. Also, as pointed out by Winters, with complications in defining and measuring changes in economic welfare for a particular sub-region, economists use proxy summary statistics that reflect growth of trade.

On the basis of the above idea, this thesis introduces a new methodology of analysis that monitors regional integration process from a new perspective. Called regional integration evaluation methodology (RIE-Methodology), this methodology will study all areas of development (political, social, economic and technological analysis simultaneously) that each country or domestic development system (DDS) in the same region (same geographical position) shows based on the results of the regional development indexes (X_i)[1]. The idea is to demonstrate that the regional development (RD)[2] can affect the evolution of regional integration process considerably. It is based on the application of a group of indexes and graphs. The group of indexes and graphs show the evolution and stages of the regional integration process of region from a multi-dimensional analysis.

If is assumed in the RIE-Methodology that the basic pre-condition to start a stronger regional integration process in any type of trade bloc is a stronger domestic development experienced by each country or domestic development system (DDS) in the same region. Another pre-condition for a stronger regional integration process is a combination of historical timing and political and social willingness. For the latter, the countries involved

must be interested in creating a formal or informal agreement with all its members so as to consolidate themselves into a single region.

The difference between the RIE-Methodology and the traditional models of analysis is that RIE-Methodology will analyze regional integration from a new perspective of analysis under a multi-dimensional analysis based on the study of all areas that domestic development evolve such as political development, social development, economic development and technological development. It allows for the detection of the pros and cons in the evolution of regional integration blocs in any region from a different perspective. The main idea is to show that successful regional integration blocs depend on majority of the members being interested in building a trade bloc and there cannot be large margin of difference in the domestic development (political development, social development, economic development and technological development) among its members. The objective of the RIE-Methodology is to offer to policy-makers and researchers a new alternative analytical tool for studying the results achieved with regional integration. This will benefit the parties concerned in their policy-making and program development.

3.2 Background Research and Analysis of Different Fields of Research in the Study of Regional Integration

Regional Integration can be studied and researched based on different focuses and approaches. This paper applies four traditional fields of research in the study of Regional Integration: economic, political, social and technological fields of research. In the first part of the research pertaining to this study, an effort was made to identify the inclination of the fields of research in the study of regional integration. 500 papers (100%) on regional integration from 75 journals[3] published between the 1950's and the 1990's were selected for this purpose (see: www.jstor.org and www.Elsiever.com). Next, the percentage of participation by fields of research (economic, political, social and technological) in the study of regional integration was calculated.

The following trend in terms of fields of research in the study of regional integration was observed: 50% from the economic field of research, 40% from the political field of research, 7% from the social field of research and 3% from the technological field of research. It was also observed that, compared to the 1950's, 1970's and 1980's, the topic of regional integration was more frequently researched and discussed in journals in the 1960's (25%) and 1990's (35%).

3.2.1 Economics Field of Research in the Study of Regional Integration

In the economic field of research (i.e. the largest field of research) in the study of regional integration, attention was placed on three specific areas: economic theory, political economy and applied economics. Economic theory is divided into two parts, namely microeconomics and macroeconomics, each of which has a different focus. Some of these focuses are: partial or general (type of equilibrium), ex-post or ex-antes (method analysis), static or dynamic (behavior), short term or long term (time frame). Method analysis is either quantitative (econometrics, statistics and mathematics) or qualitative (in the form of comparative studies based on theories or historical data). It is observed that the study of regional integration from the economic perspective mainly centers on macroeconomics

applications (80%), quantitative methods (65%), partial equilibrium (60%), ex-antes approach (65%), static models (65%). Besides, these applications are used in the short term in most research.

The common theories, models and theorems used by researchers in the economic field of research in the study of regional integration are: International Trade Policy[4] framework, Optimal Current Area theory[5], Fiscal Federalism theory[6], Heckscher-Ohlin model[7], Kemp and Wan theorem[8]. All these theories, the most important theory applied is the Customs Union theory[9] (including the Second Best theory[10]). The Customs Union theory is still used today by many economists to choose between trade creation and trade diversion[11] for evaluating regional integration. However, the static analysis used in the Customs Union theory poses a problem: it frequently uses a partial competitive equilibrium framework to arrive at a general conclusion about a process that is a general equilibrium phenomenon (Devlin and Ffrench-Davis, 1998).

According to Winters (1997), many economists are of the stand that trade creation versus trade diversion is not the core of the problem. The problem lies with the deficiency of the models of dynamics and empirical foundations used for testing them. In effect, Mordechai and Plummer (2002) point out that, economists whose research into regional integration is based on ex-post models include a gravity model, an import-growth simulation and other regression approaches. This is because computational general equilibrium (CGE)[12] model (multi-country and multi-commodity dimension) has become very popular among economists.

Furthermore, the economic field of research merely applies the positive theories of welfare gains and losses associated with regional integration; it provides no explanations of the political choices that allow for integrated fields of research. As such, the economic field of research negates the global context of the evolution and trend of regional integration process as a whole.

In a nutshell, this book maintains that the economic field of research poses many limitations in the study of the effects of regional integration, and that it is merely one part of the complicated puzzle of regional integration research. On this account, this study further maintains that the study of regional integration requires a multi-dimensional analysis (economic, social, political and technological dimensions simultaneously).

3.2.2 Political, Social and Technological Fields of Research

The study of regional integration from the political dimension is also pervasive. It is observed many studies on regional integration involve extensive elaboration of the following politically oriented topics: institutional framework (functionalism or neo-functionalism), policy dimensions and agreements (negotiation) and international law issues.

As observed, more qualitative rather than quantitative methods of evaluation are used in the political dimension of research. Just as in the economic dimension of research, the political dimension of research in the study of regional integration has many limitations. However, as pointed out by Mattli (1999), the political context in which integration occurs has been specified in the political dimension of research and this has provided insightful accounts of the process of integration.

The third field of research, that is the social field of research, focuses on issues

such as history, culture, education, social welfare programs and social policies applied by governments. Usually such research is in the form of comparative studies based on basic statistical comparison, feedbacks, interview results, history and social theoretical frameworks. Many of these studies are confined to highly important issues that are worthy of consideration in the study of the effects of regional integration.

The fourth field of research, that is the technological field of research, has a relatively smaller presence. It focuses mainly on four specific topics: regional electrical inter-connection, telecommunications, technology transfer, and Research and Development (R&D). Some of these research documents involve advanced technical terminologies and the application of quantitative methods (statistics and mathematics).

3.3 The Global Dimension of Regional Integration Model (GDRI-Model)

Economic, political, social and technological dimensions of research into regional integration clearly do not provide a global perspective in the understanding of regional integration. For this reason, the Global Dimension of Regional Integration Model (GDRI-Model) is proposed in this thesis to address the issue.

The GDRI-Model is a measuring tool for studying regional integration from a global perspective. The proposed GDRI-Model is a simple and flexible model. It applies dynamic and general equilibrium analysis to show the past and present situations in the regional integration process of any region based on a set of indexes and graphs. Its field application is not constrained by region or the development stage of each member interested in integrating into a single regional bloc.

The GDRI-Model can be applied to any form of regional integration process: between developed countries and developing countries, North-South Integration (e.g. within Europe Union –EU-), between developed and developing countries (e.g. within North America Free Trade Area –NAFTA-), and between developing countries or South-South Integration (e.g. within MERCOSUR and ASEAN).

The application of the GDRI-Model is based on the characteristics, conditions and historical moments of a region's regional integration development. The GDRI-Model is like a simulator that applies a series of simulations in different scenarios and in different phases of the regional integration process. This model does not attempt in any case to be a forecasting model. It focuses on the past and present situations in the regional integration process as a whole. It helps to provide a general idea about the situations and evolution of the regional integration process in any region.

3.4 The Domestic Development System Concept

This part of the research presents a new concept entitled "Domestic Development System (DDS)." DDS incorporates all economic, political and social characteristics that any country can show in its different phases of development. GDRI-Model assumes that each country has its own domestic system development. At the same time, it defines regional integration as the joining of a certain number of different countries (or DDS) that are interested to create a strong regional development system (RDS). The DDS concept is based on five assumptions (Ruiz, M., 2004):

1. Change of domestic development system (DDS) in any country cannot be forced; it can only be induced by material incentives and motivation.
2. The domestic development system (DDS) of any country is spurred by the limitation of resources.
3. Each domestic development system (DDS) has its unique characteristics. Therefore it might be difficult to try to implement a successful domestic development system (DDS) in another less successful domestic development system (DDS).
4. The RDS concept attempts to integrate different DDS into a regional integration agreement (RIA) depending on the different domestic developments system (DDS) that are available for integrating into a single regional system.
5. The creation of regional development system (RDS) depends on the flexibility of each domestic development system (DDS).

The domestic development system (DDS) concept offers a new perspective of analysis and research in the field of regional integration and development economics. The traditional research is based on economic, political, social and technological point of view; but with the DDS concept, it is possible to visualize different countries' developments from a global perspective.

3.5 Phases in the Global Dimension of Regional Integration Model (GDRI-Model)

3.5.1 Phase I: Design of the Multi-input Database Table

The multi-input database table is an alternative style of database analysis framework that permits storage of large amount of data to measure a single variable. This single variable can show the evolution of any phenomenon from a general perspective. The multi-input database table is designed to evaluate either by country or region (see Diagram 1).

The multi-input database table is focused on measuring four main independent variables (e.g. X_1, X_2, X_3, and X_4). Each main independent variable is formed by "n" number of sub-variables. The number of sub-variables in each main independent variable is non-limited, for this reason the multi-input database table concept does not have any specific ranking, instead exists there a basic classification of sub-variables. Only two main independent variables have classification. First, political (X_1) is divided in two large sections which are external and internal factors (see Table 3). Second, economic (X_3) is divided on production, consumption, trade, labor, investment, infrastructure, government and international cooperation. However, each sub-variable has a code number respectively. The code number depend on the area of development (X_1 = political; X_2 = social; X_3 = economic and X_4 = technological). The reason why all sub-variables have the same importance (weight) is because we are interested to measure a single value, in our case each main independent variable (X_1, X_2, X_3 and X_4). To give the same weight to all sub-variables is necessary to use a binary system. The binary system helps to maintain a balance among all variables in each multi-input database table. Another reason is that the binary system helps to create an alternative model of analysis of countries with limited information, especially in the case of developing countries and less developed countries (LDC's).

The idea to apply multi-input database is to find the domestic development system –DDS- (country) and finally the regional development –RD- (regional bloc). The idea to find

DDS and RD is to demonstrate that successful regional integration process depends on major part of DDS being enough strong and there can only be a small gap among its members. In this case, RD is result of the DDS sum. The four main independent variables will show RD in different areas of development (political (X_1), social (X_2), economic (X_3) and technological (X_4).

The number of variables used in the GDRI-Model varies, depending on the objectives of the researchers or policy-makers and the orientation of the cases of research. In the case of this thesis, 98 variables with their respective table and parameters were selected: 19 variables for regional political development index (X_1) (see Table 3); 15 variables for regional social development index (X_2) (see Table 6); 54 variables for regional economic development index (X_3) (see Table 9) and 10 variables for regional technological development index (X_4) (see Table 12).

Once the number of sub-variables is determined, the next step is to collect the statistical and historical data that constitute sub-variables ("n" number) in each main independent variables (X_1, X_2, X_3 and X_4). All sub-variables in each main independent variables X_1, X_2, X_3 and X_4) may not have a direct relationship between them -- they may be independent variables or endogenous variables. However, all the sub-variables in each multi-input database table are meant to measure a single variable or main independent variable, that is, each of the Regional Development Indexes (X_i).

Each of the four X_i indexes (X_1, X_2, X_3 and X_4) to be measured is viewed as a main independent variable (i.e. endogenous variable). However, there is no connection and interdependency among these four X_i indexes when they are joined in the graph. These four Xi indexes are used to draw a graph that represents the evolution and stages of the regional integration process of the region from a general perspective. The objective of this chapter is to apply the GDRI-Model in many trade blocs simultaneously (e.g. European Union –EU-, North America Free Trade Area –NAFTA-, Association of Southeast Asian Nations –ASEAN-, and MERCOSUR).

3.5.1.1 Rational Selection of Sub-variables in each Multi-input Database Table

REGIONAL POLITICAL DEVELOPMENT

The regional political development is divided in two large sections: external factors and internal factors.

The external factors

Colonization: The model assumes that countries which here colonized for a long time or continue under the hegemony center domination can stop the process of regional integration anywhere.

Group negotiation power: This can be visualized by the constant number of meetings try to merge all members into a single region.

Foreign Policy Orientation in each Member: The foreign policy is divided into two large focuses under regional and global level (world).

Negotiation Style: This sub-variable can show the style of negotiation under individual or grouping behavior.

The internal factors

International Organization Support: The international organizations can facilitate financial and technical support.

Intra-regional institutions number: The number of institutions can play an important role in the development of regional integration process.

Political regime: This sub-variable can offer political stability in the region

Legislative background: This can help to facilitate the regional legal framework environmental

Internal Security: Security for local and regional citizens

Human Rights: The level of protection of human rights in each member in the same region

Border Problems: If there are border problems then this problem can stop regional integration process

Political Stability: This is a basic condition to integrate all countries into the same region

Public Administration: Good public administration can facilitate regional integration process management

Army size: Less spending on army services can help to allocate resources on social public services

Bureaucracy level: Large bureaucracy can generate difficulties in the regional integration process

REGIONAL SOCIAL DEVELOPMENT

The regional social development is formed by seven sub-variables:

Literacy: This sub-variable can show the human capital stock under regional level

Social Problems: These can generate instability in one member country or regional level

Health and Medical programs: The social welfare orientation of the region

External Culture Influence: Society behavior to become an individual or a collective society

Food Security: Prevents regional disasters and emergencies

Public Education: Infrastructure for training and high education at the regional level

Low Cost Housing Projects: The equity in the distribution of income under regional level

REGIONAL ECONOMIC DEVELOPMENT

The regional economic development is formed by eight large sections which are production consumption, trade, labor, investment, infrastructure, government and international cooperation.

Production

The eleven sub-variables are considered in this section. Among the eleven variables, we include the study of the GDP to observe the production structure and growth. In the same item is considered natural resources, oil production and environmental protection to detect the supply of resources for the regional production. Market location, industrial concentration and subsidies level can generate distortions in regional prices. Export structure can help to

visualize if there exist similarities in the export products that members in the same region offer to the international market. The copyright of patents and marks can play an important role in the control of pirated massive production.

Consumption

In the consumption section seven sub-variables are considered. It considers income per-capita, buyer purchase, poverty level, saving rate, inflation rate and wealth distribution. All these sub-variables need to be found among all members to determine the consumption behavior under the regional level. The market size can play important role in the regional integration process can help to join small markets into a single market.

Trade

The trade section has five sub-variables. All these variables will show the behavior of the external sector under the regional level and the possible obstacles that each member or the region may have. These variables are intra-regional trade volume, extra-regional trade volume, intra regional tariff application, openness and monopoly controls.

Labor

The labor section is formed by six sub-variables. This section considers that international social division can facilitate the regional integration process together with labor distribution under urban and rural area. The immigration and emigration levels can show the mobility of labor into the region and the rest of the world. The population growth is considered a vital variable in the study of labor to observe the population pyramid of the region and future human capital stock supply. The labor productivity also plays an important role to observe the possibility of FDI attraction to expand regional production and exports.

Investment

This section is divided into seven sub-variables. Three categories of investment, which there are domestic, intra-regional and foreign direct investment is used in this section. We are interested to study how these three types of investment play an important role in the regional integration process of any region. Additionally, the same section considers that the privatization process (public goods) needs to be considered in the analysis of regional integration process to facilitate the mobility of capital at the regional and international level. The interest rate, exchange rate stability and stock market activity can show the level of banking and stock market development in the region, and the possibility to of joining the financial regional system.

Infrastructure

The infrastructure is formed by six sub-variables and this section will show the level of physical infrastructure under the regional level, and how it can facilitate in the mobility of labor and goods (transport system, intra-regional physical projects and tourism), communication services (telecommunications) and energy (electricity production).

Government

The government section has seven sub-variables. The inclusion of this section into the analysis of regional economic development is to study the tax income distribution (taxation), domestic debt and foreign debt of each member in the same region. In the same issue, it is possible to observe the level of government income and spending (e.g. government expenditures and planning economy sub-variables) of the different governments in the same region. We assume that good performance of governments can help the standardization and management of public finances (income and spend). Additionally, in the same study we include the level of corruption. This can help to observe how corruption can affect the regional integration process originated by political groups to protect its personal interests.

REGIONAL TECHONOLOGICAL DEVELOPMENT

The regional technological development is formed by ten sub-variables. This section aims to show the level of technological development of each member in the same region. We assume that if majority of members in the same region have a small gap of technological development this can facilitate the regional integration process. The variables are technology (R&D) level, internet hosts, software production, internet access, telecommunications, research institutes, biotechnology advances, Import of new technologies, R&D public investment and IT development.

3.5.1.2 Types of Multi-input Data Base Table

The first type of multi-input database table pertains to "country or domestic system development". It uses "N" number of variables. The number 'N' is decided by researchers or policy-makers. The number of cases in the study is represented by "M". In the case of GDRI-Model, "M" represents only one country (domestic system development). The time factor "T" is dependant on the time parameters that the researchers or policy-makers are interested in using. Therefore, "T" can be in terms of years or decades. The second type of multi-input database table pertains to "region or regional system development". All the conditions and functions of "N", "M" and "T" factors are the same as that in the first type of multi-input database table, except that "M" here represents a "region or regional system development" rather than a "country or domestic system development". For this chapter, the second type of multi-input database (by region) is adopted.

3.5.2 Phase II: Measurement of Regional Development Indexes (Xi)

The second phase of the implementation of the GDRI-Model involves the measurement of regional development indexes (X_i) using the variables in four basic multi-input database tables (see Diagram 1). The regional development indexes are regional political development index (X_1)[13], regional social development index (X_2)[14], regional economic development index (X_3)[15] and regional technological development index (X_4).[16] These variables are analyzed with their codes, descriptions, parameters and sources respectively (see Tables 4, 5, 7, 8, 10, 11, 13 and 14).

TABLE 3

Multi-input Database Table: Regional Global Political Development of Trade Bloc "XYZ"

CODE	TRADE BLOC NAME							
	POLITICAL FACTORS LIST	COUNTRY					Result	
	VARIABLES	C1	C2	C3	C4	.....CN	AS	TPR
P.1.	**External factors**							
P.1.1.	Colonization (country)	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ1	5
P.1.2.	Group negotiation power	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ2	5
P.1.3.	Domestic foreign policy influences							
P.1.3.1.	Regional	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ4	5
P.1.3.2.	Global	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ5	5
P.1.4.	Negotiation style	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ6	5
P.2.	**Internal factors**							
P.2.1.	International organizations support	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ7	5
P.2.2.	Regional institutions role	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ9	5
P.2.3.	Political regime	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ10	5
P.2.4.	Legislative background	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ11	5
P.2.5.	Internal security	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ12	5
P.2.6.	Human rights	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ13	5
P.2.7.	Border problems	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ14	5
P.2.8.	Political stability	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ15	5
P.2.9.	Political structure and public admini	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ17	5
P.2.10.	Army size	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ19	5
P.2.11.	Bureaucracy level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ20	5
TOTAL							**ΣAS**	**ΣTPR**
TOTAL (%)							**AP**	**100%**

AS= ACTUAL SITUATION

TPR = TOTAL OF POSSIBLE RESULTS

Xi= GLOBAL DEVELOPMENT

MEASURES:

Σ1.....N = The total sum of all country at the same region

ΣAS = Total of actual situation

ΣTPR= Total of possible results

Xi = ΣAS/ΣTPR

TABLE 4
The Global Regional Political Development Parameters

CODE	POLITICAL FACTORS LIST VARIABLES	PARAMETERS	
P.1.	**External factors**	**Limit**	**Description**
P.1.1.	Colonization (country)	1= Exist or 0= NE	Short colonization period less than 50 years
P.1.2.	Group negotiation power	1 = O or 0 = S	No. of activities per year under regional level
P.1.3.	Foreign policy orientation in each member		
P.1.3.1.	Regional	1 = H or 0 = L	Foreign affairs policy attention focus
P.1.3.2.	Global	1 = H or 0 = L	Foreign affairs policy attention focus
P.1.4.	Negotiation style	1 = F or 0 = I	Procedures of style negotiations
P.2.	**Internal factors**	**Limit**	**Source**
P.2.1.	International organizations support	1 = H or 0 = L	Number of international organizations
P.2.2.	Intra-Regional institutions number	1 = S or 0 = L	Number of institutions and activities
P.2.3.	Political regime	1 = D or 0 = ND	If exist democracy at the last 15 years
P.2.4.	Legislative background	1 = E or 0 = NE	Law system exist
P.2.5.	Internal security	1 = H or 0 = L	Most safe 100 countries around the world
P.2.6.	Human rights	1 = H or 0 = L	Human rights first 150 countries around the world
P.2.7.	Border problems	1 = Ne or 0 = E	Border problems at the last 30 years
P.2.8.	Political stability	1 = H or 0 = L	Exist democratic elections at the last 20 years
P.2.9.	Public administration	1 = F or 0 = U	Based on taxation system structure
P.2.10.	Army size	1= L or H = 0	Less of the 10% of all population in this country
P.2.11.	Bureaucracy level	1 = L or H = 0	Less than 15% of all population is working at the gov.

OR= Old Regionalism
NR= New Regionalism
FTA= Free Trade Area
CU= Custom Union
D= Democratic
ND= Non Democratic
NE= Non Exist
E= Exist
R= Right
L= Left
U= Unitary
F= Federalism
P= Presidential
Par= Parliamentary

Note: */ We are using in all QT measure, the average variation rate by decade
(e.g. Variation rate between 1960's and 1970's to analyzing decade of 1970's)

TABLE 5
The Global Regional Political Development Sources

CODE	POLITICAL FACTORS LIST VARIABLES	Source
P.1.	**External factors**	
P.1.1.	Colonization (country)	The Library of Congress U.S.:www.loc.gov
P.1.2.	Group negotiation power	Regional Integration Institutions by region in analysis
P.1.3.	Foreign policy orientation in each member	
P.1.3.1.	Regional	Ministry of Foreign Affairs by Country
P.1.3.2.	Global	Ministry of Foreign Affairs by Country
P.1.4.	Negotiation style	Regional Integration Institutions by region in analysis
P.2.	**Internal factors**	
P.2.1.	International organizations support	United Nations: www.un.org
P.2.2.	Intra-Regional institutions number	Ministry of Foreign Affairs by Country
P.2.3.	Political regime	Central Government Homepage by country
P.2.4.	Legislative background	Parlament by country
P.2.5.	Internal security	Ministry of Defence and Police Fources by country
P.2.6.	Human rights	Human Rights Watch: www.hrw.org
P.2.7.	Border problems	Haya Court: www.wpc-in.org
P.2.8.	Political stability	Transparency International: www.transparency.org
P.2.9.	Public administration	Transparency International: www.transparency.org
P.2.10.	Army size	NATO: http://www.nato.int
P.2.11.	Bureaucracy level	Transparency International: www.transparency.org

OR= Old Regionalism
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D= Democratic
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NE= Non Exist
E= Exist
R= Right
L= Left
U= Unitary
F= Federalism
P= Presidential
Par= Parliamentary

Note: */ We are using in all QT measure, the average variation rate by decade
(e.g. Variation rate between 1960's and 1970's to analyzing decade of 1970's)

TABLE 6
Multi-input Database Table: Regional Social Development of Trade Bloc "XYZ"

CODE	TRADE BLOC NAME							
	SOCIAL FACTORS LIST	COUNTRY					RESULT	
	VARIABLES	C1	C2	C3	C4	.....CN	AS	TPR
S.1.	Literacy	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ1	5
S.2.	Social problems (crime & drugs)	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ8	5
S.3.	Health and medical programs	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ9	5
S.4.	External culture influence	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ10	5
S.5.	Food security	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ13	5
S.6.	Public education	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ14	5
S.7.	Low cost housing projects	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ15	5
TOTAL							ΣAS	ΣTPR
TOTAL (%)							AP	100%

AS= ACTUAL SITUATION
TPR = TOTAL OF POSSIBLE RESULTS
Xi= Regional Development Indexes

Σ1.....N = The total sum of all country at the same region
ΣAS = Total of actual situation
ΣTPR= Total of possible results
Xi = ΣAS/ΣTPR

TABLE 7
The Regional Social Development Parameters

CODE	SOCIAL FACTORS LIST VARIABLES	PARAMETERS	
		LIMIT	Source
S.1.	Literacy	1= high or 0 = low	> 70% of total population has education
S.2.	Social problems (crime & drugs)	1= low or 0= high	Out of the country list with higher crime and drugs
S.3.	Health and medical programs	1= high or 0 = low	> 45% total of population has health care
S.4.	External culture influence	1= exist or 0 = NE	Cable T.V. Access
S.5.	Food security	1= Exist or 0 = NE	Programs in food security
S.6.	Public education	1=high or 0 = low	Number of public schools and universities
S.7.	Low cost housing projects	1=high or 0 = low	Number of low cost housing projects

H= Homogeneous
M=Multicultural
W= West
E= East
I= Individual
C= Collective
M= Modern
T= Traditional
NE= Non exist

Note: */ We are using in all QT measure, the average variation rate by decade
(e.g. Variation rate between 1960's and 1970's to analyzing decade of 1970's)

TABLE 8
Regional Social Development Sources

CODE	SOCIAL FACTORS LIST VARIABLES	Source
S.1.	Literacy	United Nations: www.un.org
S.2.	Social problems (crime & drugs)	United Nations Office on Drugs and Crime: www.unodc.org/unodc/en/crime
S.3.	Health and medical programs	World Health Organization: www.who.int
S.4.	External culture influence	Cable TV. customers per capita
S.5.	Food security	United Nations World Food Programme: www.wfp.org
S.6.	Public education	United Nations: www.un.org and World Bank: www.wb.org
S.7.	Low cost housing projects	World Bank: www.worldbank.org/poverty/

TABLE 9

Multi-input Database Table: Regional Economic Development of Trade Bloc "XYZ"

CODE	TRADE BLOC NAME							
	ECONOMICS FACTORS LIST	COUNTRY					RESULT	
	VARIABLES	C1	C2	C3	C4	.....CN	AS	TPR
E.1.	**Production**							
E.1.1.	GDP structure by sector							
E.1.1.1.	Agriculture	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ1	5
E.1.1.2.	Industry	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ2	5
E.1.1.3.	Services	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ3	5
E.1.2.	GDP (%)	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ4	5
E.1.3.	Natural resources	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ5	5
E.1.4.	Market location	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ6	5
E.1.5.	Economic development stage	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ7	5
E.1.6.	Subsidies level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ8	5
E.1.7.	Environmental protection	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ9	5
E.1.8.	Industrial concentration in large cities	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ10	5
E.1.9.	Export structure	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ11	5
E.1.10.	Oil production and energy resources	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ12	5
E.1.11.	Copy right regulations	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ13	5
E.2.	**Consumption**							
E.2.1.	Income Per-capita	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ14	5
E.2.2.	Buyer purchase	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ15	5
E.2.3.	Market size	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ16	5
E.2.4.	Poverty level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ17	5
E.2.5.	Inflation rate	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ18	5
E.2.6.	Wealth distribution	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ19	5
E.2.7.	Saving rate level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ20	5
E.3.	**Trade**							
E.3.1.	Intra-regional trade volume	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ22	5
E.3.2.	Extra-regional trade volume	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ23	5
E.3.3.	Intra-regional tariff application							
E.3.3.1.	Tariff barriers level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ24	5
E.3.3.2.	Non tariff barriers level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ25	5
E.3.4.	Opening Economy to the world	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ26	5
E.3.5.	Monopoly controls	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ27	5
E.4.	**Labor**							
E.4.1.	International social division	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ28	5
E.4.2.	Labor concentration							
E.4.2.1.	Urban	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ29	5
E.4.2.2.	Rural	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ30	5
E.4.3.	Immigration level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ31	5
E.4.4.	Emigration level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ32	5
E.4.5.	Population growth	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ33	5
E.4.6.	Labor productivity	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ35	5
E.5.	**Investment**							
E.5.1.	Domestic Direct investment -DDI-	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ36	5
E.5.2.	Intra-regional Direct Invesment -IDI-	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ37	5
E.5.3.	Foreign Direct Investment -FDI-	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ38	5
E.5.4.	Privatization process	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ40	5
E.5.5.	Interest rate	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ41	5
E.5.6.	Exchange rate stability	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ42	5
E.5.7.	Stock market activity	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ43	5

TABLE 9 *(Continued)*

CODE	TRADE BLOC NAME							
	ECONOMICS FACTORS LIST	COUNTRY					RESULT	
	VARIABLES	C1	C2	C3	C4	.....CN	AS	TPR
E.6.	**Infrastructure**							
E.6.1.	Domestic physical infrastructure	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ44	5
E.6.2.	Transportation system	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ45	5
E.6.3.	Intra-regional physical projects	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ46	5
E.6.4.	Tourism facilities	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ47	5
E.6.5.	Telecommunications	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ48	5
E.6.6.	Electricity production	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ49	5
E.7.	**Government**							
E.7.1.	Taxation							
E.7.1.1.	Indirect	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ50	5
E.7.1.2.	Direct	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ51	5
E.7.2.	Domestic debt	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ52	5
E.7.3.	Foreign debt	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ53	5
E.7.4.	Government expenditures							
E.7.4.1.	Operational and administratives	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ54	5
E.7.4.2.	Investment	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ55	5
E.7.5.	Trade promotion expenditures	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ56	5
E.7.6.	Corruption level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ57	5
E.7.7.	Planning ecomomy (medium run)	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ58	5
E.8.	**International cooperation**							
E.8.1.	Financial	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ59	5
E.8.2.	Technical	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ60	5
TOTAL							**ΣAS**	**ΣTPR**
TOTAL (%)							**AP**	**100%**

AS= ACTUAL SITUATION

TPR = TOTAL OF POSSIBLE RESULTS

Xi= REGIONAL DEVELOPMENT INDIXES

MEASURES:

Σ1.....N = The total sum of all country at the same region

ΣAS = Total of actual situation

ΣTPR= Total of possible results

Xi = ΣAS/ΣTPR

TABLE 10
Regional Economic Development Parameters

CODE	ECONOMICS FACTORS LIST VARIABLES	PARAMETERS	
E.1.	**Production**	**Limit**	**Source**
E.1.1.	GDP structure by sector		
E.1.1.1.	Agriculture	1= high or 0= low	Rate variation between two periods
E.1.1.2.	Industry	1= high or 0= low	Rate variation between two periods
E.1.1.3.	Services	1= high or 0= low	Rate variation between two periods
E.1.2.	GDP (%)	1= high or 0= low	GDP real > 2%
E.1.3.	Natural resources	1=high or 0=low	Agriculture line < 50%
E.1.4.	Market location	1=C or 0=Fsr	Gravity model results
E.1.5.	Economic development stage	1=Develped or 0= dev	World Bank Classification based on income
E.1.6.	Subsidies level	1= low or 0=high	Free of subsidies or < 10% of production has subs.
E.1.7.	Environmental protection	1= high or 0= low	Exist a legal framework can protect environmetal
E.1.8.	Industrial concentration in large cities	1=low or 0=high	< 45% of the industry is concetrated at capital city
E.1.9.	Export Gross	1= HAV or 0= LAV	Rate variation between two periods
E.1.10.	Oil production and energy resources	1=high or 0=low	Country can generate 40% of the local energy
E.1.11.	Copyright regulations	1= E or 0= NE	Exist a legal framework can protect copyright issues
E.2.	**Consumption**		
E.2.1.	Income Per-capita	1= high or 0= low	Amount of income > US$ 1,500 per year
E.2.2.	Buyer purchase	1= high or 0= low	Table of buyer purchase by country based on a list
E.2.3.	Market size	1= large or 0= small	> 5 millions Population level
E.2.4.	Poverty level	1= low or 0= high	< 25% in the poverty line
E.2.5.	Inflation rate	1= low or 0= high	rate of inflation < 5% annual
E.2.6.	Wealth distribution	1= low or 0= high	Gini coefficient by country and region
E.2.7.	Saving rate level	1= high or 0= low	Amount of private deposits, variation rate
E.3.	**Trade**		
E.3.1.	Intra-regional trade volume	1= high or 0= low	Variation rate of trade volume (export and import)
E.3.2.	Extra-regional trade volume	1= high or 0= low	Variation rate of trade volume (export and import)
E.3.3.	Intra-regional tariff application		
E.3.3.1.	Tariff barriers level	1= high or 0= low	Percentage of tariiff barriers average variateion rate
E.3.3.2.	Non tariff barriers level	1= high or 0= low	Number of cases apply Non-trade barriers
E.3.4.	Opening Economy to the world	1= high or 0= low	Index of freedom market between the first 50 countries
E.3.5.	Monopoly controls	1= high or 0= low	Index of Anti-trust law report (the first 50 countries)
E.4.	**Labor**		
E.4.1.	International social division	1= high or 0= low	Industrial and Services sector < 60%
E.4.2.	Labor concentration		
E.4.2.1.	Urban	1= high or 0= low	Variation rate of the urban labor concentration
E.4.2.2.	Rural	1= low or 0= high	Variation rate of the rural labor concentration
E.4.3.	Immigration level	1= low or 0= high	Variation rate of the number of Immigrants per year
E.4.4.	Emigration level	1= high or 0= low	Variation rate of number of emigrants per year
E.4.5.	Population growth	1= low or 0= high	Percentage of population growth < 2%
E.4.6.	Labor productivity	1= high or 0= low	Index of productivity first 50 countries arounf the world
E.5.	**Investment**		
E.5.1.	Domestic Direct investment -DDI-	1= high or 0= low	Rate variation between two periods
E.5.2.	Intra-regional Direct Invesment -IDI-	1= high or 0= low	Rate variation between two periods
E.5.3.	Foreign Direct Investment -FDI-	1= high or 0= low	Rate variation between two periods
E.5.4.	Privatization process	1= high or 0= low	Number of privatizations projects
E.5.5.	Interest rate	1= low or 0= high	Rate variation between two periods
E.5.6.	Exchange rate stability	1= high or 0= low	Rate variation between two periods
E.5.7.	Stock market activity	1= high or 0= low	Rate variation between two periods

TABLE 10 *(Continued)*

CODE	ECONOMICS FACTORS LIST VARIABLES	PARAMETERS	
E.6.	**Infrastructure**		
E.6.1.	Domestic physical infrastructure	1= high or 0= low	Number of airports, ports, Km.highways and rail
E.6.2.	Transportation system	1=cheap or 0=exp.	Prices level of basic transportation is using into the region
E.6.3.	Intra-regional physical projects	1= high or 0= low	Number of projects under regional level
E.6.4.	Tourism facilities	1= high or 0= low	Number of hotels and travel agencies
E.6.5.	Telecommunications	1= high or 0= low	Number of telecommunications companies
E.6.6.	Electricity production	1= high or 0= low	Variation rate of electricity production per year
E.7.	**Government**		
E.7.1.	Taxation		
E.7.1.1.	Indirect	1= high or 0= low	Rate variation of the total of indirect tax
E.7.1.2.	Direct	1= high or 0= low	Rate variation of the total of direct tax
E.7.2.	Domestic debt	1= high or 0= low	Rate variation between two periods
E.7.3.	Foreign debt	1= high or 0= low	Rate variation between two periods
E.7.4.	Government expenditures		
E.7.4.1.	Operational and administratives	1= high or 0= low	Rate variation between two periods
E.7.4.2.	Investment	1= high or 0= low	Rate variation between two periods
E.7.5.	Trade&Tourism promotion expenditures	1= high or 0= low	Gov. expenditures variation rate
E.7.6.	Corruption level	1= high or 0= low	Outside from the first 50 countries with higher corruption
E.7.7.	Planning ecomomy (medium run)	1= high or 0= low	Number of macro-prejects in the medium run
E.8.	**International cooperation**		
E.8.1.	Financial	1= high or 0= low	Rate variation between two periods
E.8.2.	Technical	1= high or 0= low	Number of trainig programs

QL = Qualitative Variable
QT = Quantitative Variable
%= Percentage
S= Strategic
NS= Non Strategic
Dd= Developed Country
Ding= Developing Country
LDC= Less Developed Country
E= Exist
NE= Non exist

Note: */ We are using in all QT measure, the average variation rate by decade
(e.g. Variation rate between 1960's and 1970's to analizing decade of 1970's)

TABLE 11
Regional Economic Development Sources

CODE	ECONOMICS FACTORS LIST VARIABLES	Source
E.1.	**Production**	
E.1.1.	GDP structure by sector	
E.1.1.1.	Agriculture	World Bank: www.worldbank.org/data/
E.1.1.2.	Industry	World Bank: www.worldbank.org/data/
E.1.1.3.	Services	World Bank: www.worldbank.org/data/
E.1.2.	GDP (%)	World Bank: www.worldbank.org/data/
E.1.3.	Natural resources	Ministry of Trade and Industry by Country
E.1.4.	Market location	Department of Statistics in each Country
E.1.5.	Economic development stage	World Bank: www.worldbank.org/data/
E.1.6.	Subsidies level	World Trade Organization: www.wto.org
E.1.7.	Environmental protection	Green Peace Organization: www.greenpeace.org
E.1.8.	Industrial concentration in large cities	Ministry of Trade and Industry by Country
E.1.9.	Export Gross	World Bank: www.worldbank.org/data/
E.1.10.	Oil production and energy resources	Oil Producers Organization (OPEC): www.opec.org
E.1.11.	Copyright regulations	International Federation of Reproduction Rights Organizations: www.ifrro.org
E.2.	**Consumption**	
E.2.1.	Income Per-capita	World Bank: www.worldbank.org/data/
E.2.2.	Buyer purchase	World Bank: www.worldbank.org/data/
E.2.3.	Market size	Department of Statistics by Country
E.2.4.	Poverty level	World Bank: www.worldbank.org/data/
E.2.5.	Inflation rate	World Bank: www.worldbank.org/data/
E.2.6.	Wealth distribution	World Bank: www.worldbank.org/data/
E.2.7.	Saving rate level	World Bank: www.worldbank.org/data/
E.3.	**Trade**	
E.3.1.	Intra-regional trade volume	World Bank: www.worldbank.org/data/
E.3.2.	Extra-regional trade volume	World Bank: www.worldbank.org/data/
E.3.3.	Intra-regional tariff application	
E.3.3.1.	Tariff barriers level	World Trade Organization: www.wto.org
E.3.3.2.	Non tariff barriers level	World Trade Organization: www.wto.org
E.3.4.	Opening Economy to the world	World Trade Organization: www.wto.org
E.3.5.	Monopoly controls	Ministry of Trade and Industry by Country
E.4.	**Labor**	
E.4.1.	International social division	Department of Statistics in each Country
E.4.2.	Labor concentration	
E.4.2.1.	Urban	Department of Statistics in each Country
E.4.2.2.	Rural	Department of Statistics in each Country
E.4.3.	Immigration level	Ministry of Foreign Affairs by Country
E.4.4.	Emigration level	Ministry of Foreign Affairs by Country
E.4.5.	Population growth	Department of Statistics in each Country
E.4.6.	Labor productivity	Ministry of Industry and Trade by Country

TABLE 11 *(Continued)*

CODE	ECONOMICS FACTORS LIST VARIABLES	Source
E.5.	**Investment**	
E.5.1.	Domestic Direct investment -DDI-	Central Bank by Country
E.5.2.	Intra-regional Direct Invesment -IDI-	Central Bank by Country
E.5.3.	Foreign Direct Investment -FDI-	Central Bank by Country
E.5.4.	Privatization process	Central Bank by Country
E.5.5.	Interest rate	Central Bank by Country
E.5.6.	Exchange rate stability	Central Bank by Country
E.5.7.	Stock market activity	Central Bank by Country
E.6.	**Infrastructure**	
E.6.1.	Domestic physical infrastructure	Ministry of Communication by country
E.6.2.	Transportation system	Ministry of Communication by country
E.6.3.	Intra-regional physical projects	World Trade Organization: www.wto.org
E.6.4.	Tourism facilities	Tourism Agency by country
E.6.5.	Telecommunications	Tecommunications companies by country
E.6.6.	Electricity production	Electricity Power Companies by country
E.7.	**Government**	
E.7.1.	Taxation	
E.7.1.1.	Indirect	International Monetary Found (IMF): www.imf.org
E.7.1.2.	Direct	International Monetary Found (IMF): www.imf.org
E.7.2.	Domestic debt	International Monetary Found (IMF): www.imf.org
E.7.3.	Foreign debt	International Monetary Found (IMF): www.imf.org
E.7.4.	Government expenditures	Ministry of Finance by country
E.7.4.1.	Operational and administratives	Ministry of Finance by country
E.7.4.2.	Investment	Ministry of Finance by country
E.7.5.	Trade&Tourism promotion expenditures	International Trade Promotion Agencies by Country
E.7.6.	Corruption level	Transperency International: www.transparency.org
E.7.7.	Planning ecomomy (medium run)	Ministry of Planining and Development by Country
E.8.	**International cooperation**	
E.8.1.	Financial	Ministry of Foreign Affairs by Country
E.8.2.	Technical	Ministry of Foreign Affairs by Country

TABLE 12

Multi-input Database Table: Regional Technological Development of Trade Bloc "XYZ"

CODE	TRADE BLOC NAME							
	TECHNOLOGY FACTORS LIST	COUNTRY					RESULT	
	VARIABLES	C1	C2	C3	C4	.....CN	AS	TPR
T.1.	Technology (R&D) level	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ1	5
T.2.	Internnet hosts	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ2	5
T.3.	Software production	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ3	5
T.4.	Internnet access	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ4	5
T.5.	Telecommunications (mobil phones)	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ5	5
T.6.	Research institutes	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ6	5
T.7.	Biotechnology advances	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ7	5
T.8.	Import of new technologies	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ8	5
T.9.	R&D public investment	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ9	5
T.10.	Technology information development	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ10	5
TOTAL							**ΣAS**	**ΣTPR**
TOTAL (%)							**AP**	**100%**

AS= ACTUAL SITUATION

TPR = TOTAL OF POSSIBLE RESULTS

Xi= REGIONAL DEVELOPMENT INDEXES

MEASURES:

Σ1 ……N = The total sum of all country at the same region

ΣAS = Total of actual situation

ΣTPR= Total of possible results

Xi = ΣAS/ΣTPR

TABLE 13
The Technological Development Parameters

CODE	TECHNOLOGY FACTORS LIST VARIABLES	PARAMETERS	DESCRIPTION
T.1.	Technology (R&D) level	1 = High or 0 = low	Number of technological parks and institutes
T.2.	Internnet hosts	1 = High or 0 = low	Number of WEB's
T.3.	Software production	1 = High or 0 = low	Number of software companies
T.4.	Internnet access	1 = High or 0 = low	Internet acces per habitant
T.5.	Telecommunications (mobil phones)	1 = High or 0 = low	Percentage of population using hand phone
T.6.	Research institutes	1 = High or 0 = low	Number of Universities and research inst.
T.7.	Biotechnology advances	1 = High or 0 = low	Number of Universities and research inst.
T.8.	Import of new technologies	1 = High or 0 = low	Percentage of capital goods import
T.9.	R&D public investment	1 = High or 0 = low	Number of Public Universities and Research Inst.
T.10.	Information Technology Development	1 = High or 0 = low	Number of the Home-page Designers Companies

Note: */ We are using in all QT measure, the average variation rate by decade
(e.g. Variation rate between 1960's and 1970's to analizing decade of 1970's)

TABLE 14
The Regional Technological Development Sources

CODE	TECHNOLOGY FACTORS LIST VARIABLES	Source
T.1.	Technology (R&D) level	Technological and Universities by Country
T.2.	Internnet hosts	Internet Suppliers
T.3.	Software production	Companies Homepage
T.4.	Internnet access	Telecoommunications companies by Country
T.5.	Telecommunications (mobil phones)	Telecoommunications companies by Country
T.6.	Research institutes	Universities by Country
T.7.	Biotechnology advances	Biotechnology research centers by Country
T.8.	Import of new technologies	Customs Services Agencies by country
T.9.	R&D public investment	National Budget by Country
T.10.	Technology information development	Home-page Designers Companies

The parameters are divided into two categories. The categories are:

(i) **Quantitative variables**

(i.a.) The measurement of regional variation rate (RVR) consists of two phases. The first phase is to measure the variation rate by country (VRC). VRC is calculated based on two periods: present period data minus last period data. The data of each period can be in percentage or absolute values. In the second phase, the sum of all VRC is divided by the total number of countries in the trade bloc. The end result is the number RVR.

$$RGR = \Sigma \text{ VRC} / \text{total number of countries}$$
$$RGR = \Sigma \text{ (present period data – last period data)} / \text{total number of countries}$$

The RVR can then be compared against each VRC. The final result obtained presents two possible scenarios: first, if RVR ≤ VRC then this specific country in the trade bloc obtains a value of 1; second, if RVR ≥ VRC then this specific country in the regional bloc obtains a value of 0.

(i.b.) The regional average rate (RAR) is obtained by dividing the sum of the local input data of each country in the trade bloc by the total number of countries in the trade bloc.

$$RAR = \Sigma \text{ local input data} / \text{total number of countries}$$

The RAR is fixed parameters that can be compared against each local input data by country. The final result of RAR presents two possible scenarios: first, if the RAR ≥ country value, then the final data has the average rate = 0; second, if the RAR ≤ country value, then the final data has the average rate = 1.

(ii) **Qualitative variables**

(ii.a.) The historical data focalization (HDF) can be classified by existence (i.e. an attempt is made to prove if 1 = existing data or 0 = non-existing data). This type of qualitative variables provides an alternative to measure non-quantitative variables that affect ranking regional integration process.

(ii.b.) The ranking list (RL) originates from the best results of certain areas (social, economic, political and technological) in some countries. RL can be found in international organizations such as United Nations, World Bank, International Monetary Fund and etc. The size of the RL is determined by the researcher or policy maker interested in applying the RL.

Once the RL is established, countries in the trade bloc can be compared. The RL can present two possible results: first, if the country in the trade bloc is found in the RL, then this country receives a value of 1; second, if the country in the trade bloc cannot be found in the RL, then this country receives a value of 0.

3.5.2.1 Steps to Obtain Regional Development Indexes (X_i)

There are four regional development indexes (Xi) to be obtained. These four Xi

indexes are: regional political development index (X_1), regional social development index (X_2), regional economic development index (X_3) and regional technological development index (X_4). The first step is to define all variables and parameters. Once all the variables and parameters are defined, all the data based on the variables and parameters is listed in each multi-input database table. The next step is to add the values of all variables in the column of the actual situation (AS) in each multi-input database table. The total possible results (TPR) obtained are then located in the TPR column next to AS column. With TPR in place, the next step is to compute each regional development indexes (X_i). The computation is done by applying the expression (1) to the values in the multi-input database tables.

$$(1) \qquad X_i = \sum_{i=1}^{4} X_i = \Sigma AS_i \times 100 / \Sigma TPR_i$$

Following the above four steps, the fifth step is the plotting of two graphs: (a) the regional development indexes (X_i) (see Figure 1), (b) the regional political, social, economic and technological diagnostic (see Figure 2). The latter graph serves as a means to study the balance between achievements and difficulties that any region may experience in its regional integration process (see Figure 2).

3.5.2.2 Introduction to Analysis of RD Index and RIS Index

Each of the regional global indexes ($X_{i's}$) plays an important role in the measurement of the regional development (RD) index and the regional integration stage (RIS) index. These two indexes can be affected by any change in the Xi indexes in the short and long run. The Xi indexes may reflect one of two different scenarios. First, if some or all-regional development indexes which are political (X_1), social (X_2), economic (X_3) and technological

FIGURE 1
The Regional Development (Xi) Indexes Diagram

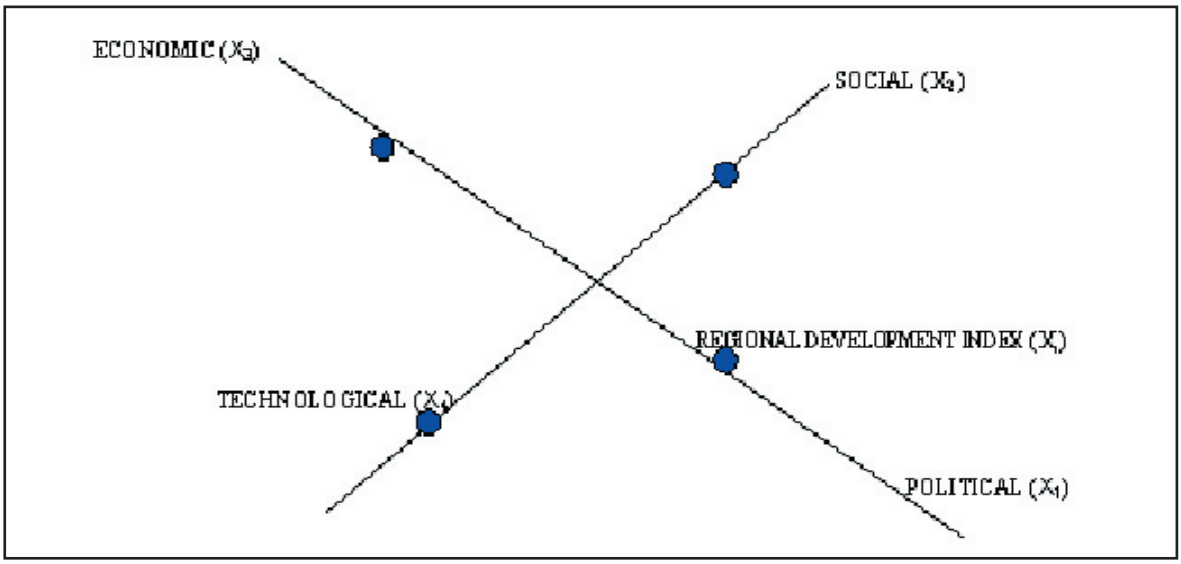
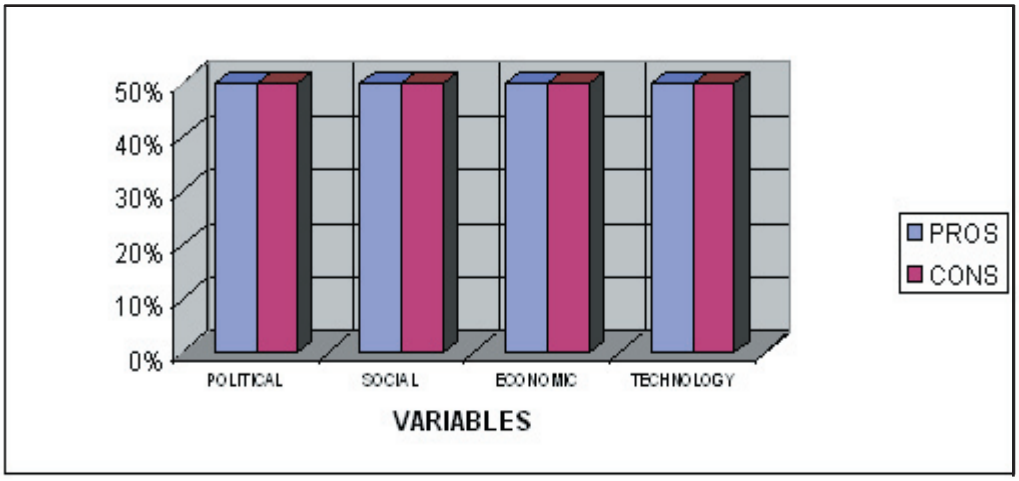


FIGURE 2
The Intra-Regional Political, Social, Economic and Technology Diagnostic



(X_4) increase, then RD index and RIS index may increase. The second scenario is, if some or all regional development Indexes (X_i) by area of development (political, social, economic and technological) decrease, then the RD index and RIS index may decrease.

3.5.3 Phase III: Measurement of the Regional Development (RD) Index

The third phase of the implementation of the GDRI-Model presents a general definition of the regional development indexes (X_i) (see Diagram 1). The RD index is an indicator to compare different historical periods of the regional integration process in any region. It is based on the regional development indexes (X_i) of a region. Therefore, the RD index is a means of analyzing the evolution of any regional integration process from a global perspective.

3.5.3.1 Steps to Obtain the RD Index

The first step is to plot each (X_i) index: regional political development index (X_1), regional social development index (X_2), regional economic development index (X_3) and regional technological development index (X_4) on the Cartesian plane (see Figure 3 and Figure 5). It should be noted that the RD index value (single percentage) is an approximation of the past and present situations that any trade bloc may encounter in its evolution. The RD index is the summation of all the four regional development indexes (X_i).

The second step is to plot the RD graph based on the total value of the four regional development indexes (X_i). This is followed by the calculation of the regional technological index (X_4) based on expression (2). It should be noted that the values of the X_i indexes are independent of one another. The RD graph consists of four different areas, where each area has a limit equivalent to 0.25. The total value of these four areas is equal to 1 as observed in the expression (2.6.)

Each axis of Figure 8 and Figure 9 is either the base or the height of the graph (represented by B and H respectively in the graph). The RD_1 uses the result of the global

development index in the axis X_1 which is equal to B_1, and the global development index in the axis X_2 which is equal to H_1, followed by the application of (2.1.) The same steps and expression are used for RD_1, RD_2, RD_3 and RD_4 (see Figure 4). The total RD index for this period is the sum of all the RD's. This is depicted in expression (2.5.)

The total area is divided into four dissimilar triangles each of area equal to {Base (=B_i) x Height (=H_i)}/2. Therefore, the triangles areas have to be summed to derive the total surface area (See expression 2.5.)

$$(2) \qquad \sum_{i=1}^{4} RD_i = \sum_{i=1} \{Base\ (=X_i) \times Height\ (=H_i)\} / 2$$

2.1) $[B_1 = H_4]: RD_1 = \{X_1(=B_1) \times X2(=H_1)\}/2$

2.2) $[B_2 = H_1]: RD_2 = \{X_2(=B_2) \times X3(=H_2)\}/2$

2.3) $[B_3 = H_2]: RD_3 = \{X_3(=B_3) \times X_4(=H_3)\}/2$

2.4) $[B_4 = H_3]: RD_4 = \{X_4(=B_4) \times X_1(=H_4)\}/2$

2.5) $RD = RD_1 + RD_2 + RD_3 + RD_4$

B= Base H= Height

The main reason to apply this formula is based on the measure of the area of the four sides figure on the horizontal plane. Therefore, the value of each area will be used to measure the final result on the origin (Y) or fifth axis. Y is based on the result of the four triangles areas under the horizontal plan.

3.5.3.2. Analysis of RD Index

The analysis of the RD index is based on the comparison of two periods or regions. In the case of this thesis, two periods (i.e. first period and second period) are compared. The total RD index may present three possible scenarios, namely (a) expansion (RD' first period < RD" second period), (b) stagnation (RD' first period = RD" second period) and (c) contraction (RD' first period > RD" second period).

In terms of time-span, the RD index can be measured and compared on a yearly basis, five-yearly basis, and by decades. For this research, the time-span is divided into four specific decades (the 1960's to the 1990's), which can later be compared. In terms of space, the RD index can be measured and compared in relation to countries or regional blocs. At any historical moment, the regional integration process in any region is based on the comparison of the size of the regional development index (X_i).

FIGURE 3
The Regional Development (RD) Index

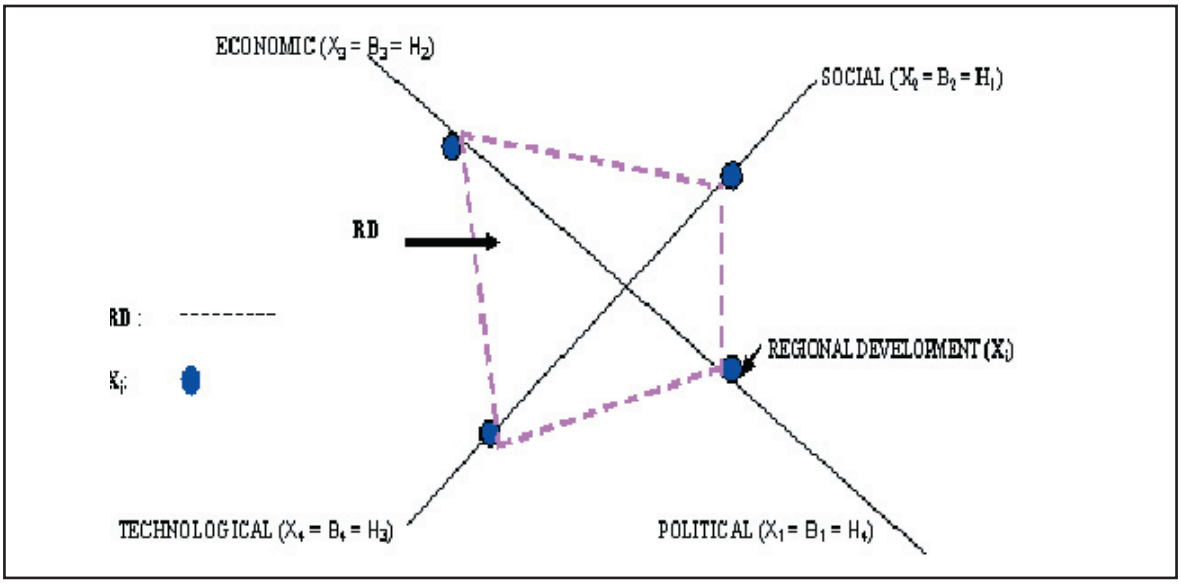


FIGURE 4
Areas of Rotation Applied to RD Index

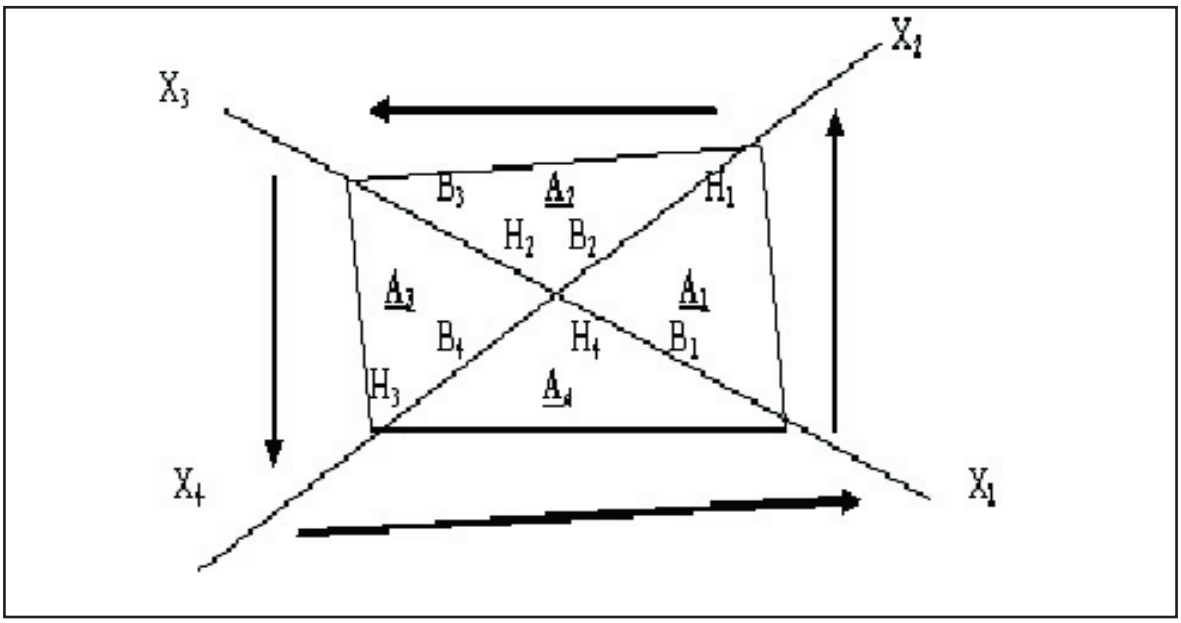
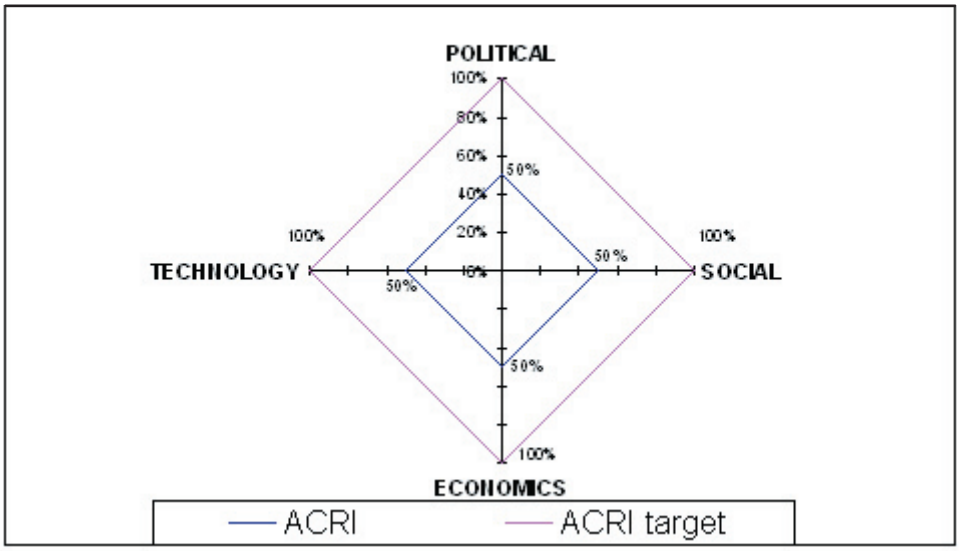


FIGURE 5
Regional Development (RD) Index



3.5.4. Phase IV: Measurement of the Regional Integration Stage (RIS) Index

The last phase in the implementation of the GDRI-Model is the measurement of the regional integration stage (RIS) index (see Diagram 1). The RIS index measures the degree or stage of the regional integration development that any region achieves in its different stages of evolution. The RIS index is considered a dependent variable in the GDRI-Model.

In the measurement of the RIS index, four regional development indexes (X_i) are used: regional political development index (X_1), regional social development index (X_2), regional economic development index (X_3) and regional technological development index (X_4). A constant coefficient – regional integration approach inclines (RIAI) is also used concurrently. The RIAI is represented by a, b, c, and d in expression (3) and is applied to each global development index (Xi). Each RIAI (a, b, c, or d) has a limit that is equal to 1 [Refer to expression (3)]. The weighted sum of the RIAI's cannot be more than 1.

The application of the RIAI is twofold. The first application is the RIAI Homogeneous Interest. In this application, each RIAI has the same level of importance in the analysis [Refer to expression (3.1.)]. The second application is the RIAI Incline. There are four possibilities in this application: political approach incline (3.2.), social approach incline (3.3.), economic approach incline (3.4.) and technological approach incline (3.5.)

Analysis of RIS Index

After the type of RIAI to be applied is determined, the regional integration stage (RIS) index is measured according to expression (3). The RIS index analysis may reveal one of three different scenarios, namely (a) under-developed stage ($0 \leq RIS \leq 0.33$), (b) developing stage ($0.34 \leq RIS \leq 0.66$) and (c) developed stage ($0.67 \leq RIS \leq 1$). The analysis of the RIS index can provide a general idea or approximation of the stage of regional integration achieved in any region through time and space. The following is a suggested combination of the application of the RIAI in the measurement of the RIS index:

(3) $Y = RIS = aX_1 + bX_2 + cX_3 + dX_4 \leq 1$

(3.1) a = 0.25, b = 0.25, c = 0.25, d = 0.25 = 1 => RIAI homogeneous interest

(3.2) a = 0.40, b = 0.20, c= 0.20, d = 0.20 = 1 => RIAI political approach incline

(3.3) a = 0.20, b = 0.40, c = 0.20, d = 0.20 = 1 => RIAI social approach incline

(3.4) a = 0.20, b = 0.20, c = 0.40, d = 0.20 = 1 => RIAI economic approach incline

(3.5) a = 0.20, b = 0.20, c = 0.20, d = 0.40 = 1 => RIAI technological approach incline

It must be highlighted that the above combination represents only several of many possibilities or permutations. This should draw attention to the flexibility of the RIS index in adapting to any situation or chosen policy mode. The RIS index presents an approximation of the global development from the political, social, economic and technological perspectives concurrently based on a new concept of graphic representation. This new concept of graphic representation consists of five axes, each of which has a positive value (in the case of this research, the value in each axis is represented by a percentage). Once the axes of the graph are in place, the next step is to plot the four X_i indexes (political, social, economic, and technological X_i indexes) in four of the axes respectively. These X_i indexes are independent variables. The total value of the four axes is equal to 1 (see Figure 6). The fifth axis, which is represented by Y and positioned in the center of the graph (among the other four axes) represents the dependent variable RIS index. This fifth axis is the convergent point of all the other four axes or more precisely, the four areas - political, social, economic, and technological - of regional development indexes (X_i). The RIS index (Y) is depicted as follows in expression (4):

$$Y = F(X_1, X_2, X_3, X_4) \leq 1$$

FIGURE 6
The Graph of the Regional Integration Stage (RIS) Index

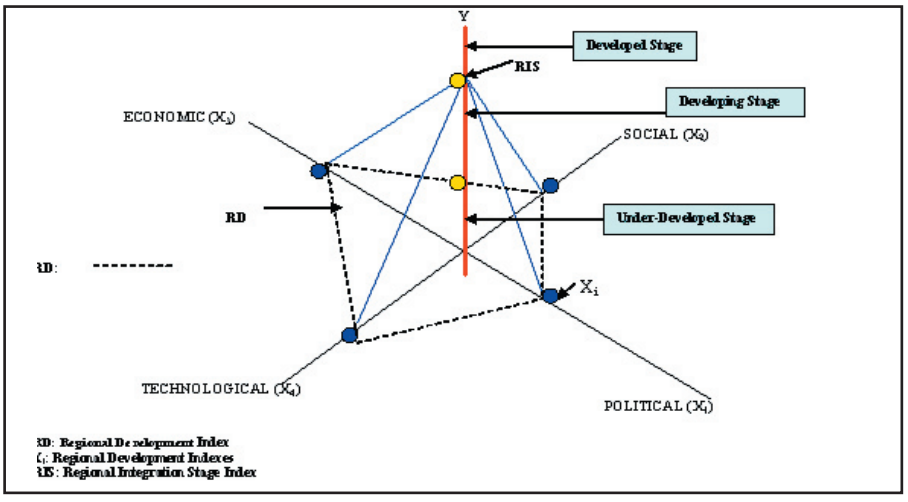
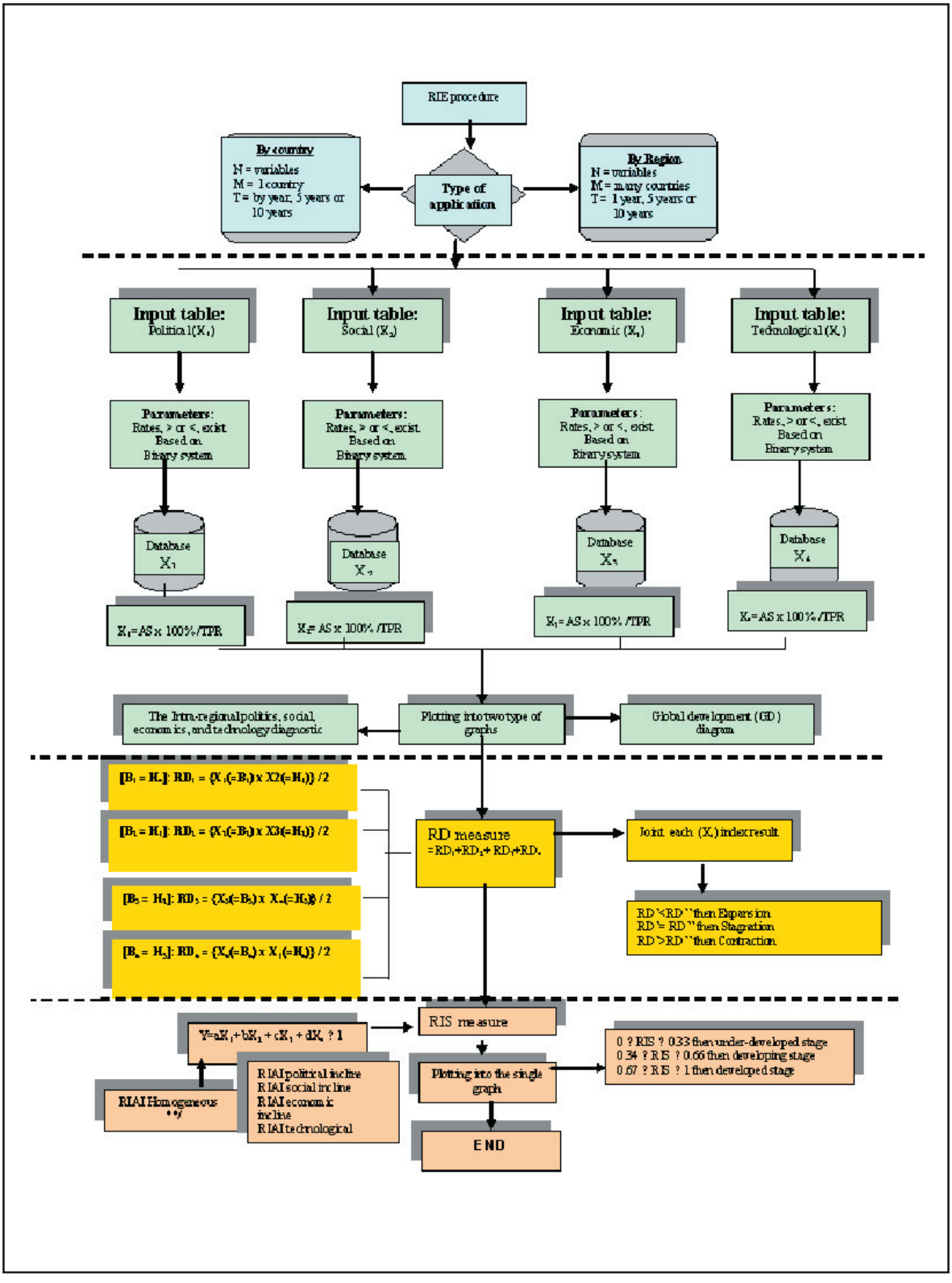


DIAGRAM 1
Flowchart of GDRI-MODEL



3.6 Application of the GDRI-Model into a Single Trade Bloc

The GDRI-Model can be also applied to different trade blocs in different regions around the world. The trade blocs under study in this thesis are the European Union (EU), the North American Free Trade Area (NAFTA), the Association of Southeast Asian Nations (ASEAN-5) and the Market of the South Cone (MERCOSUR). The two periods identified in the application of GDRI-Model are the 1980's 1990's and the period 2000-2006.

3.6.1 European Union (EU): Advanced Regional Integration Development

The regional integration of EU is based on the old regionalism. The Custom Union scheme in EU generated the highest level of regional development indexes (Xi) by area (political, social, economic and technological). The result of the regional political development index (X_1) was 0.80 and the regional social development index (X_2) was 0.71 (see Table 15). These two results locate EU in the top position of regional integration development stage in the world. Meanwhile, the regional economic development index (X_3) and regional technological development index (X_4) were 0.83 and 0.88 respectively (see Table 15). The X_3 and X_4 were located in the developed stage, but not at the same level as the regional political development (X_1) and regional social development (X_2). While the RIS index of the EU in the 1980's was 0.81. The RIS of the same trade bloc in the 1990's was 0.83. The RIS index in 1990s was located in the developed stage, as shown in Figure 8.

In the 1990's all regional development indexes (X_i) of EU (politics, social, economic, and technology) present a stronger growth. The regional political development index (X_1) and regional social development index (X_2) present the highest value ever of 0.81 and 0.78 respectively. The RIS index in the 1990's is located in the developed stage of 0.83 (see Figure 8). It is clear that the strong regional development indexes (X_i) in EU are the regional political development index (X_1) and the regional social development index (X_2). The regional economic development index (X_3) and regional technological development index (X_4) present positive advances of 0.85 and 0.89 respectively (see Table 15). The EU scheme proves that if each member in the same region presents strong regional development indexes (X_i) in each area (political, social, economic, and technological), then regionalism can be successful. At the same time, successful regionalism can generate expansion of the regional development indexes (X_i) in each member.

In the period 2000-2006, the idea to incorporate a new members into the EU with less Regional Development (social, political, economic and technological) such as Republic of Cyprus (2004), Republic of Estonia (2004), Republic of Hungary (2004), Republic of Latvia (2004), Republic of Lithuania (2004), Republic of Malta (2004), Republic of Poland (2004), Slovak Republic (2004), Republic of Slovenia, Czech republic (2004). It generates a negative impact on the EU Regional Development Stage (RIS) in this specific period. The regional political development index (X_1) of 0.75, the regional economic development index (X_3) of 0.80, regional social development index (X_3) of 0.73 and regional technological development index (X_4) of 0.85. In this period, the new European Union members saw some negative impact in all regional development indexes (Xi) on EU members. Meanwhile, the regional development stage (RIS) index decreased to 0.78 (see Figure 9). However, the RIS index in the 2000-2006 periods was lower than those of the 1990's due to the introduction of new members in the E.U.

3.6.2 NAFTA: Constant Regional Integration Development

Unlike the EU, the North America Free Trade Area (NAFTA) applies the Free Trade Areas scheme. The regional development in NAFTA in the 1980's saw a high regional economic development index (X_3). X_3 is located in the developed stage with the value of 0.65 (see Table 15). X_3 of NAFTA is a higher value compared to the rest of the regional development indexes (X_i) of other areas: political, social and technological development indexes (see Figure 7).

The regional technological development Index (X_4) was in the development stage of 0.90. The regional political development index (X_1) and regional social development index (X_2) have lower results of 0.65 and 0.48 respectively. While the regional integration stage (RIS) index in NAFTA in the 1980's is 0.69, the same in the 1990's experienced an expansion to the level of 0.80. Meanwhile the regional integration stage (RIS) index in the 1980s and the 1990s are both located in the developed stage with the value of 0.69 and 0.80 respectively (see Figure 8).

In the 1990's, the favorable conditions resulting from the improvement of global development of Mexico made it possible to join NAFTA. The regional political development index (X_1) of NAFTA was 0.67 and the regional economic development index (X_3) of NAFTA was 0.82. While X_1 continued in the same stage level (developed stage), the regional social development index (X_2) in the 1990's saw a rise compared to 0.76, but continued to be in the developed stage. The regional technological development index (X_4) also observed an expansion to 0.93 (see Table 15). The improvement of X_i originated mainly from a strong regional economic development (X_3).

The expansion of NAFTA in the period 2000-2006 is constant. The regional economic development index (X_3) then was 0.70 (see Figure 9). It is now being suggested that much of the growth during this period was actually due to export and, more specifically, to exports that were destined abroad rather than among the countries. Favorable terms of trade, especially with respect to Mexico. The regional technological development index (X_4) was recorded as 0.93. It is important to note that in the period 2000-2006 Mexico presented a better political situation compared to the 1990's and the 1980's. This was reflected in the regional political development index (X_1) of 0.70. The regional social development index (X_2) of 0.76, which move within the developed stage or level 3. The regional integration stage (RIS) index being 0.81, the NAFTA was in the developing stage of regional integration (see Figure 9). It can be concluded that in the period 2000-2006 NAFTA witnessed and strong trade unification in this stage.

3.6.3 ASEAN: Stagnation Regional Integration Development

The following are the results of the regional development indexes (X_i) by area in the Association of Southeast Asian Nations (ASEAN) in the 1980's (see Figure 7): regional political development index (X_1) was in the under-developed stage of 0.23; regional social development index (X_2) was in the developing stage of 0.37; regional economic development (X_3) was in the developing stage of 0.36 and the regional technological development (X_4) was located in the under-developed stage of 0.22 (see Table 15). The low regional development indexes (X_i) by area in ASEAN originated from the different levels of development in all member countries. There was a large gap in the regional development among most ASEAN members.

However, in the 1990's the regional political development index (X_1) of ASEAN expanded to 0.33 (see Table 15). X_1 was located in the developing stage. The regional social development index (X_2) maintained a high rate of 0.46. X_2 is in the developing stage. It is important to note that in the 1990s, the financial crisis of 1997 affected several ASEAN members; especially Indonesia, Thailand and Malaysia. In fact, the financial crisis in these three countries affected the regional economic development index (X_3) of ASEAN in the 1990's, as it was located in the developing stage of 0.41 (see Table 15).

The regional technological development index (X_4) also received a negative impact; with the value of 0.51. It was in the developing stage. The RIS index in the 1980's was located in the under-developed stage with 0.30, but with the value of 0.43 in the 1990's. It is continuing to be in the developing stage (see Figure 7). From the above, it can be observed that the major factor that contributed in the small improvement of the regional development index (X_i) of ASEAN is the weak improvement of the regional political development (X_1).

The ASEAN regional integration process continued to decline in the period 2000-2006. The average growth rates relative to those achieved in the previous decade declined. The regional economic development index (X_3) of the ASEAN then fell to 0.32. The root of the problem was that ASEAN depended mainly on weak his integration model. The regional technological development index (X_4) was then 0.52. Consequently, ASEAN saw a drastic shift in the terms of trade among his members. The latter generated high levels of inflation and negative payoff trade with the rest of the world, especially Philippines, Indonesia and Thailand. Consequently, the interregional system of payments of the region is weak and a foreign exchange vulnerable in these three countries.

There was growing disillusionment among ASEAN members. The constant competition to attract Foreign Direct Investment (FDI) among ASEAN members generated a large obstacle in the regional integration process of the ASEAN. Several social problems also started to surface in some ASEAN members in the case of the South Part of Thailand (army forces and Islamic radical groups) in this period. This situation was reflected in the regional political development index (X_2) of 0.32. It was also in the 2000-2006 that several political problems in Thailand were formed against the former primer minister of Thailand Mr. Thaksin Shinawatra. As a result, the regional political development index (X_1) decreased to 0.32 (see Table 15). Natural disasters were another negative contributory factor to the regional integration process of ASEAN members. Indonesia, Thailand, Malaysia were hit by massive tsunami in 2004. This Tsunami generated a higher social and economic costfor these three countries in the 2004-2005. In this period, all regional development indexes (X_i) for ASEAN members were located in the developing stage or level 1 and 2. The regional integration stage (RIS) index was 0.41 compared to 0.44 in the 1990's. Obviously there was a small contraction in the regional integration process of ASEAN members in the 2000-2006 (see Figure 9).

3.6.4 MERCOSUR: Fast Regional Integration Development

The Market of the South Cone (MERCOSUR) followed the NAFTA regional integration scheme (New Regionalism). The RIS of MERCOSUR in the 1980's was 0.26, but in the 1990's the RIS expanded to 0.46. The regional global development indexes (X_i) by area of MERCOSUR in the 1980's exhibited these results: the regional political development

index (X_1) was in the under-developed stage of 0.11; regional social development index (X_2) was in the developing stage with a value of 0.36; regional economic development index (X_3) was located in the under-developed stage of 0.32 and regional technological development index (X_4) was in the under-developed stage with the value of 0.23 (see Table 15). It could be observed that X_1 in the 1980's was weak and non-stable. The lower value of X_1 in the 1980's originated from military governments led by dictators and copula military groups.

In the 1990's, the RIS reached 0.46. This is an expansion compare to RIS of the 1980's. The regional integration stage (RIS) attained the value of 0.46 (see Figure 7 and 8). Therefore, RIS in the 1990's was located in the developing stage. The better result of RIS in the 1990's originated from the improved regional political development index (X_1) of 0.44, which located in the developing stage. However, the regional social development index (X_2) was in the developing stage with a value of 0.46. Regional economic development index (X_3) moved to the developing stage of 0.41. Meanwhile regional technological development index (X_4) was in the developing stage with a value of 0.51 (see Table 15).

Two basic factors that led to the formation of MERCOSUR are: (i) better conditions in external debt and stable exchange rate in Argentina in the 1990's. (ii) the strengthening of democracy in the 1990's (democracy is a decisive factor that consolidated the formation of MERCOSUR). Two main reasons for the improvement of the regional economic development index (X_3) among MERCOSUR members in the 1990's were the privatization of public enterprises coupled with the attraction and greater dynamism of foreign direct investment (FDI). Countries of MERCOSUR encouraged the transfer of technology which gave then a greater dynamism in their market. Transfer of technology also permitted a higher competitiveness and greater productivity among MERCOSUR members. The MERCOSUR can be considered the leader of the regional integration process of Latin America. It can be concluded that MERCOSUR has higher regional development indexes (X_i) value compared to the rest of the trade blocs in Latin America (e.g. CACM and AC), especially in the regional political development index (X_1) and regional economic development index (X_3).

The regional integration process of MERCOSUR in the 2000-2006 saw a RIS index result of 0.51 (see Figure 9). The Xi indexes by area in the period 2000-2006 are as follows: regional political development index (X_1) in the developing stage with the value of 0.52; regional social development index (X_2) in the developing stage of 0.50; regional economic development index (X_3) in the developing stage of 0.48 and regional technological development index (X_4) in the developing stage of 0.55 (see Table 15). The origin of these better results, especially in the regional economic development (X_3) was high inter-trade exchange, stable exchange rates and improvement of external debts in the major part of MERCOSUR members. The strong trade and investment relationship between Argentina and Brazil based on free trade regional agreement that are oriented to the intra-regional trade development that was adopted by MERCOSUR in the 1990's. The MERCOSUR regional integration scheme is generating positive results among MERCOSUR member countries

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TABLE 15
regional Political, Social, Economic, technological Regional Develeopment and Regional Integration Stage (RIS)

	RPD		RSD		RED		RTD		RIS
NAFTA									
1980	0.65	16.25	0.48	12	0.74	18.5	0.9	22.5	69
1990	0.67	16.75	0.76	19	0.82	20.5	0.93	23.25	80
2000-2006	0.7	17.5	0.76	19	0.85	21.25	0.93	23.25	81
MERCOSUR									
1980	0.11	2.75	0.36	9	0.32	8	0.23	5.75	26
1990	0.44	11	0.46	11.5	0.41	10.25	0.51	12.75	46
2000-2006	0.52	13	0.5	12.5	0.48	12	0.55	13.75	51
EUROPE UNION									
1980	0.8	20	0.71	17.75	0.83	20.75	0.88	22	81
1990	0.81	20.25	0.78	19.5	0.85	21.25	0.89	22.25	83
2000-2006	0.75	18.75	0.73	18.25	0.8	20	0.85	21.25	78
ASEAN									
1980	0.23	5.75	0.37	9.25	0.36	9	0.22	5.5	30
1990	0.33	8.25	0.46	11.5	0.41	10.25	0.51	12.75	43
2000-2006	0.32	8	0.4	10	0.41	10.25	0.52	13	41

FIGURE 7
Regional Integration Stage (RIS) in Different Trade Blocs 1980's

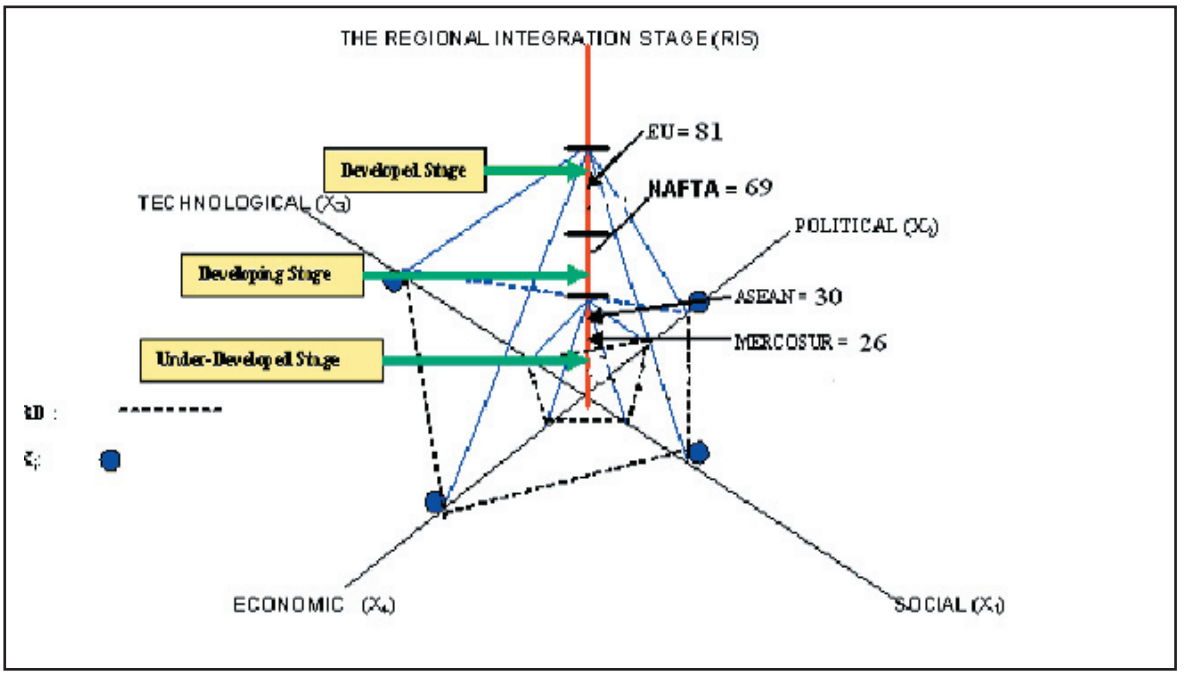


FIGURE 8
Regional Integration Stage (RIS) in Different Trade Blocs 1990's

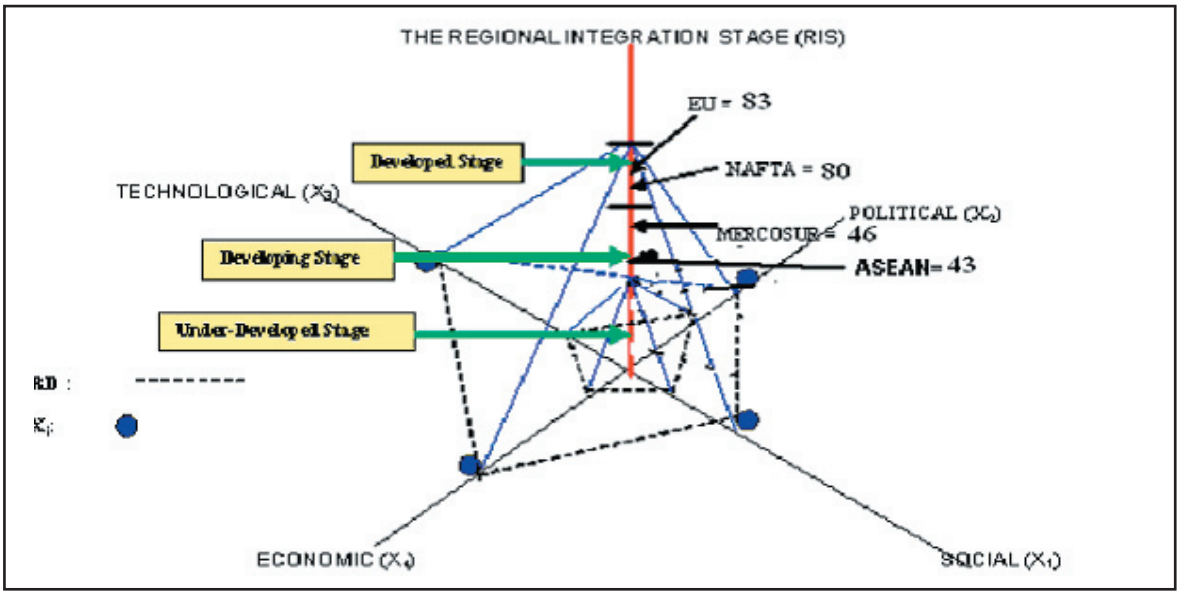
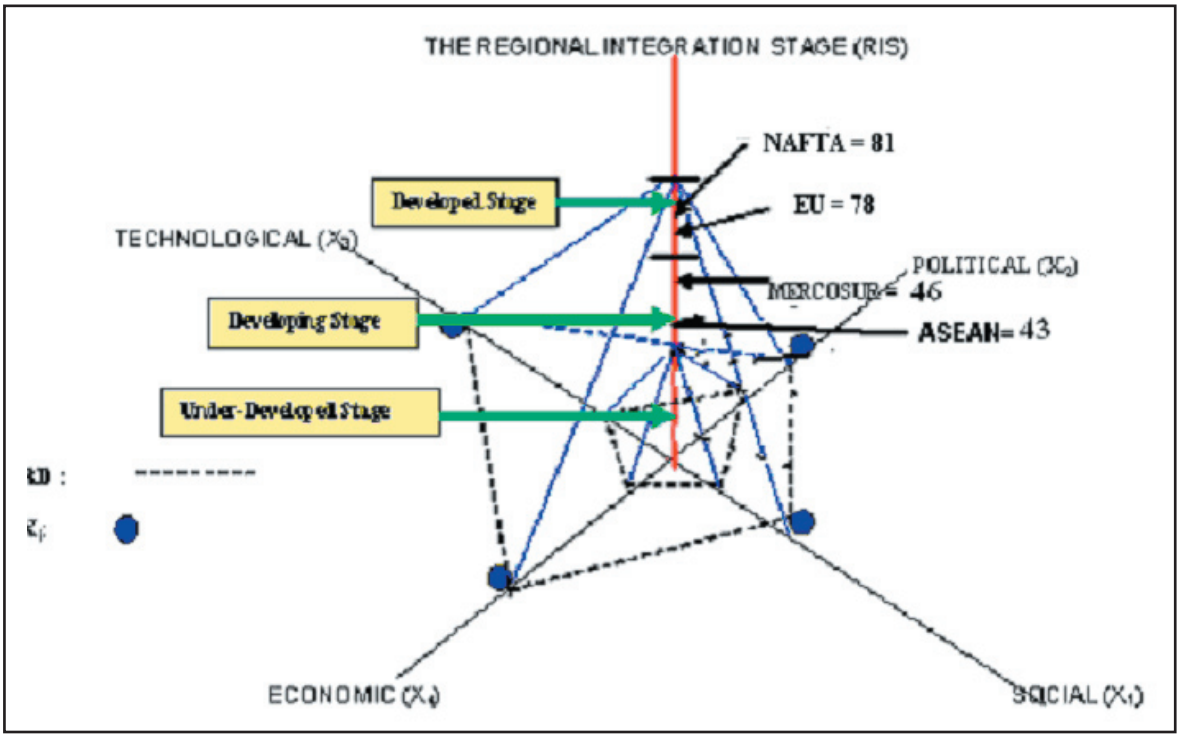


FIGURE 9
Regional Integration Stage (RIS) in Different Trade Blocs 2000–2006



3.7 Concluding Remarks

Regional Integration can be given a new definition. It can be defined as a process that combines different domestic development systems (DDS) (countries) into a single regional development system (trade bloc). Strong regionalism, whether old regionalism or new regionalism, it depends on the favorable conditions derived from Regional Development (RD), where RD is the combined result of all or most individual domestic development systems in the same trade bloc. Meanwhile, growth of RD in a trade bloc can be generated through strong domestic development systems (DDS) in the same region. If the domestic development systems (DDS) in some or most member countries in the trade bloc are weak, then the trade bloc cannot be successful.

This chapter maintains that there is a strong inter-dependency between Regional Global Development (RGD) and domestic development systems (DDS). This can be observed from the application of the RIE-Model (Chapter 3) to different trade blocs (i.e. European Union –EU-, North America Free Trade Area –NAFTA-, Association of Southeast Asian Nations ASEAN- and MERCOSUR).

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Notes

[1] Regional development index (X_i) is formed by:

Regional Political Development Index (X_1) will show the level of political environmental that this specific region shows.

Regional Social Development Index (X_2) is interested to show trend of the social agenda under regional

level. Regional Economic Development Index (X_3) will present the economic trend that the region shows.

Regional Technological Development Index (X_4**)** is trying to present the level of technology development that this specific region shows. Each regional development indices (Xi) by area together will try to present the different stages that any country can chart its own evolution.

2 Regional Development (RD) originates from the different levels of political, social, economic and technological development that each member in the same region shows. If the gap of all areas of development (political, social, economic and technological) among all members is considerable large then the regional integration process can experiment serious difficulties.

3 American Economic Review, *C*anadian Journal of Economics, Econometrica, Economic History Review, Economic Journal, International Economic Review, Journal of Economic History, Journal of Economic Literature, Journal of Political Economy, Journal of Policy Modeling, Economic Development Journal, Oxford Economic Papers, Quarterly Journal of Economics, Review of Economic Studies, Review of Economics and Statistics, Canadian Journal of Economics and Political Science, Journal of Economic Abstracts, Contributions to Canadian Economics, Journal of Labor Economics, *J*ournal of Applied Econometrics, Journal of Economic Perspectives, Publications of the American Economic Association, Brookings Papers on Economic Activity, microeconomics *and* American Economic Association Quarterly.

4 It includes the basic tariff analysis; cost and benefits of trade; tariff and non-tariff trade barriers analysis and the new protectionism. (Krugman and Obstfeld, 2000).

5 The optimal currency areas were introduced by Mundell (1961) and Mckinnon (1963). "This approach based its study on monetary policy issues (money, markets for goods, and markets for production factors.) First, we will present the concept of a currency area defined as an area in which a common currency exists (Mattli, 1999). Optimal is defined in terms of the ability of an area to achieve both internal balance (maintenance of full employment and stable internal average price level) and external balance (maintenance of balanced international payments equilibrium). The main idea of optimal currency area was developed because of a dilemma between introducing fixed versus flexible exchange rate. Therefore, Mundell's argument that before applying the optimum currency area, it is necessary to ask what economic characteristics determine the optimum size of the domain of a single currency."

6 "The fiscal federalism is an offshoot of public finance theory that analyzes the special fiscal problems which arise in federal countries, drawing on the literature on public goods, taxation, income distribution and public debt incidence, and various parts of location theory" (Mattli,1999). We can observe that this approach focuses on fiscal policy issues based on the fiscal coordination. The general objective of this theoretical approach is the improvement of market efficiency focused on the interaction of market and public goods. The method was applied in the fiscal federalism is positive dynamic (general equilibrium).

7 The Heckscher-Ohlin (H-O) model (Breton, Scott, and Sinclair, 1997), "which is the whole theoretical construction concerning trade and production based upon a difference between countries in their factor endowments, and four hypotheses or propositions which arise from this model. The H-O model hypobook that each country will export products that are intensive in the use of that country's abundant factor of production (labor or capital), and will import products that are intensive factor of production (labor and capital) in the use of the country's scarce factor of production."

8 Kemp and Wan theorem present this proposition related to the formation of custom unions. "It is consider any competitive world trading equilibrium, with any number of countries and commodities, and with no restrictions whatever on the tariffs and other commodity taxes of individual countries, and with costs of transportation fully recognized. Now let any subset of the countries form a customs union. Ten there exists a common tariff vector and a system of lump-sum compensatory payments, involving only members of the union, such that there is an associated tariff-ridden competitive equilibrium in which each individual, whether a member of the union or not, is not worse off than before the formation of the union." (Kemp and Wan, 1976).

9 "The custom union argument is based on the free-trade point of view, whether a particular custom union is a move in the right or in the wrong directions depend, therefore, so far as the argument has as yet been carried, on which of two types of consequences ensue from that custom union. Where the free trade-creating force is predominant, one of the members at least must benefit, both may benefit, the two combined must have a net

benefit, and the world at large benefits; but the outside world loses, in the short-run at least, and can gain in the long-run only as the result of the general diffusion of the increased prosperity of the custom union. Where the trade-diverting effect is predominant, one al least of the member countries is bound to be injured, both maybe injured, the two combined will suffer a net injury, and there will be injury to the outside world and to the world at large." (Viner, 1950).

[10] "The second best theory was presented by Lipsey and Lancaster (1997). These two authors present a deeper study about the custom union theory of Viner based on the application of a positive dynamic method (general equilibrium) to explain the custom union effect on the world trade. The contribution of Lipsey and Lancaster in the custom union theory follows the Paretian optimum which requires the simultaneous fulfillment of all the optimum conditions based on the general economic problem of maximization. A function is maximized subject to at least one constraint, in this case production function and utility function."

[11] "Trade-creation effect occurs when some domestic production in a nation that is a member of the custom union is replaced by lower-cost imports from another member nation. Assuming that all economic resources are fully employed before and after formation of the custom union, this production is based on comparative advantage. The Trade-diversion effect occurs when lower-cost imports from outside the custom union are replaced by higher cost import from a union member. This result because of the preferential trade treatment given to member nation. Trade-diversion effect, by itself, reduces welfare because it shifts production from more efficient producers outside the custom union to less efficient inside in the union. Thus, trade diversion worsens the international allocation of resources and shifts production away from comparative advantage." (Salvatore,2001)

[12] "The CGE models are standard tool for analyzing trade policy. The case of general equilibrium models are: first liking trade and productivity growth; second foreign investment and productivity growth; third, endogenous growth and CGE modeling." (Mordechai and Plummer, 2002).

[13] The measuring of regional political development index (X_1) originates from the calculus obtained from the politics multi-input database table (see table 3 and 5). After we obtain the result of X_1, we can proceed to classify our results into three different parameters. These parameters are under-developed stage or level 1 ($0 \leq X_1 \leq 0.33$), X_1 index is developing stage or level 2 ($0.34 \leq X_1 \leq 0.66$) and X_1 index is developed stage or level 3 ($0.67 \leq X_1 \leq 1$).

[14] The measuring of regional social development index (X_2) originates from the calculus applied in the social multi-input database table (see table 6 and 8). After we obtain the result of X_2, we can proceed to classify our results into three different parameters. These parameters are under-developed stage or level 1 ($0 \leq X_2 \leq 0.33$), X_2 index is developing stage or level 2 ($0.34 \leq X_2 \leq 0.66$) and X_2 index is developed stage or level 3 ($0.67 \leq X_2 \leq 1$).

[15] The measuring of regional economic development index (X_3) originates from the calculus applied in the economic multi-input database table (see table 9 and 11). After we obtain the result of X_3, we can proceed to classify our results into three different parameters. These parameters are under-developed stage or level 1 ($0 \leq X_3 \leq 0.33$), X_3 index is developing stage or level 2 ($0.34 \leq X_3 \leq 0.66$) and X_3 index is developed stage or level 3 ($0.67 \leq X_3 \leq 1$).

[16] The measuring of regional technological development index (X_4) originates from the calculus applied in the technological multi-input database table (see table 12 and 14). After we obtain the result of X_4, we can proceed to classify our results into three different parameters. These parameters are under-developed stage or level 1 ($0 \leq X_4 \leq 0.33$), X_4 index is developing stage or level 2 ($0.34 \leq X_4 \leq 0.66$) and X_4 index is developed stage or level 3 ($0.67 \leq X_4 \leq 1$).

CHAPTER 4

Trade Liberalization Evaluation Methodology (TLE-Methodology) Theoretical Framework

The trade liberalization evaluation methodology (TLE-Methodology) is a measuring tool for studying regional integration from a global perspective. The proposed trade liberalization evaluation methodology (TLE-Methodology) is a simple and flexible model. It applies dynamic and general equilibrium analysis to show the past and present situations in the trade liberalization process of any country based on a set of indexes and Figures. Its field application is not constrained by regions or the development stage of each country interested in negotiating a free trade area (FTA). The TLE-Methodology can be applied to any form of country in its trade liberalization issues, whether it is developed country (e.g. Japan), developing country (e.g. Malaysia) and less developed country (e.g. Cambodia).

The application of the TLE-Methodology is also based upon the characteristics, conditions and historical moments that any country presents in its trade liberalization development. In its application, TLE-Methodology is like a simulator that allows the application of a series of simulations in different scenarios and in the different phases of the trade liberalization process of any country. This model does not try at any time to be a forecasting model. It is focused upon showing the past and present situation in a free trade area process as a whole. It can help to provide a general idea about the situations and evolution of the trade liberalization process of any country.

4.1 Introduction

We can observe the fast expansion of Preferential Trade Agreements (PTAs) that has taken place throughout the world till today. In the shape of Free Trade Area (FTA), the participant countries agree to eliminate the internal tariff barriers but set their external tariffs barriers independently. It is important to remember the Customs Union (CU) (Viners, 1950) constitutes the other main shape of PTAs. CU differs from FTA essentially because its member has a common external trade policy (Breton, Scott, & Sinclair, 1997).

We consider it necessary to analyze the different evaluation methods and theories applied to the study of Free Trade Areas (FTA's) or Customs Union (CU) before addressing trade liberalization policies from two different approaches, namely multilateralism[1] approach and regionalism[2] approach. In this paper, the regionalism approach is adopted. Moreover, the two categories of the regionalism approach are applied. These two categories of regionalism, as suggested by Bhagwati, Krishna and Panagarija (1999) are the old regionalism (i.e. close regionalism) and the new regionalism (i.e. open regionalism).

The old regionalism was used in the 1950's, 1960's and 1970's. It was used constantly and in successive stages. It covered preferential trade arrangements, free trade area, customs union, common market and economic union. The old regionalism is applied in the development strategy known as Import Substitution Industrialization Strategy (ISI)[3].

The new regionalism, on the other hand, was developed and promoted in the end of the 1980's and 1990's. It is based on trade liberalization or open market. It uses the export-led oriented or outward oriented model strategy. In contrast with the old regionalism, the new regionalism endeavors to eliminate all trade barriers and non-trade barriers in the same region.

Both cases of regionalism revolve around static trade creation and trade diversion effects. This is partly due to the fact that many economists consider these effects to be the fundamental dimension for evaluating regional integration (Devlin and Efrench-Davis, 1998). This paper, however, is of the view that these models of analysis require considerable transformation for application in the study of trade liberalization issues. The core idea presented here is that the study of trade liberalization should encompass more than one isolated economic or political analysis revolving around one specific problem.

The common theories, models used by researchers and specialists in the economic area of research in the study of Free Trade Areas (FTAs) are: Effective rate of protection for industry (j); free trade production coefficient (Aij) and the frequency indexes (Fj) covered by NTB's; General equilibrium. Of all these methods of analysis in trade liberalization, the most important effective rate of protection. The customs union theory is still used today and continues to be used by many economists to consider static trade creation and trade diversion for evaluating free trade agreements. However, the static analysis used in the customs union theory posts a problem: it frequently uses a partial competitive equilibrium framework to arrive at a general conclusion about a process that is general equilibrium phenomenon. (Devlin and Efrench-Davis, 1998).

4.2 Trade Liberalization Evaluation Methodology (TLE-Methodology) Phases

4.2.1 Phase I: Design of the Multi-input Tariff Database Table

The multi-input tariff database Table is a new style of analysis framework that permits storage of a large amount of data to measure a single variable. This single variable can show the evolution of any phenomenon from a global perspective. The multi-input tariff database Table is designed to evaluate two countries or many countries simultaneously (see Diagram 1 and Table 1). The country multi-input database Table pertains to "country". It uses "n" number of variables. The number 'n' is decided by the researchers or policy-makers. The number of cases in the study is represented by "m". In the case of TLE-Methodology, "m" represents one country. The time factor "t" is dependant upon the time parameters that the researchers or policy-makers are interested in using. Therefore, "t" can be in terms of years or decades.

4.2.2 Phase II: Measurement of the Trade Liberalization Index by Production Sector (Xi)

The second phase of the implementation of the trade liberalization evaluation methodology (TLE-Methodology) involves the measurement of the trade liberalization

DIAGRAM 1
Flowchart of Trade Liberalization Evaluation (TLE) Methodology

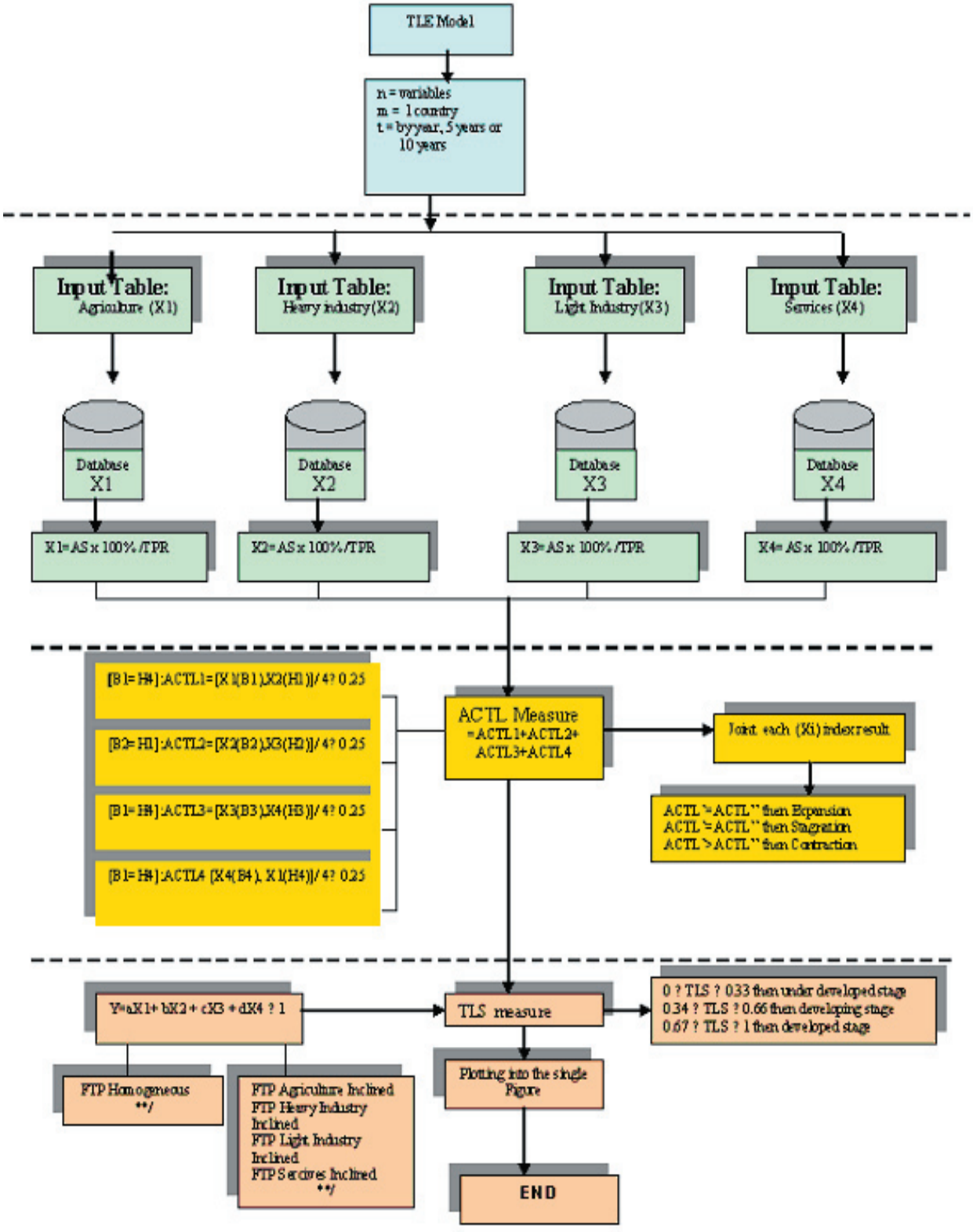


TABLE 1
Multi-Input Tariff Database

CODE	TRADE BLOC NAME						ATS	TPR
	TITLED	COUNTRY						
		Y1	Y2	Y3	Y4	.....YN		
Tariff Barriers (%)								
Item-1	Titled-1	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ1	T1
Item-2	Titled-2	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ2	T2
Item-3	Titled-3	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ3	T3
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ4	T4
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ5	T5
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ6	T6
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ7	T7
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ8	T8
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ9	T9
Non-tariff Barriers (No. cases)								
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ10	T10
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ11	T11
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ12	T12
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ13	T13
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ14	T14
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ15	T15
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ16	T16
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ17	T17
.	.	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σ18	T18
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
Item-n	Titled-n	1 or 0	1 or 0	1 or 0	1 or 0	1 or 0	Σn	Σn
TOTAL							ΣATS	ΣTPR

index by production sector (X_i) using the variables in four basic multi-input tariff database tables (see Diagram 1). The trade liberalization evaluation methodology (TLE-Methodology) indexes are agriculture trade liberalization index (X_1)[4], heavy industry trade liberalization index (X_2)[5], light industry trade liberalization index (X_3)[6] and services trade liberalization index (X_4)[7]. These variables (tariff and non-tariff barriers) are analyzed with their codes, descriptions and parameters respectively. The parameters are divided into two categories. The categories are: tariff barriers rate based on limits (e.g. we have tariff rate acceptable (TRA)[8] and actual tariff rate (ATR), if ATR is large than TRA, then it is equal to 0, but if ATR is equal or less than TRA, then it is equal to 1) and non-tariff barriers analysis based on the existence or non-existence of non-tariff barriers) (e.g. an attempt is made to prove the following: if the non-tariff barriers exist, then it is equal to 0; if non-tariff barriers do not exist, it is equal to 1.)

The number of variables used in the TLE-Methodology varies, depending on the objectives of the researchers or policy-makers and the orientation research. In the case of

the present study, 40 items from the tariff manual of each country under analysis with their respective parameters were selected: 10 items for Agriculture Trade Liberalization Index (X_1); 10 items for heavy industry trade liberalization Index (X_2); 10 items for Light industry trade liberalization index (X_3) and 10 items for services trade liberalization index (X_4).

Once the number of variables is determined, the next step is to collect the statistical and historical data that constitutes the variables. Variables in each multi-input tariff database Table may not have a direct relationship among them, they may be dependent variables or exogenous variables. However, all the variables in each multi-input tariff database Table are meant to measure a single general variable, that is, each of the trade liberalization index by production sector (X_i).

Each of the four trade liberalization indexes by production sector (X_i) by sector to be measured is viewed as a dependent variable (i.e. exogenous variable). However, there is no connection and interdependency among these four trade liberalization indexes by production sector (X_i) when they are joined in the Figure. These four trade liberalization indexes by production sector (X_i) are used to draw a Figure that represents the evolution and stages of the regional integration process of the region from a global perspective. The objective of this study is to apply the TLE-Methodology to the case of the trade liberalization trend and stage between developing and developed country.

4.2.2.1 Steps to Obtain Each Trade Liberalization Index by Production Sector (X_i)

There are four trade liberalization indexes by production sector (X_i) to be obtained. These four trade liberalization indexes by production sector (X_i) are: agriculture trade liberalization index (X_1), heavy industry trade liberalization index (X_2), light industry trade liberalization index (X_3) and services trade liberalization index (X_4). The first step is to define all variables and parameters. Once all the variables and parameters are defined, all the data based on the variables and parameters are listed in each multi-input tariff database table.

The next step is to add up the values of all variables in the column of the actual situation (AS) in each multi-input tariff database Table. The total possible results (TPR) obtained is then located in the TPR column next to AS column. With TPR in place, the next step is to compute each trade liberalization index by production sector (X_i). The computation is done by applying expression (1) to the values in the multi-input tariff database Tables.

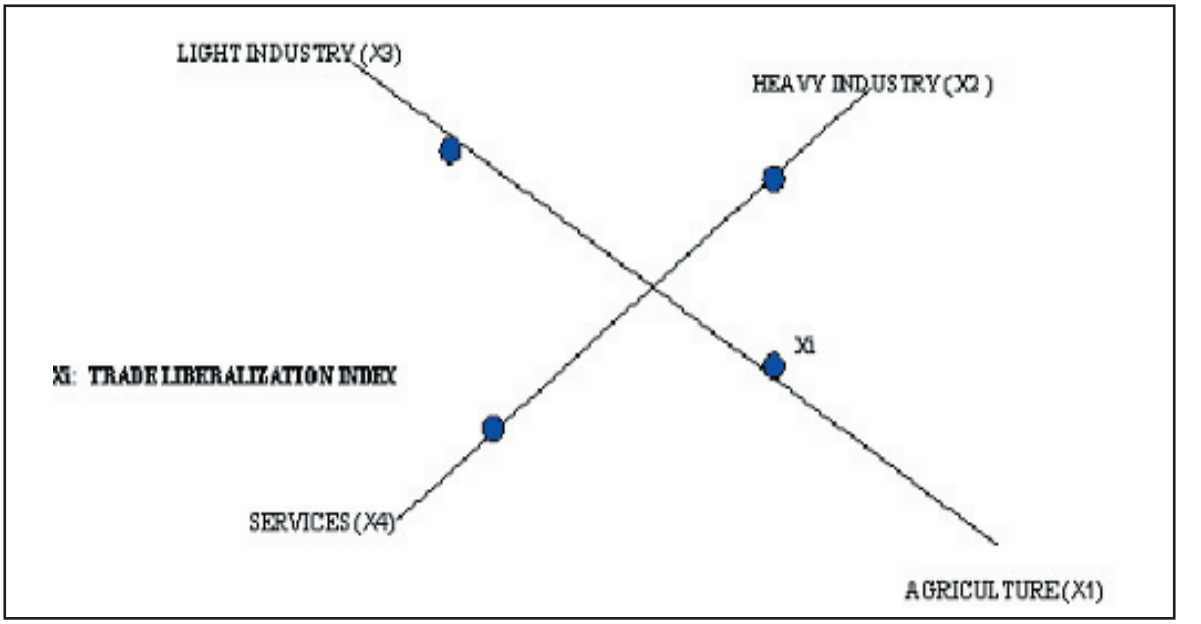
$$\textbf{(1)} \qquad \Sigma X_i = \sum_{i=1}^{4} AS_i \times 100 / \Sigma TPR_i$$

Following the above four steps, the fifth step is the plotting of a Figure: (a) the trade liberalization index by production sector (X_i) diagram (see Figure 1).

4.2.3 Introduction to Analysis of TLT Index and TLS Index Based on Trade Liberalization Index by Production Sector (Xi)

Each Trade Liberalization Index by Production Sector (X_i) plays an important role in the measurement of the trade liberalization trend (TLT) index and the trade liberalization stage (TLS) index. These two indexes can be affected by any change in the X_i indexes in the

FIGURE 1
The Trade Liberalization Index by Production Sector (Xi)



short and long term. The liberalization index by production sector (X_i) may reflect one of two different scenarios. First, if some or all-trade liberalization indexes (agriculture, heavy industry, light industry and services) increase, then TLT index and TLS index may increase. The second scenario is, if some or all-trade liberalization indexes by production sector (agriculture, heavy industry, light industry and services) decrease, then the TLT index and TLS index may decrease.

4.2.4 Phase III: Measurement of the Trade Liberalization Trend (TLT) Index

The third phase of the implementation of the trade liberalization evaluation methodology (TLE-Methodology) Model presents a general definition of trade liberalization trend (TLT) index (see Diagram 1). The TLT index is an indicator to compare different trends of the trade liberalization process in any country. It is based on the trade liberalization index by production sector (X_i) of a country. Therefore, the TLT index is a means of analyzing the evolution of any trade liberalization process from a global perspective.

4.2.4.1 Steps to Obtain the TLT Index

The first step is to plot each (Xi) index: agriculture trade liberalization index (X_1), heavy industry trade liberalization index (X_2), light industry trade liberalization index (X_3) and services trade liberalization index (X_4) on the Cartesian plane (see Figure 2 and 3). It should be noted that the TLT index value (single percentage) is an approximation of the past and present situations that any trade bloc may encounter in the evolution of its trade liberalization. The TLT index is the summation of all the four trade liberalization indexes by production sector (X_i).

The second step is to plot the TLT Figure based on the total value of the four trade liberalization indexes by production sector (X_i). This is followed by calculation of the trade

FIGURE 2
The Trade Liberalization Trend (TLT)

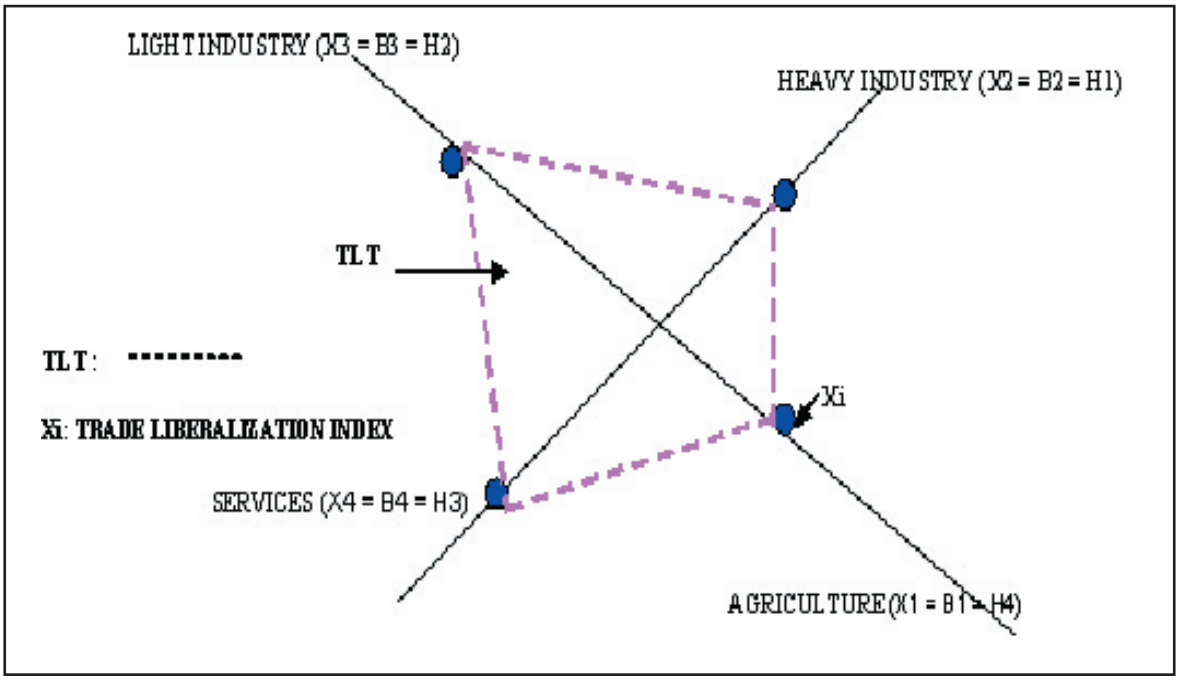
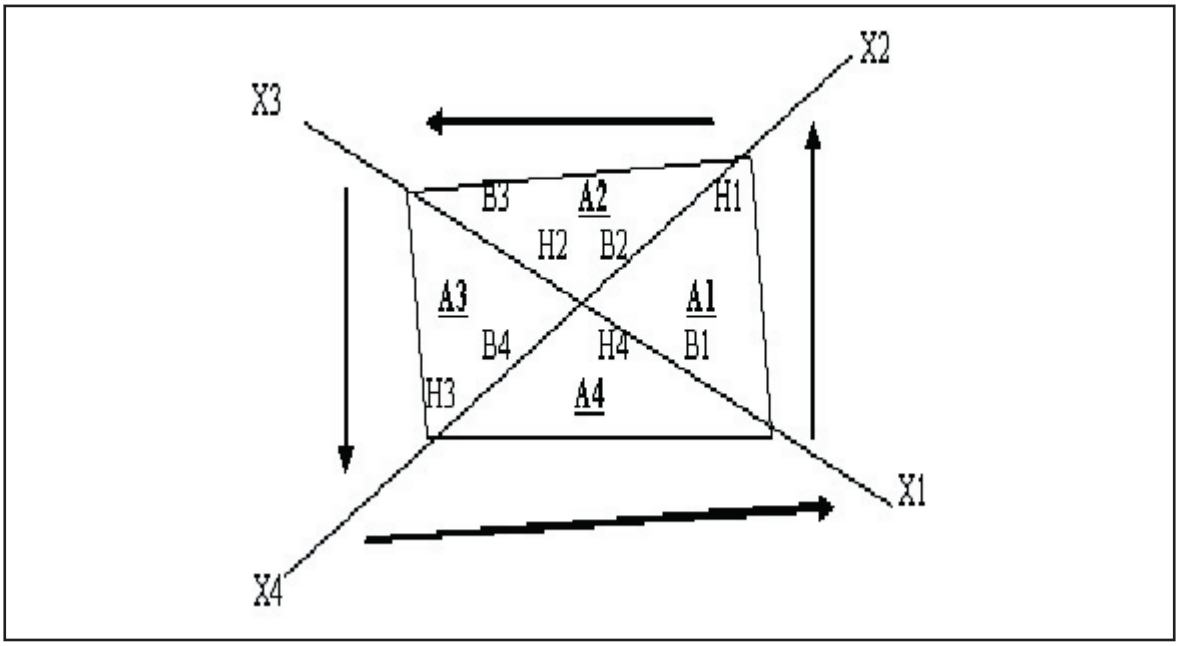


FIGURE 3
TLT Index Measurement and Areas of Rotation



liberalization trend (TLT) index based on expression (2). It should be noted that the values of the X_i indexes are independent of one another. The TLT Figure consists of four different areas, where each area has a limit equivalent to 0.25. The total value of these four areas is equal to 1 as observed in the expression (2.6.)

Each axis of Figure 1 and Figure 2 is either the base or the height of the Figure (represented by B and H respectively in the Figure). The TLT_1 uses the result of the production sector X_1 which is equal to B_1, and the production sector X_2 which is equal to H1, followed by the application of (2.1.) The same steps and expression are used for TLT_1, TLT_2, TLT_3 and TLT_4 (See Figure 3). The total TLT index for this period is the sum of all the TLT's. This is depicted in expression (2.5.)

The total area is divided from four dissimilar triangles each of area equal to {Base ($=B_i$) x Height ($=H_i$)}/2. Therefore, the triangles areas have to be summed to derive the total surface area (see expression 2.5.)

$$\textbf{(2)} \qquad \sum_{i=1}^{4} RD_i = \sum_{i=1}^{4} \{\text{Base } (=X_i) \times \text{Height } (=H_i)\}/2$$

2.1.) $[B_1 = H_4]: RD_1 = \{X_1(=B_1) \times X_2(=H_1)\}/2$

2.2.) $[B_2 = H_1]: RD_2 = \{X_2(=B_2) \times X_3(=H_2)\}/2$

2.3.) $[B_3 = H_2]: RD_3 = \{X_3(=B_3) \times X_4(=H_3)\}/2$

2.4.) $[B_4 = H_3]: RD_4 = \{X_4(=B_4) \times X_1(=H_4)\}/2$

2.5.) $RD = RD_1 + RD_2 + RD_3 + RD_4$

B = Base H = Height

We have applied the same concept as regional integration evaluation (GDRI-Model) (See Chapter 3) to apply this formula to measure the area of the four sides of the figure on the horizontal plane.

4.2.4.2 Analysis of TLT Index

The analysis of the TLT index is based on the comparison of two periods or countries. In the case of this study, two periods (i.e. first period and second period) are compared. The total TLT index may present three possible scenarios, namely:

(a) The trade liberalization expansion (TLT' first period < TLT" second period)

(b) The trade liberalization stagnation (TLT' first period = TLT" second period)

(c) The trade liberalization contraction (TLT' first period > TLT" second period)

In terms of time-span, the TLT index can be measured and compared on a yearly basis, five-yearly basis, and by decades. For this research, the time-span is one decade (the 1990s), which can later be compared. In terms of space, the TLT index can be measured and compared in relation to countries or regions. At any historical moment, the regional integration process in any region is based on the comparison of the size of the trade liberalization trend (TLT) index.

4.2.5 Phase IV: Measurement of the Trade Liberalization Stage (TLS) Index

The last phase in the implementation of the trade liberalization evaluation methodology (TLE-Methodology) is the measurement of the trade liberalization stage (TLS) (see Diagram 1). The TLS index measures the degree of the trade liberalization that any country achieves in the different stages of its evolution. The TLS index is considered a dependent variable in the TLE-Methodology.

In the measurement of the TLS index, four Trade Liberalization Indexes by Production Sector (X_i) are used: agriculture trade liberalization index (X_1), heavy industry trade liberalization index (X_2), light industry trade liberalization index (X_3) and services trade liberalization index (X_4). A constant coefficient, focal trade policy approach incline (FTP-Approach Incline) is also used concurrently. The FTP-approach incline is represented by a, b, c, and d in expression (3) and is applied to each trade liberalization index by production sector (X_i). Each FTP-approach incline (a, b, c, or d) has a limit that is equal to 1 [Refer to expression (3)]. The sum of the FTP-approach incline cannot be more than 1.

The application of the FTP-approach incline is twofold. The first application is the FTP-approach incline Homogeneous Interest. In this application, each FTP-approach incline has the same level of importance in the analysis [refer to expression (3.1)]. The second application is the FTP-approach incline. There are four possibilities in this application: agriculture trade liberalization approach incline (3.2.), heavy industry liberalization approach incline (3.3.), light industry trade liberalization approach incline (3.4.) and services trade liberalization approach incline (3.5.)

4.2.5.1 Analysis of TLS Index

After the type of FTP-approach incline to be applied is determined, the trade liberalization stage (TLS) index is measured according to expression (3). The TLS index analysis may reveal one of three different scenarios, namely:

(a) The trade liberalization under-developed stage or level 1 ($0 \leq TLS \leq 0.33$)

(b) The trade liberalization developing stage or level 2 ($0.34 \leq TLS \leq 0.66$)

(c) The trade liberalization developed stage or level 3 ($0.67 \leq TLS \leq 1$).

The analysis of the TLS index can provide a general idea or approximation of the stage of regional integration achieved in any region through time and space. The following is a suggested combination of the application of the FTP-approach incline in the measurement of the TLS index:

$$(3) \quad Y = TLS = aX_1 + bX_2 + cX_3 + dX_4 \leq 1$$

3.1.) a = 0.25, b = 0.25, c = 0.25, d = 0.25 = 1 => FTP Homogeneous

3.2.) a = 0.40, b = 0.20, c= 0.20, d = 0.20 = 1 => FTP Agriculture Approach Inclined

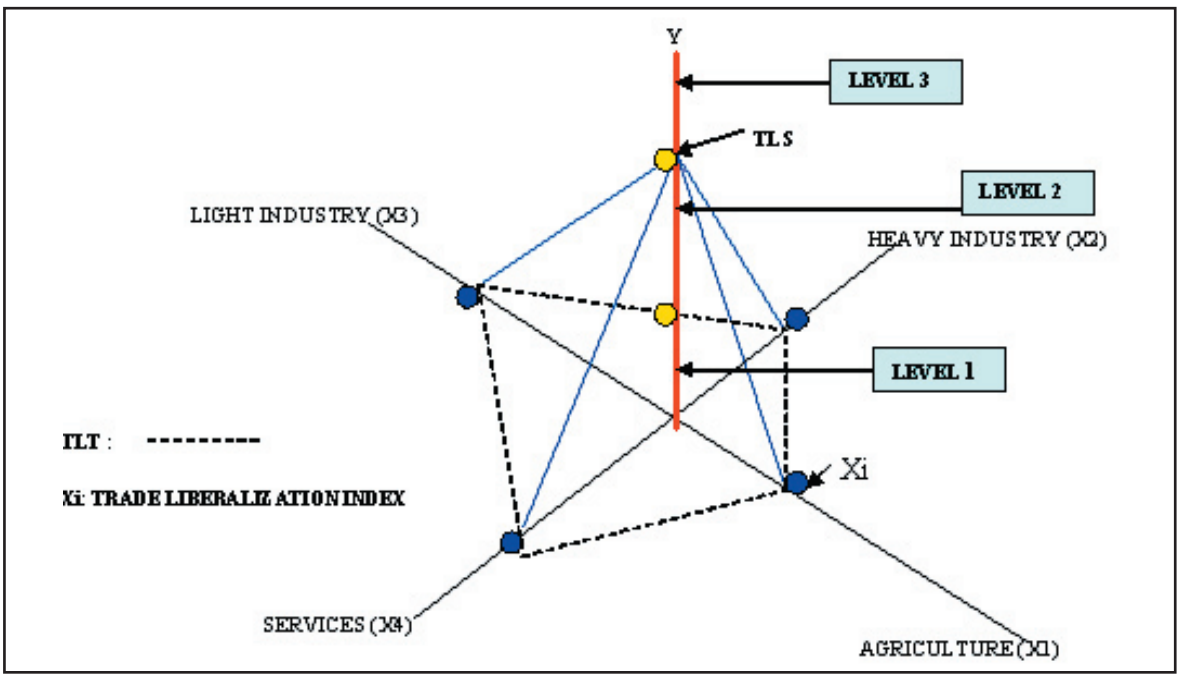
3.3.) a = 0.20, b = 0.40, c = 0.20, d = 0.20 = 1 => FTP Heavy Industry Approach Inclined

3.4.) a = 0.20, b = 0.20, c = 0.40, d = 0.20 = 1 => FTP Light Industry Approach Inclined

3.5.) a = 0.20, b = 0.20, c = 0.20, d = 0.40 = 1 => FTP Services Approach Inclined

It must be highlighted that the above combination represents only several of many possibilities or permutations. This should draw attention to the flexibility of the TLS index in adapting to any situation or chosen policy mode. The TLS index presents an approximation of the development stage of trade liberalization concurrently based on a new concept of graphic representation (see Figure 4). This new concept of graphic representation consists of five axes, each of which has a positive value, (in the case of this research, the value in each axis is represented by a percentage).

FIGURE 4
The Trade Liberalization Stage (TLS)



Once the axes of the Figure are in place, the next step is to plot the four X_i indexes (agriculture, heavy industry, light industry, and services X_i indexes) in four of the axes respectively. These X_i indexes are independent variables. The total value of the four axes is equal to 1 (see Figure 4). The fifth axis, which is represented by Y and positioned in the center of the Figure (among the other four axes) represents the dependent variable TLS index. This fifth axis is the convergent point of all the other four axes or more precisely, the four areas -agriculture, heavy industry, light industry and services- of Trade Liberalization Level index (X_i). The TLS index (Y) is depicted as follows in expression (4).

$$\textbf{(4)} \qquad Y = F(X_1, X_2, X_3, X_4) \leq 1$$

4.3. Concluding Remarks

This chapter has presented the Trade Liberalization Evaluation Methodology (TLE-Methodology). The focus of this methodology is a trade liberalization diagnostic. As such, it enables policy makers and researchers of trade issues to observe and analyze any country's trade liberalization trends and stages from a new perspective. The new series of indexes and graphs that are introduced in the TLE-Methodology are useful for the study of trade liberalization. This Methodology can certainly be taken as a means to study the level of trade liberalization that a country or region has applied in its trade evolution.

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Notes

[1] "Multilateralism is considered a basic principle of globalization. This principle tries to promote the free market through trade and non-trade barriers measures among nations without discrimination or some preferences under the control of the general agreement trade and tariffs (GATT). From 1947 until today, GATT is considered by many experts in the international trade field as an organization that plays the role of mediator and moderator in the international trade legal framework among all members of GATT that have trade differences. The GATT

base is supported by the application of the unconditional and voluntary principles of non-discrimination and reciprocity based on the most-favored-nation (MFN) clause. The MFN complies with the modus operandi of the GATT, and it is given the basic elements to bilateralism in all GATT negotiations among its members. Usually, when we refer to GATT, some confusion may arise especially when the GATT focus its attention on multilateralism, and we forget that the importance of bilateralism which is a vital complementary part of multilateralism. After this clause was implemented, it gave rise to article XXIV**.** Article XXIV refers to regional agreements based on custom union and free trade areas." (Alan V. Deardorff y Robert M. Stern,1994).

2 Regionalism is defined by many experts as the formation of trade blocs or regional integration agreements (RIA's) based on reduction of tariff measures (import tariff) and non-tariff measures (quotas and quality controls) among its members under the implementation of custom unions and free trade areas among a group of countries in the same geographical area.

3 ISI is applied a higher tariffs to protect some specific areas of production based on the infant industry principle.

4 The measuring of agriculture trade liberalization index (X_1) originates from the calculus obtained from the agriculture multi-input tariff database Table (see Table 1). After we have obtained the result of X_1, we can proceed to classify our results into three different parameters. These parameters are lower trade liberalization or level 1 ($0 \leq X_1 \leq 0.33$), stagnation trade liberalization or level 2 ($0.34 \leq X_1 \leq 0.66$) and higher trade liberalization or level 3 ($0.67 \leq X_1 \leq 1$).

5 The measuring of heavy industry trade liberalization index (X_2) originates from the calculus applied in the heavy industry multi-input tariff database Table (see Table 1). After we have obtained the result of X_2, we can proceed to classify our results into three different parameters. These parameters are lower trade liberalization or level 1 ($0 \leq X_2 \leq 0.33$), stagnation trade liberalization or level 2 ($0.34 \leq X_2 \leq 0.66$) and higher trade liberalization or level 3 ($0.67 \leq X_2 \leq 1$).

6 The measuring of light industry trade liberalization index (X_3) originates from the calculus applied in the light industry multi-input tariff database Table (see Table 1). After we have obtained the result of X_3, we can proceed to classify our results into three different parameters. These parameters are lower trade liberalization or level 1 ($0 \leq X_3 \leq 0.33$), stagnation trade liberalization or level 2 ($0.34 \leq X_3 \leq 0.66$) and higher trade liberalization or level 3 ($0.67 \leq X_3 \leq 1$).

7 The measuring of services trade liberalization index (X_4) originates from the calculus applied in the services multi-input tariff database Table (see Table 1). After we have obtained the result of X_4, we can proceed to classify our results into three different parameters. These parameters are lower trade liberalization or level 1 ($0 \leq X_4 \leq 0.33$), stagnation trade liberalization or level 2 ($0.34 \leq X_4 \leq 0.66$) and higher trade liberalization or level 3 ($0.67 \leq X_4 \leq 1$).

8 Tariff rate acceptable (TRA) is fixed by the researcher, policy maker, or based on parameters of international. trade organizations (e.g. World Trade Organization (WTO) or UNCTAD) interested to evaluate the tariff structure of any country or region.

CHAPTER 5

Korean Unification: A Multi-dimensional Analysis

By Mario Arturo Ruiz Estrada and Donghyun Park*

5.1 Introduction

The Korean peninsula has been divided between the capitalist South Korea and the communist North Korea since the end of the Second World War. The two countries share a common people, history and culture, and the political division of the peninsula is an artificial relic of the Cold War. Nevertheless, the division is very real, and the border between the two countries remains among the most tightly sealed and heavily militarized in the world. Continuous rapid growth has transformed South Korea from a typical poor developing country into an economic powerhouse which is one of the world's 12 biggest economies.[1] In contrast, decades of autarky and central planning have reduced North Korea to one of the poorest countries in the world.[2] The dire and worsening economic crisis in North Korea has fuelled concerns in South Korea about a chaotic collapse of the North Korean government and hence chaotic reunification. Politically, South Korea is a thriving democracy whereas North Korea is communist dictatorship. There are thus many parallels between the German unification which took place in 1990 and a potential unification between the two Koreas.

The existing literature on the prospects for Korean unification focuses primarily on the economic consequences of unification.[3] This is perfectly understandable in light of the gaping difference in income levels between the two Koreas and the large economic costs of unification for South Korea. Furthermore, the poor performance of the German economy since unification has highlighted the potentially adverse effects of unification for the Korean economy.[4] The central objective of our paper is to contribute to the literature on Korean unification by examining Korean unification from a more global perspective that encompasses not only the economic dimension but other relevant dimensions as well. To do so, we use the Global Dimension of Regional Integration Model (henceforth GDRI Model) recently developed by Ruiz (2004). The defining characteristic of the model, which we discuss in the next section, is that it looks at regional integration simultaneously from political, social, economic and technological perspectives. We apply the model to a comparative analysis of the development levels of the two Koreas in the 1970s, 1980s and 1990s. Convergence has positive implications about the prospects for unification whereas divergence has negative implications.

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5.2 The Global Dimension of Regional Integration Model (GDRI Model) and Its Application to a Comparative Analysis of the Two Koreas

The main objective of the GDRI Model is to provide policymakers and researchers a new analytical tool to study the evolution of any regional integration process from a global perspective encompassing the political, social, economic and technological dimensions.[5] The simple and flexible model is based on a group of indexes and graphs, and it can be applied to any case of regional integration. The GDRI Model involves four basic phases. The first phase is the design of the multi-input database table. The second phase is the measurement of individual Regional Global Development Indexes (Xi), which include the Regional Global Political Development Index (X1), Regional Global Social Development Index (X2), Regional Global Economic Development Index (X3) and Regional Global Technological Development Index (X4). The third phase is the measurement of the Regional Global Development (RGD) index. The last phase is the measurement of Regional Integration Stage (RIS) index.

Let us now discuss each of the four basic phases, beginning with the design of the multi-input database table. Table 1 below is an example of the multi-input database table and shows global regional political development. Global refers to the multidimensional nature of political development and is represented by a wide range of political variables. Regional refers to the specific region of interest to the research. Therefore, in our case, global regional political development refers to the political development of the two Koreas as measured by the 15 political variables in Table 1. There is no reason why the number of variables in a multi-input database table should be constant and it can vary according to the objectives of

TABLE 1
Multi-Input Database Table: Global Political Development

CODE	POLITICAL FACTORS
P.1.	**External factors**
P.1.1.	Colonization (country)
P.1.2.	Group negotiation power
P.1.3.	Foreign policy influences
P.1.4.1.	Regional
P.1.4.2.	Global
P.1.5.	Negotiation style
P.2.	**Internal factors**
P.2.1.	International organizations support
P.2.3.	Political regime
P.2.4.	Legislative background
P.2.5.	Internal security
P.2.6.	Human rights
P.2.7.	Border problems
P.2.8.	Political stability
P.2.9.	Political structure and public administration
P.2.10.	Army size
P.2.11.	Bureaucracy level

the research and data availability. We can similarly construct multi-input database tables for global regional economic, social and technological development.

The second phase of the GDRI-Model is to measure the Global Development Indexes (Xi) using the variables in the four multi-input database tables described above. The four Global Development Indexes are the Global Political Development Index (X1), Global Social Development Index (X2), Global Economic Development Index (X3) and Global Technological Development Index (X4). The data we input for each country in the region – in our case, North Korea and South Korea are the countries and Korea is the region – are based on statistical and historical data. Furthermore, all our data are binary – i.e. either 1 or 0 – and determined by either quantitative or qualitative criteria. A big reason for using binary data is that we attach the same level of importance to all the variables in our multi-input database tables. Another reason for using binary data is that it allows us to analyze countries with limited data, such as North Korea.

Table 2 below is an example of a multi-input database table with binary data inputted, and it shows the global political development of South Korea, North Korea and the Koreas in the 1970s. For example, the value for the variable "political regime" is 1 if the country is democratic and 0 if the country is non-democratic.[6] Therefore, as the last three columns show, the value is 1 for South Korea and 0 for North Korea. Similarly, the value of the variable "human rights" is 1 if a country's protection of human rights is strong and 0 if it is weak. This is why we input 1 for South Korea and 0 for North Korea. The total for South

TABLE 2
Global Political Development of South Korea and North Korea in the 1970s

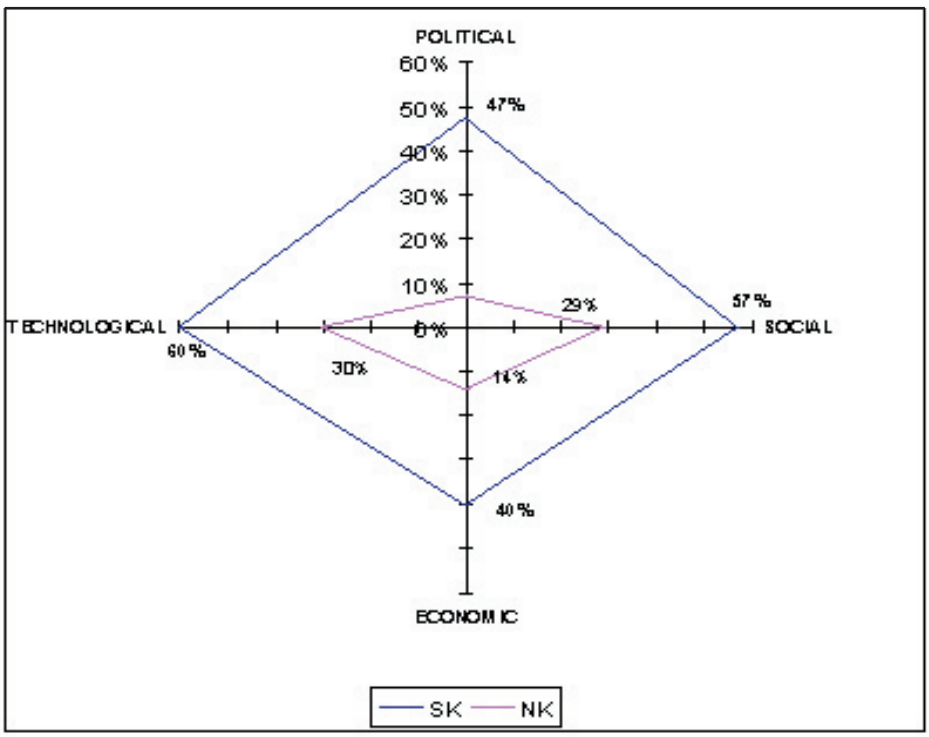
CODE	POLITICAL FACTORS	SK	NK
P.1.	**External factors**		
P.1.1.	Colonization (country)	0	0
P.1.2.	Group negotiation power	1	0
P.1.3.	Foreign policy influences		
P.1.4.1.	Regional	1	0
P.1.4.2.	Global	0	0
P.1.5.	Negotiation style	1	0
P.2.	**Internal factors**		
P.2.1.	International organizations support	1	0
P.2.3.	Political regime	1	0
P.2.4.	Legislative background	0	0
P.2.5.	Internal security	1	1
P.2.6.	Human rights	1	0
P.2.7.	Border problems	0	0
P.2.8.	Political stability	0	0
P.2.9.	Political structure and public administration	0	0
P.2.10.	Army size	0	0
P.2.11.	Bureaucracy level	0	0
TOTAL		**7**	**1**
TOTAL (%)		**47**	**7**

Korea is 7 or 47 % since there are 15 variables and the total for North Korea is 1 or 7%. The global political development of South Korea and North Korea in the 1970s is thus 47% and 7%, respectively.

We can similarly input binary data for all the variables in the multi-input database tables for social, economic and technological development of the two Koreas in the 1970s.[7] We find the global social development of South Korea and North Korea in the 1970s to be 57% and 29%, the global economic development of South Korea and North Korea in the 1970s to be 40% and 14%, and the global technological development of South Korea and North Korea in the 1970s to be 60% and 30%.[8]

The third phase of the GDRI model is to use the four Global Development Indices (Xi) we found in the model's second phase – i.e. political, social, economic and technological – to estimate the Global Overall Development Index (X), which sums up the information contained in the four indices. Intuitively, the Global Overall Development Index (X) measures a country's overall level of development from a multidimensional or global perspective encompassing political, social, economic and technological development. Furthermore, as we saw earlier, we measured political, social, economic and technological development themselves from a multidimensional or global perspective, using a wide range of variables relevant to the development of each sphere. The first step in estimating the Global Overall Development Index (X) is to plot the values of the four Global Development Indices (Xi), as shown in Figure 1 below. This graph will help to illustrate how we compute X. Graph 1 consists of four different triangular areas – each bounded by the values of two of the four global development indices – for South Korea, North Korea and the Koreas. Let us define the

FIGURE 1
Global Overall Development of South Korea and North Korea in the 1970s

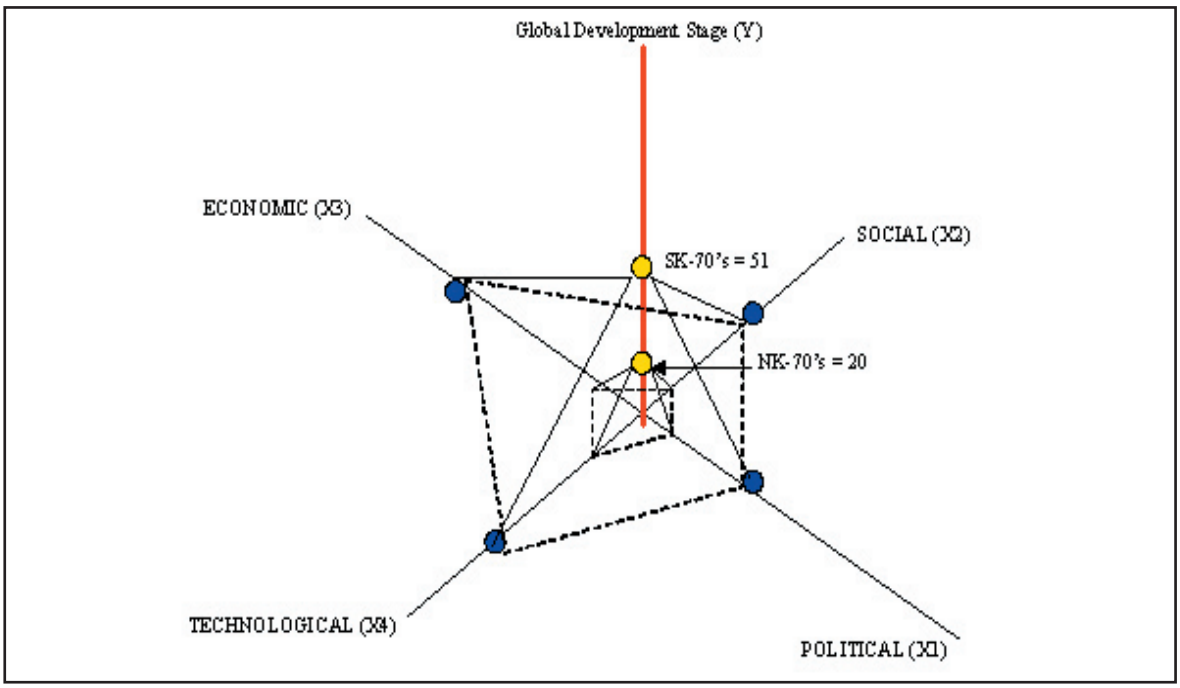


triangular area between the political and social axes as A1, social and economic axes as A2, economic and technological axes as A3, and technological and political axes as A4. Each area has a maximum value of 0.25 and the total value of the four areas is 1.

We compute the overall global development index (X) as the sum of the four areas – A1, A2, A3 and A4. In computing A1, it is useful to think of the value of the Global Political Development Index (X1) as the base and the value of the Global Social Development Index (X2) as the height. We compute A1 by first multiplying X1 and X2, and then dividing their product by four. Similarly, we can compute A2, A3 and A4 by doing the same with the pairs (X2, X3), (X3, X4) and (X4, X1), respectively. For example, for South Korea, A1 is 6.7% since X1 is 47% and X2 is 57%. Likewise, we compute A2, A3 and A4 for South Korea to be 5.7%, 6% and 7.05%. Therefore, South Korea's overall global development index (X) is 25%. We can similarly compute X for North Korea as 3%. Therefore, in the 1970s, South Korea's overall development level was about eight times higher than that of North Korea.

The fourth and final phase of the GDRI model is to use the four Global Development Indices (Xi) and coefficients to measure the Global Development Stage (Y) of South Korea and North Korea. The coefficient indicates the relative importance of the political, social, economic and technological dimensions, and sum up to one. For example, if we attach equal importance to the four dimensions, the coefficient for each dimension is 0.25. To obtain the Global Development Stage (Y), we first multiply the Global Development Index (Xi) with the corresponding coefficient – for example, the Global Political Development Index (X1) and the political coefficient – and then sum up the four products. Assuming that each of the four coefficients is 0.25, so that the four dimensions are equally important, we can compute the Global Development Stage (Y) for South Korea and North Korea as 51% and 20%,

FIGURE 2
Global Development sTAGE of South Korea and North Korea in the 1970s



respectively, in the 1970s. The large gap in Y between South Korea and North Korea indicates a large gap between the two countries in terms of overall development. Figure 2 provides a graphical representation of Global Development Stage (Y). The height corresponds to Y and the quadrangular area inside the dotted lines corresponds to the Overall Global Development Index (X).

The Global Development Stage (Y) is broadly similar to the Global Overall Development Index (X) since both reflect the overall development level of a country or a region. We define a value of Y between 0% and 33% as the underdeveloped stage, 34% and 66% as the developing stage, and 67% and 100% as the developed stage. Therefore, in the 1970s, South Korea was in the developing stage whereas North Korea was in the underdeveloped stage. We should note that Y is more flexible than X in the sense that it allows us to attach any combination of relative weights to the political, social, economic and technological dimensions. For example, if we attach more importance to the political dimension than the other dimensions, the political coefficient may be 0.40 while the social, economic and technological coefficients may each be 0.20. More generally, we can flexibly vary the relative sizes of the four coefficients to suit our needs.

We now report the main results of our GDRI Model analysis of the two Korea during the 1980s and the 1990s.[9] South Korea's Global Political Development Index (X1) increased from 47% in the 1970s to 67% in the 1980s and 79% in the 1990s, which indicates that South Korea has become progressively more politically developed over time. This reflects South Korea's transformation from authoritarian military-based governments to a thriving pluralistic democracy. In contrast, the same index has remained constant at only 7% for North Korea in the three decades, which is hardly surprising given that the country has remained a communist dictatorship with almost no freedom of expression. The large and

FIGURE 3
Global Overall Development Stage of South Korea and North Korea in the 1980s

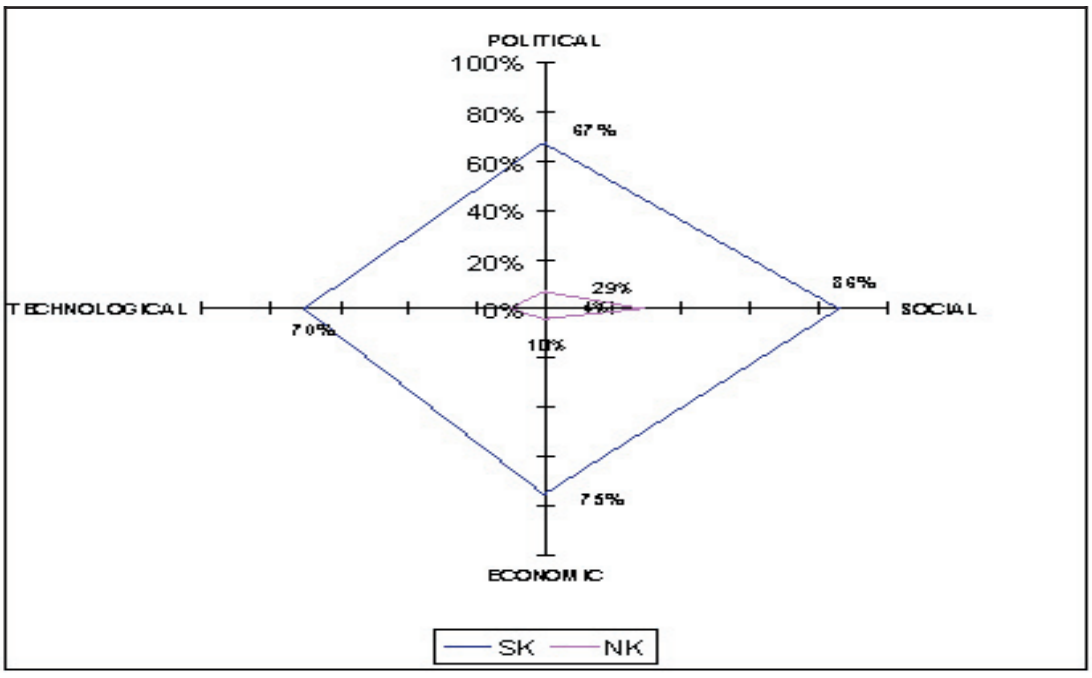
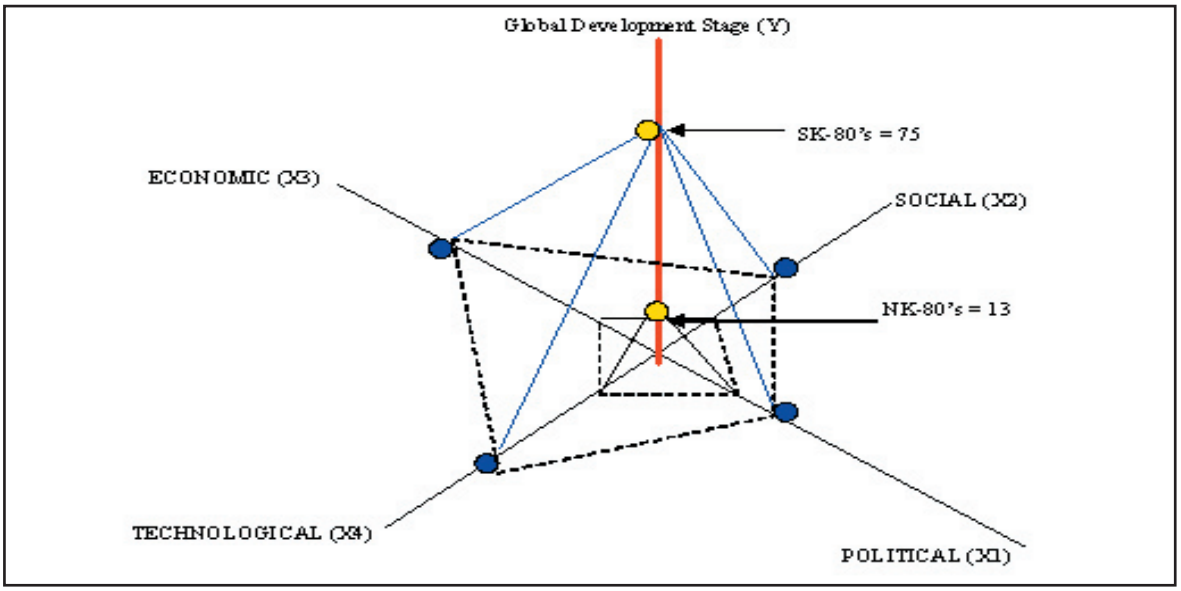


FIGURE 4
Global Development Stage of South Korea and North Korea in the 1980s



growing gap between the two Koreas in political development does not bode well for the prospects of Korean unification since common political values facilitate regional integration, as most clearly evident in the EU.

The social development of South Korea has moved significantly forward in the 1980s and 1990s, in contrast to North Korea, which has failed to make any progress in this area. South Korea's Global Social Development Index (X2) rose from 57% in the 1970s to 75% in the 1980s and 85% in the 1990s. To a large extent, this reflects South Korea's rapid economic development since basic social services such as healthcare and education tend to improve with a country's living standards. In stark contrast, the same index declined from 29% in the 1970s and 1980s to 15% in the 1990s for North Korea, and this decline parallels the country's steep economic decline. The large gap in social development between the two Koreas and the consequent costliness of integrating the social systems of the two countries has negative implications for Korean unification.

The South Korean economy has achieved rapid growth and development, in sharp contrast to the North Korean economy, which has deteriorated sharply over time. South Korea's Global Economic Development Index (X3) has more than doubled, from 40% in the 1970s to 75% in the 1980s and 84% in the 1990s. This is consistent with the country's radical transformation from a poor developing country to a highly successful newly industrialized economy (NIE) that has become a model of economic development for the Third World. On the other hand, for North Korea, the same index has plummeted from 14% in the 1970s to 5% in the 1980s and 1990s. The North Korean economy has collapsed to such an extent that malnutrition is a fairly widespread problem. The wide and growing economic divide between the two Koreas remains by far the most serious obstacle to unification. It implies that the financial and economic costs of unification may be unsustainably high for South Korea.

South Korea has made substantial technological progress and has reached a high level of technological development, as evident in the evolution of its Global Technological Development Index (X4), which rose from 60% in the 1970s to 70 % in the 1980s and 90% in the 1990s. This is hardly surprising in light of the fact that technological upgrading has been an essential ingredient of South Korea's successful economy. On the other hand, North Korea's X4 fell from 30% in the 1970s to 10% in the 1980s and 1990s, reflecting a sharp decline in the country's technological base. This decline is both an effect and cause of the collapse of the country's poor economic performance. The large and increasing technological gap between the two countries raises the technological costs of unification and thereby has negative implications for the prospects of unification.

Table 3 below summarizes the global development of South Korea and North Korea in the political, social, economic and technological spheres during the 1970s, 1980s and 1990s. Table 3 clearly shows an unmistakable difference between the two Koreas. In contrast to South Korea, which has achieved substantial progress in all four spheres, North Korea has failed to do so in any of the four spheres. The wide and growing inter-Korean gap is not limited to economic development but extends to development in other areas as well. The fact that the Koreas are becoming less similar in all aspects rather than more similar does not bode well for their unification.

TABLE 3
Global Political, Social, Economic and Technological Development of South Korea and North Korea in the 1970s, 1980s and 1990s

Years	1970s		1980s		1990s	
Countries	SK	NK	SK	NK	SK	NK
POLITICAL	47%	7%	67%	7%	79%	7%
SOCIAL	57%	29%	75%	29%	85%	15%
ECONOMIC	40%	14%	75%	5%	84%	2%
TECHNOLOGICAL	60%	30%	70%	10%	90%	10%

We now use the four Global Development Indices (Xi) to estimate the Global Overall Development Index (X) for the two Koreas in the 1980s and 1990s.[10] To repeat, the Global Overall Development Index (X) measures a country's overall level of development from a multidimensional perspective encompassing the political, social, economic and technological aspects. We find X to be 55% for South Korea and 1% for North Korea in the 1980s, and 82% for South Korea and 1% for North Korea in the 1990s. The evolution of X over time confirms the picture of a wide and growing gap between the Koreas. South Korea has managed to reach a high overall development level through rapid progress in all four areas whereas North Korea's overall development level continues to stagnate at a very low level.

We use the four Global Development Indices (Xi) and coefficients reflecting the relative importance of each Xi to measure the Global Development Stage (Y) of South Korea and North Korea in the 1980s and 1990s.[11] To repeat, the Global Development Stage (Y) is similar to the Global Overall Development Index (X) in the sense that both reflect a country's overall development level. Assuming that each coefficient is 0.25, so that the

FIGURE 5
Global Overall Development Stage of South Korea and North Korea in the 1990s

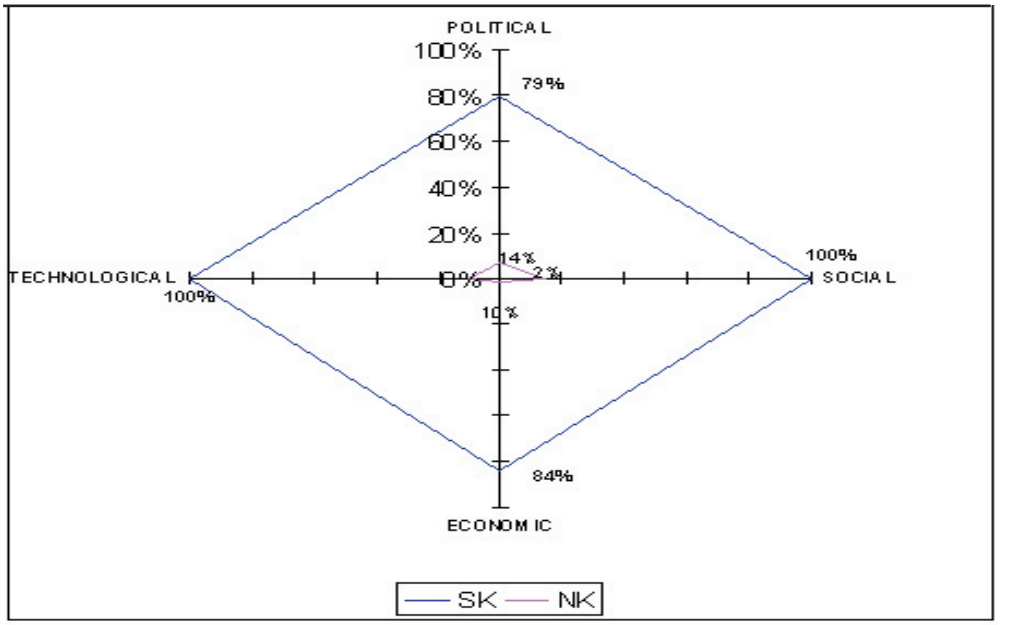
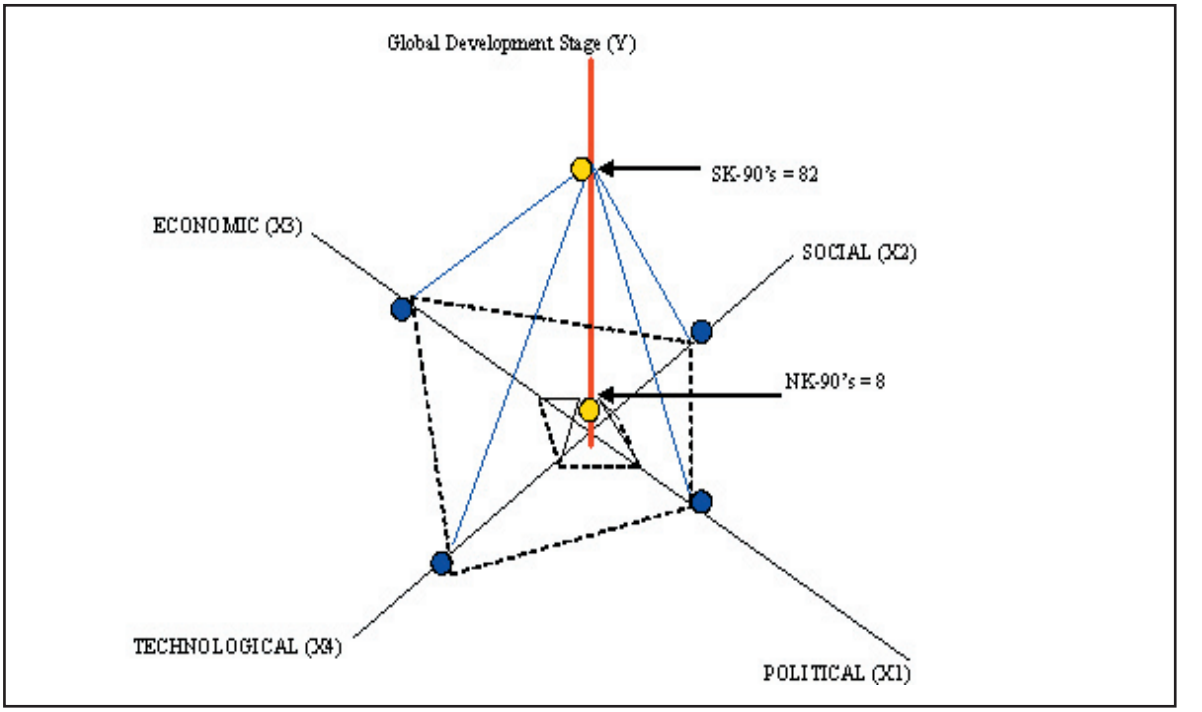


FIGURE 6
Global Development Stage of South Korea and North Korea in the 1990s



political, social, economic and technological dimensions are equally important, we compute the Global Development Stage (Y) for South Korea and North Korea to be 75% and 13%, respectively, in the 1980s. Our computed value of Y rises to 91% for South Korea but falls even further to 8% for North Korea in the 1990s. According to our earlier definitions, South Korea is well into the developed stage while North Korea remains at a very low stage of development. The large and growing difference in Y between the two Koreas mirrors the large and growing difference in their overall development level.

5.3. The Union Viable and Sustainable of the Two Koreas Analysis

According to results in this paper for a viable and sustainable union between South Korea and North Korea became impossible. The gap development between South Korea and North Korea is growing decade by decade. The gap development between South Korean and North Korea in 1970's is equal to political development (40%), social development (28%), economic development (26%) and technological development (30%). The gap development between both Koreas in 1970's is not so large than 1980's and 1990's. The balance point between South Korea and North Korea is small and easy to catch by both countries. For South Korean need to sacrifice from its political development -20%, Social development -14%, economic development -13% and technological development -15%. In the case of North Korea to arrive to the balance point in the 1970's is equal to political development +20%, Social development +14%, economic development +13% and technological development +15%. The gap development and balance point in 19070's can be accepted to facilitate the union of both Koreas.

TABLE 4
Union Viable and Sustainable Table in the 1970's

Variables	SK	NK	K	GD	BP	LC-SK	LC-NK
POLITICAL	79%	7%	86%	72%	43%	-36%	+36%
SOCIAL	85%	15%	100%	70%	50%	-35%	+35%
ECONOMIC	84%	5%	89%	79%	45%	-39%	+39%
TECHNOLOGICAL	90%	10%	100%	80%	50%	-40%	+40%

Notes:
SK = South Korea NK = North Korea K (Korea) = SK + NK
GD (Gap Development between South Korea and North Korea) = SK – NK
BP (The Balance Point is the point that both countries need to arrive for a possible viable and sustainable unification. E.g. South Korea and North Korea)
BP = K/2
(LC-SK) Level of contribution of South Korea in the process of unification with North Korea
LC-SK = BP - SK
Negative result (-) = How much South Korea need to sacrifice of its development to arrive at the balance point to generate a possible unification with North Korea
Positive result (+) = How much South Korea need to work to arrive at the balance point to generate a possible unification with North Korea
(LC-NK) Level of contribution of North Korea in the process of unification with South Korea
LC-NK = BP - NK
Negative result (-) = How much North Korea need to sacrifice of its development to arrive at the balance point to generate a possible unification with South Korea
Positive result (+) = How much North Korea need to work to arrive at the balance point to generate a possible unification with South Korea.

In the 1980's the development gap continue growing in the political development (60%), social development (46%), economic development (71%) and technological development (60%). However, the balance point is more distant for South Korea compare North Korea. South Korea needs to sacrifice more than North Korea to unify both countries. In the case of North Korea, it needs to work more hard to meet South Korea in the balance point.

TABLE 5
Union Viable and Sustainable Table in the 1980's

Variables	SK	NK	K	GD	BP	LC-SK	LC-NK
POLITICAL	67%	7%	74%	60%	37%	-30%	+30%
SOCIAL	75%	29%	104%	46%	52%	-23%	+23%
ECONOMIC	75%	5%	79%	71%	40%	-35%	+35%
TECHNOLOGICAL	70%	10%	80%	60%	40%	-30%	+30%

Notes:
SK = South Korea NK = North Korea K (Korea) = SK + NK
GD (Gap Development between South Korea and North Korea) = SK – NK
BP (The Balance Point is the point that both countries need to arrive for a possible viable and sustainable unification. E.g. South Korea and North Korea)
BP = K/2
(LC-SK) Level of contribution of South Korea in the process of unification with North Korea
LC-SK = BP - SK
Negative result (-) = How much South Korea need to sacrifice of its development to arrive at the balance point to generate a possible unification with North Korea
Positive result (+) = How much South Korea need to work to arrive at the balance point to generate a possible unification with North Korea
(LC-NK) Level of contribution of North Korea in the process of unification with South Korea
LC-NK = BP - NK
Negative result (-) = How much North Korea need to sacrifice of its development to arrive at the balance point to generate a possible unification with South Korea
Positive result (+) = How much North Korea need to work to arrive at the balance point to generate a possible unification with South Korea.

Finally, in the 1990's the gap development between South Korea and North Korea is extremely large than 1970's and 1980's. In the 1990's the gap development shows a political development (72%), social development (70%), economic development (79%) and technological development (80%). The balance point in 1990's between South Korea and North Korea is large and hard to arrive both countries. In the case of South Korea need to sacrifice more than North Korean in last past two decade (1970's and 1980's) in his political development -36%, Social development -35%, economic development -39% and technological development -40%. In the case of North Korea the balance point in the 1990's is equal to political development +36%, Social development +35%, economic development +39% and technological development +40%. The large gap development and balance point in 1990's for both countries generate difficulties for a possible union in the short and long term.

We can say that the unification of both Koreas have a high cost for South Korea, because South Korea need to sacrifice a lot of its political, social, economic and technological development to unify a single Korea, but in the case of North Korea need to work more

TABLE 6
Union Viable and Sustainable Table in the 1990's

Variables	SK	NK	K	GD	BP	LC-SK	LC-NK
POLITICAL	79%	7%	86%	72%	43%	-36%	+36%
SOCIAL	85%	15%	100%	70%	50%	-35%	+35%
ECONOMIC	84%	5%	89%	79%	45%	-39%	+39%
TECHNOLOGICAL	90%	10%	100%	80%	50%	-40%	+40%

Notes:
SK = South Korea NK = North Korea K (Korea) = SK + NK
GD (Gap Development between South Korea and North Korea) = SK – NK
BP (The Balance Point is the point that both countries need to arrive for a possible viable and sustainable unification. E.g. South Korea and North Korea)
BP = K/2
(LC-SK) Level of contribution of South Korea in the process of unification with North Korea
LC-SK = BP - SK
Negative result (-) = How much South Korea need to sacrifice of its development to arrive at the balance point to generate a possible unification with North Korea
Positive result (+) = How much South Korea need to work to arrive at the balance point to generate a possible unification with North Korea
(LC-NK) Level of contribution of North Korea in the process of unification with South Korea
LC-NK = BP - NK
Negative result (-) = How much North Korea need to sacrifice of its development to arrive at the balance point to generate a possible unification with South Korea
Positive result (+) = How much North Korea need to work to arrive at the balance point to generate a possible unification with South Korea.

hard to catch the balance point and reduce the gap development between both countries. Therefore a suitable union between South Korea and North Korea is more hardly for a possible successful unification.

5.4 Concluding Remarks

Unification between two countries is inherently a complex and multidimensional phenomenon entailing the unification of their economies, political systems, social systems, and a wide range of other societal hardware and software. The German unification of 1990 clearly illustrated the multidimensional nature of inter-country unification. Like pre-unification Germany, Korea is divided into a democratic market economy – South Korea – and a communist centrally planned economy – North Korea. In this paper, we look at the prospects for Korean unification by comparing their development from a multidimensional perspective rather than focusing solely on any single dimension. To carry out such a broader analysis, we use the Global Dimension of Regional Integration Model (GDRI Model) recently developed by Ruiz (2004), which evaluates the prospects for regional integration from a global or multidimensional perspective. More specifically, we use the GDRI model to examine and compare the political, social, economic and technological development of the two Koreas in the 1970s, 1980s and 1990s. Our main finding is a large and growing gap between the two Koreas in terms of political, social, economic and technological development and consequently, overall development. Our analysis thus clearly reveals a divergence between

the two Koreas rather than a convergence, which suggests that unification is likely to be a painful and disruptive process entailing large adjustment costs.

In terms of policy implications, our analysis suggests that while the large and growing political, social, economic and technical gap between the two Koreas is indeed a serious obstacle to inter-Korean integration and unification, South Korean policymakers would do well to appreciate the inherently multidimensional nature of unification. That is, unifying the two Koreas is not simply a matter of unifying two economies but also unifying political, social and technological systems as well. This is a valuable lesson that is also highly relevant for policymakers in other countries pursuing closer integration. Our analysis provides support for the South Korean government's "sunshine policy" of diplomatically engaging North Korea and providing economic assistance in the sense that such a policy will slow down the momentum of inter-Korean divergence in the short run and promote convergence in the long run.[12] The international community also has a stake in facilitating eventual inter-Korean unification through dialogue and assistance since convergence and stronger links between the two Koreas offer the best hopes for transforming North Korea into a responsible full-fledged member of the international community.

At the same time, while "sunshine policy" is appropriate in a broader sense, South Korean policymakers should pay closer attention to the non-economic aspects of inter-Korean convergence. For example, they have so far chosen to largely ignore the lack of progress in the political development of North Korea, whose government remains one of the world's most repressive dictatorships with almost complete lack of basic human rights. Our analysis implies that a narrow policy approach based on economic assistance alone is likely to be misguided and unproductive since lack of political convergence may hinder unification even if there is significant progress in terms of economic convergence. Of course, economic convergence could indirectly promote convergence in the political, social and technological spheres as well. After all, materially better off societies tend to have more open political systems, provide better education and use more advanced technology. Be that as it may, in light of our findings, South Korean policymakers would do well to extend more multidimensional assistance which has a direct positive impact on the multidimensional development of North Korea and hence multidimensional inter-Korean convergence. Finally, our study also lends support to the European Union's policy of requiring potential new members to pursue reforms in non-economic areas well as economic areas. We can say that the unification of both Koreans have a high cost for South Korea, because South Korean need to sacrifice a lot of its political, social, economic and technological development, but in the case of North Korean need to work more hard to catch the balance point between both countries in the short run to unify both country into a single country.

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Notes:

[1] Please refer to Harvie and Lee (2003), Stiglitz and Yusuf (2001) and World Bank (1993) for comprehensive discussions of the rapid economic growth of South Korea and other East Asian economies.

[2] The limited literature on the North Korean economy include Jin (2003), Choi, Kim and Merrill (2003), Yoon and Lau (2001), Noland, Robinson and Scatasta (1997), and Hwang (1993).

[3] See, for example, Yoo (2004), Lee (2001), Choi (2001), Noland, Robinson and Wang (2000), Noland, Robinson and Liu (1999), and Noland (1998). In an indirectly related paper, Kim (2005) examines economic integration between asymmetric Northeast Asian countries. For the German case, please refer to Lipschitz and McDonald (2005), Gundlach (2003) and Sinn (2002) for the economic consequences of unification. In contributions to this journal, De Bonis (1996) and Adams, Alexander and Gagnon (1993) discuss the economic consequences of German unification for Europe as a whole. In a more recent contribution to this journal, Atici and Kennedy (2005) explore the welfare implications of a poor country – Turkey – into the rich EU.

[4] Bibow (2005), Knot and de Haan (1999) and Gokhale, Rafflehuschen and Walliser (1995), among others, discuss the relationship between Germany's unification and economic performance.

[5] For a full description of the model, please refer to Ruiz (2004). The paper is available from the authors upon request.

[6] All the binary variables in our study are explained in Ruiz (2004).

[7] The binary variables are, of course, different than those in Table 2. There are 7 binary variables for social development, 57 binary variables for economic development and 10 binary variables for technological development.

[8] The tables for the global social, economic and technological development – corresponding to Table 2 for global political development – are available from the authors upon request.

[9] The tables for the global political, social, economic and technological development in the 1980s and 1990s are available from the authors upon request. Please refer to Table 2, which looks at global political development in the 1970s, for an example of the tables.

[10] The graphical representations of the Overall Global Development Index (X) for the two Koreas in the 1980s and 1990s – corresponding to Figure 1 for X in the 1970s – are available from the authors upon request.

[11] The graphical representations of the Global Development Stage (Y) for the two Koreas in the 1980s and 1990s – corresponding to Figure 2 for Y in the 1970s – are available from the authors upon request.

[12] Please refer to Levin and Han (2003) for a comprehensive discussion of sunshine policy.

CHAPTER 6

A New Multi-Dimensional Framework for Analyzing Regional Integration: Regional Integration Evaluation (RIE) Methodology

By Mario Arturo Ruiz Estrada and Donghyun Park*

6.1 Introduction

Research on regional integration has engendered a wide range of theories, models and methodologies. Most of the existing theories, models and research methodologies on regional integration are based on the perspectives of a single discipline, most often economics.[1] In this paper, we approach regional integration from a multi-disciplinary perspective which incorporates not only economics but also the political, social and technological dimensions of integration.[2] More specifically, we introduce a new multi-dimensional analytical framework – the regional integration evaluation (RIE) methodology – which is based on all four dimensions of development. Our measure of a region's development level in the economic, political, social and technological spheres is the regional development index X_i. The index incorporates the development levels of all regional countries as well as differences among the regional countries. For example, ASEAN's economic development index measures ASEAN's economic development level, which, in turn, depends on the economic development levels of all its member countries. Wide gaps in economic development levels among member countries, say between Singapore and Cambodia, reduce ASEAN's economic development index.

The central idea behind the RIE methodology is that regional development promotes regional integration. That is, the higher the development level of a region, the more likely it is that the countries of the region will experience closer integration with each other. The development level of a region, in turn, depends on the domestic development level of each country in the region. While the idea that regional development is beneficial for regional integration is hardly new, our RIE methodology differs from the existing literature in that it is based on a more comprehensive definition of development than just economic development. A high level of regional economic development is certainly conducive for integration since it allows for more trade, investment and other economic interaction among its member

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countries. However, it is equally clear that a high level of development in non-economic spheres is also conducive for integration. For example, regional integration is more likely to occur among well-functioning democracies than among countries with less mature and stable political systems.

Furthermore, regional integration not only involves the progressive removal of barriers to economic interaction among members, it draws them closer together in non-economic spheres as well. As such, not only can we expect high levels of regional economic and non-economic development to promote regional integration, we can also expect regional integration to promote both economic and non-economic development of a region. For example, the widely cited economic benefits of integration, such as greater trade and investment among member countries, can stimulate the region's economic growth, and indeed higher growth has been a major driving motivation behind most regional integration initiatives. Integration can also bring member countries closer together in terms of their political, social and technological environments, for example by promoting the adoption of common labor or environmental standards. There is thus a mutually supportive and reinforcing relationship between regional development and regional integration. We believe that our RIE methodology can provide more accurate and comprehensive guidance for both policymakers and researchers about the feasibility and desirability of regional integration initiatives than traditional methodologies. While our methodology recognizes that both economic and non-economic factors drive regional integration, the traditional methodologies tend to focus narrowly on economic motivations. In addition, our methodology takes into account the fact that integration entails both economic and non-economic effects.

6.2 Application of the RIE Methodology to Different Trade Blocs

In this section, we apply the RIE methodology to different trade blocs – European Union (EU), North American Free Trade Area (NAFTA), Association of Southeast Asian Nations (ASEAN) and Market of the South Cone (MERCOSUR) – to estimate their regional development levels. The four trade blocs encompass a wide range of geographical locations as well as economic, political, social and technological structures. Applying the RIE methodology to such a diverse group of regions and comparing their development levels enables us to have a clearer picture of the effect of regional development on regional integration. We also look at how the regional development of each trade bloc has evolved over time so as to evaluate whether its integration prospects have become stronger or weaker over time. More specifically, we estimate and compare the regional development level in 3 different time periods – 1980s, 1990s and 2000-2006. Our application of the RIE methodology allows us to compare the prospects for integration among different groups of countries as well as the evolution of those prospects over time.

6.2.1 European Union (EU): High Regional Development and High Regional Integration

The European Union (EU) was established as the European Economic Community in 1957 and represents the most advanced form of regional integration in the world today.[3] Geopolitical factors, in particular the strong political commitment of Western European governments to prevent another military conflict in the aftermath of the devastating Second

Word War, provided a powerful initial impetus for regional integration. An equally powerful impetus came from a common desire of Western European countries to achieve more rapid economic growth by reducing barriers to trade and thus promoting trade with each other. The convergence of powerful geopolitical and economic self-interest has led to a deepening and broadening of integration unparalleled by any other regional group in the world. The depth of EU integration is epitomized by the euro, the common currency shared by 13 member states, while the breadth of integration is perhaps best illustrated by the steady expansion of membership from six to twenty-seven. The EU is in many ways a unique supranational and intergovernmental organization.

Table 1 below shows the evolution of the EU's regional development indices in the 1980s, 1990s and 2000-2006.[4] The regional political development index (X_1) rose slightly from 0.80 in the 1980s to 0.81 in the 1990s before falling to 0.75 during 2000-2006. The regional social (X_2), economic (X_3) and technological (X_4) regional development index all show the same pattern of (i) a slight increase between the 1980s and the 1990s and (ii) a somewhat bigger decrease between the 1990s and 2000-2006. The most striking feature of Table 1 is EU's high level of regional development in all 4 spheres – political, social, economic and technological. This is not surprising since the EU consists of high-income countries with relatively homogenous social and political values as well as technological capabilities. The column to the right of each of the 4 regional development index corresponds to the triangular area used to compute the regional integration stage (RIS) index, which is a measure of overall regional development incorporating all 4 spheres.[5] The larger a particular development index, the larger the corresponding triangular area. The pattern of the RIS index is similar to the 4 development indices – rising from 81 in the 1980s to 83 in the 1990s before falling to 78 in 2000-2006. Figure 1 below shows the graphical illustration of the 4 regional development indices, the corresponding triangular areas, and the RIS index during the 1980s for the EU.

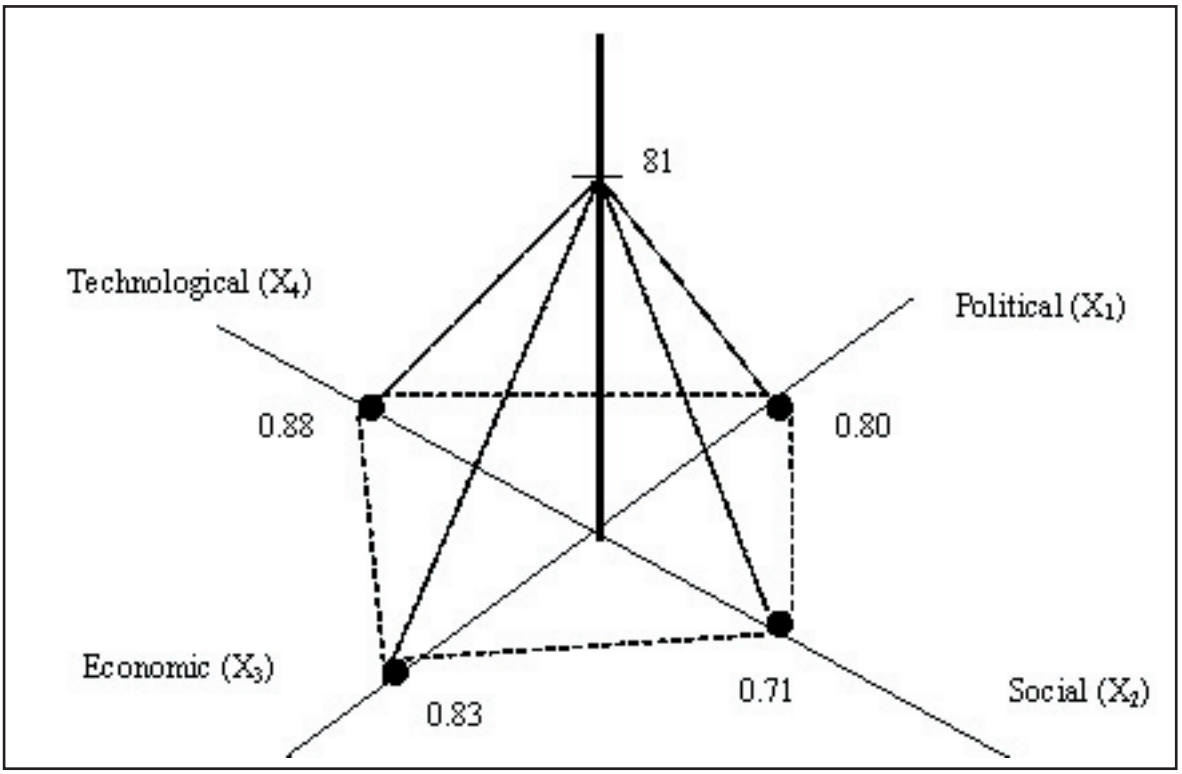
A major development within the EU during 2000-2006 was the accession of new members with lower levels of political, social, economic and technological developments. More specifically, in 2004 Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia and the Czech Republic joined the EU. Except for Cyprus and Malta, all the new members were formerly communist countries making the transition from centrally planned economies to market-based economies and authoritarian political systems to liberal multi-party democracies. The reduction in the 4 regional development indices between the 1990s and 2000-2006, along with the RIS index, is a natural consequence of the entry of ten less developed new members. However, what is more significant is that even after absorbing ten new members, the EU remains highly developed politically, socially, economically

TABLE 1
EU's Political, Social, Economic and Technological Development and Regional Integration Stage (RIS) Index

Period	RPD	Area	RSD	Area	RED	Area	RTD	Area	RIS
1980s	0.80	20	0.71	17.75	0.83	20.75	0.88	22	81
1990s	0.81	20.25	0.78	19.5	0.85	21.25	0.89	22.25	83
2000-2006	0.75	18.75	0.73	18.25	0.80	20	0.85	21.25	78

Note: RPD = regional political development, RSD = regional social development, RED = regional economic development, RTD = regional technological development, RIS = regional integration stage

FIGURE 1
Graphical Illustration of the 4 Regional Development Indices and The Regional Integration Stage (RIS) Index: EU in the 1980s



and technologically. Although the development gap between the old and new members has made the EU more heterogeneous, such heterogeneity has not significantly reduced its overall development level. This suggests that despite the recent membership expansion, the EU remains a viable and forceful mechanism for European integration. Going forward, our analysis implies that the entry of Romania and Bulgaria in 2007, as well as the future prospective entry of Turkey and some Balkan countries, is unlikely to adversely affect the sustainability of the EU.

6.2.2 NAFTA: High Regional Development and Economics-Focused Regional Integration

The North American Free Trade Agreement (NAFTA) came into effect on 1 January 1994 and established a North American free trade area consisting of the United States, Canada and Mexico.[6] The free trade area is the world's largest in terms of the combined economic size, larger than even the EU. Unlike the EU, which addresses a wide range of economic and non-economic issues, NAFTA is a purely economic agreement which seeks to boost trade among the three countries by reducing trade barriers, in particular tariffs. The formation of NAFTA was driven by a common desire to make the North American markets more efficient, and thereby promote the international competitiveness and economic welfare of the three countries. Unlike the EU, NAFTA did not create any supranational organizations such as the European Commission. In the context of their roles as trade blocs, the US, Canada and

Mexico pursue different trade policies with respect to non-NAFTA countries. In contrast, the EU is a customs union in which all EU members pursue the same trade policies vis-à-vis non-EU countries.

Table 2 below shows the evolution of NAFTA's regional development indices in the 1980s, 1990s and 2000-2006. The regional political development index (X_1) rose slightly from 0.65 in the 1980s to 0.67 in the 1990s and further to 0.70 during 2000-2006. The regional social development index (X_2) shows a much sharper rise, from 0.48 in the 1980s to 0.76 in the 1990s and during 2000-2006. The regional economic development index (X_3) rose from 0.74 in the 1980s to 0.82 in the 1990s and further to 0.85 during 2000-2006. Finally, the increase in the regional technological development index (X_4) is smaller, rising from 0.90 in the 1980s to 0.93 in the 1990s and 2000-2006. Table 2 indicates that relative to the pre-NAFTA period, the NAFTA bloc has become more developed politically, socially, economically and technologically. The progress in regional development has been especially pronounced in the social, and to a lesser extent, economic spheres. The regional integration stage (RIS) index rose from 69 in the 1980s to 80 in the 1990s and 81 in 2000-2006.

TABLE 2
NAFTA's Political, Social, Economic and Technological Development and Regional Integration Stage (RIS) Index

Period	RPD	Area	RSD	Area	RED	Area	RTD	Area	RIS
1980s	0.65	16.25	0.48	12	0.74	18.5	0.90	22.5	69
1990s	0.67	16.75	0.76	19	0.82	20.5	0.93	23.25	80
2000-2006	0.70	17.5	0.76	19	0.85	21.25	0.93	23.25	81

Note: RPD = regional political development, RSD = regional social development, RED = regional economic development, RTD = regional technological development, RIS = regional integration stage index

Our application of the RIE methodology to NAFTA indicates that conditions are becoming more conducive for broader and deeper integration among the US, Mexico and Canada. Indeed we find that the RIS index is higher for NAFTA than the EU. The balance of evidence suggests that NAFTA has served as a major catalyst of trade and investment in all three countries. In particular, NAFTA seems to have been beneficial for the economic growth of Mexico, which considerably lags behind its two northern neighbors in per capita income and overall development. Although Mexico's post-1994 growth performance has been neither striking nor fast enough to permit convergence with the US and Canada, it would have been even less impressive without the benefits of NAFTA – greater access to the two rich markets and higher FDI inflows attracted by such access. Although various structural obstacles, for example political opposition in the US to Mexican immigration, stand in the way of deeper integration, our analysis lends support to those who argue that NAFTA should now aspire to become more than just a free trade area.

6.2.3 ASEAN: Low Regional Development and Low Regional Integration

The Association of Southeast Asian Nations (ASEAN) was established in 1967 by Indonesia, Malaysia, Philippines, Singapore and Thailand, and its membership has expanded over time to include Vietnam, Myanmar, Cambodia, Laos and Brunei.[7] ASEAN was formed

by a group of pro-Western, anticommunist countries at the height of the Cold War against the backdrop of the Vietnam War. As such, ASEAN was initially driven by geopolitical considerations and served primarily as a forum for fostering dialogue and cooperation on political and security issues. More specifically, ASEAN sought to build up a united front against the communist threat and to defuse potential conflict among its members. Although the initial impetus for ASEAN came from geopolitics rather, promoting trade, investment and other economic cooperation has become increasingly more important in line with the region's rapid economic growth. Southeast Asia has been part and parcel of the East Asian Miracle which transformed the region from an economic backwater to the most dynamic component of the global economy. The end of the Cold War has further accelerated the strategic shift in ASEAN's focus from geopolitical cooperation to economic cooperation. A concrete example of this strategic shift is the ASEAN Free Trade Area initiative, which was launched in 1992 to reduce trade and non-trade barriers among members.

Table 3 below shows how ASEAN's regional development indices have evolved over time. The regional political development index (X_1) rose sharply from 0.23 in the 1980s to 0.33 in the 1990s before falling marginally to 0.32 during 2000-2006. The regional social development index (X_2) also rises sharply from 0.37 in the 1980s to 0.46 during the 1990s before falling back to 0.40 during 2000-2006. The regional economic development index (X_3) rose from 0.36 in the 1980s to 0.41 in the 1990s and during 2000-2006. The increase in the regional technological development index (X_4) is larger, rising from 0.22 in the 1980s to 0.51 in the 1990s and 0.52 during 2000-2006. Table 3 reveals that ASEAN became more developed politically, socially, economically and technologically between the 1980s and the 1990s. However, by and large there has been almost no progress in ASEAN's development between the 1990s and 2000-2006. The regional integration stage (RIS) index shows a similar trend, rising from 30 in the 1980s to 43 in the 1990s before falling to 41 during 2000-2006.

The progress in political, social, economic and technological development between the 1980s and the 1990s closely mirrors ASEAN's remarkable economic growth and development from 1980 to 1997. The aftereffects of the Asian currency crisis of 1997-1998, which put a rude stop to the region's seemingly unstoppable march toward prosperity, are reflected in the lack of development progress between the 1990s and 2000-2006. The low level of regional development is primarily due to a great deal of income heterogeneity within ASEAN, which includes some of the world's poorest countries as well as one of the richest – Singapore. While intra-ASEAN trade is not negligible, its relative importance falls far short of trade with non-ASEAN countries for all ASEAN members. Likewise, one of the

TABLE 3
ASEAN's Political, Social, Economic and Technological Development and Regional Integration Stage (RIS) Index

Period	RPD	Area	RSD	Area	RED	Area	RTD	Area	RIS
1980s	0.23	5.75	0.37	9.25	0.36	9	0.22	5.5	30
1990s	0.33	8.25	0.46	11.5	0.41	10.25	0.51	12.75	43
2000-2006	0.32	8	0.40	10	0.41	10.25	0.52	13	41

Note: RPD = regional political development, RSD = regional social development, RED = regional economic development, RTD = regional technological development, RIS = regional integration stage index

guiding principles of ASEAN – non-interference in the internal affairs of other members – has prevented ASEAN countries from collectively pushing for political reform. In short, the low level of regional development has prevented ASEAN from becoming an effective vehicle for regional integration. Our analysis suggests that at this point in time it may be more productive for ASEAN to consolidate its existing scope and level of integration rather than seek to horizontally or vertically expand its integration. One possible strategy for ASEAN going forward is to first strengthen integration among relatively more developed members before doing the same for all members.

6.2.4 MERCOSUR: Rapid Regional Development and Slow Regional Integration

MERCOSUR, or Common Market of the South, was set up in 1991 by Argentina, Brazil, Paraguay and Uruguay, and is South America's leading trade bloc.[8] MERCOSUR's combined market accounts for around 70% of the continent's output, and its stated aim is to create a customs union with common external tariffs against non-members and free trade within the bloc. The main driver behind the formation of the South American common market was the shared desire of the continent's two largest economies – Argentina and Brazil – to intensify their economic interaction as a means of enhancing efficiency, productivity and international competitiveness. Both countries were very much part of the Latin American debt crisis in the early 1980s, which led to macroeconomic instability and slow growth throughout the decade, so much so that the 1980s is widely known as the region's "lost decade" from the economic perspective. Along with sounder macroeconomic policies and structural reform, Argentina and Brazil viewed greater regional trade as an important potential channel for recovering from the lost decade and speeding up growth. Geographical proximity and economic linkages with the two giants made Paraguay and Uruguay natural additional partners to the trade bloc. A major contributing political factor is the fact that the debt crisis and its adverse effects on economic performance have discredited the region's authoritarian military governments, which paved the way for their replacement by democratic civilian governments more willing to cooperation with other countries.

Table 4 below shows the evolution of MERCOSUR's regional development indices in the 1980s, 1990s and 2000-2006. The regional political development index (X_1) rose sharply from 0.11 in the 1980s to 0.44 in the 1990s and further to 0.52 during 2000-2006. The regional social development index (X_2) also rose sharply from 0.36 in the 1980s to 0.46 in the 1990s and more moderately to 0.50 during 2000-2006. The regional economic development index (X_3) rose from 0.32 in the 1980s to 0.41 in the 1990s and further to 0.48 during 2000-2006. The increase in the regional technological development index (X_4)

TABLE 4
MERCOSUR's Political, Social, Economic and Technological Development and Regional Integration Stage (RIS) Index

Period	RPD	Area	RSD	Area	RED	Area	RTD	Area	RIS
1980s	0.11	2.75	0.36	9	0.32	8	0.23	5.75	26
1990s	0.44	11	0.46	11.5	0.41	10.25	0.51	12.75	46
2000-2006	0.52	13	0.50	12.5	0.48	12	0.55	13.75	51

Note: RPD = regional political development, RSD = regional social development, RED = regional economic development, RTD = regional technological development, RIS = regional integration stage index

has also been pronounced, rising from 0.23 in the 1980s to 0.51 in the 1990s and further to 0.55 during 2000-2006. Table 4 reveals that during the post-MERCOSUR period, the MERCOSUR bloc has made a great deal of progress in political, social, economic and technological development as well as overall development. The regional integration stage (RIS) index rose from 26 in the 1980s to 46 in the 1990s and further to 51 during 2000-2006.

Our application of the RIE methodology to MERCOSUR indicates that between the 1980s and the 1990s conditions have become much conducive for integration among the four South American countries. In particular, the substantial improvement in the macroeconomic performance of Argentina and Brazil as well as their political transformation into multi-party democracies has strengthened intra-ASEAN political and economic integration. The empirical evidence also indicates that during the 1990s the reduction of tariff and non-tariff trade barriers under MERCOSUR was effective in expanding trade among the four members and serving as an engine of regional growth. However, during 2000-2006, regional integration has failed to keep pace with regional development. In fact, further integration has stalled in the face of growing protectionism within the region, which was initially precipitated by currency devaluations and economic stagnation of 1999-2002. Our analysis suggests that the region's development has continued to move forward despite those temporary setbacks. Therefore, instead of erecting more trade barriers against each other and moving away from the ideal of a customs union, the four MERCOSUR governments should work hard to get regional integration back on track in light of the development progress between 1990s and 2000-2006.

6.3 Concluding Remarks

In this paper, we introduce a new multi-disciplinary analytical framework – the regional integration evaluation (RIE) methodology – for analyzing regional integration. The methodology is based on the recognition that regional integration is not a narrowly economic phenomenon, but a much broader phenomenon which also includes political, social and technological dimensions. That is, integration not only involves reducing barriers to trade, investment and other cross-border economic activities, but also facilitating cooperation in other areas as well. As such, the pre-conditions for successful integration include both economic and non-economic factors. The central idea behind the RIE methodology is that (i) regional development should be defined broadly to encompass political, social, economic and technological development, and (ii) regional development is conducive for regional integration. It is likely that a group of highly developed and homogeneous countries will be able to pursue integration more effectively than a group of less developed and heterogeneous countries. Furthermore, we can expect regional integration to promote regional development, which means there is a complementary relationship between regional development and regional integration, one supporting the other.

To illustrate its practical usefulness for policymakers, we applied the RIE methodology to the European Union (EU), North American Free Trade Area (NAFTA), Association of Southeast Asian Nations (ASEAN) and Market of the South Cone (MERCOSUR) to estimate the regional development levels of four geographically dispersed trade blocs which differ widely in terms of their economic, political, social and technological characteristics.

We also apply the RIE methodology for three different time periods – the 1980s, the 1990s and 2000-2006 – to track the evolution of each bloc's regional development level over time. Broadly speaking, we can characterize the regional development and integration levels of the four blocs as follows: (1) EU – high regional development and high regional integration, (2) NAFTA – high regional development and economics-focused regional integration, (3) ASEAN – low regional development and low regional integration, and (4) MERCOSUR – rapid regional development and slow regional integration. Our analysis not only allows for a comparison of different trade blocs but also captures the impact of major economic and non-economic shocks on the evolution of regional development over time. For example, the entry of less developed new members from Central and Eastern Europe in the past few years has reduced the EU's development level. Likewise, South America's strong and sustained economic recovery from the lost decade of the 1980s has lifted up MERCOSUR's development level.

Our application of the RIE methodology yields estimates of the regional integration stage (RIS) index, which is a measure of a region's overall development. Those estimates provide practical, useful and relevant information to policymakers, especially in terms of whether or not to strengthen integration through either broadening or deepening. Our analysis implies that conditions are now conducive for NAFTA to seek higher levels of integration by expanding into new fields of integration and/or further deepening the existing, economics-focused integration. Our analysis also suggests that at this point in time consolidating the current level of integration makes more strategic sense for ASEAN than broadening or deepening. We find that regional integration has failed to keep pace with regional development in the case of MERCOSUR, which means that policymakers should give seriously consider pursuing integration with renewed vigor and commitment. The decrease in the EU's development level due to the absorption of a large number of new members calls for a period of pause and consolidation. The growing indifference and opposition toward the EU among the general public, highlighted by the French and Dutch voters' rejection of the EU constitution in 2005, lends further support to slowing down the pace of integration. At a broader level, we hope that our study will contribute toward a more multi-disciplinary approach to regional integration among researchers as well as a more multi-dimensional understanding of regional integration among policymakers.

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Notes

[1] Please refer to Jovanovic (2006), Robson (2006), Fratianni (2006), Das (2004) and El-Agraa (1989) for comprehensive discussions of regional economic integration.

[2] Although the vast majority of the literature on regional integration addresses regional economic integration, there are some papers which look at the political, social and technological dimensions of integration. For example, (i) Schiff and Wang (2003) explore technology diffusion under NAFTA, (ii) Duina (2006) examines the social aspects of regional integration in the EU, NAFTA and MERCOSUR, and (iii) Marsh (2006) looks at the relationship between political liberalization and regionalism in East and Southeast Asia.

[3] Please refer to Molle (2006) and Dinan (2005) for comprehensive overviews of the EU.

[4] Please refer to Ruiz and Park (2007) and Ruiz (2004) for a comprehensive overview of the derivation of the regional development index.

[5] For example, in the 1980s, 20 is the triangular area associated with the regional political development index of 0.8. In computing the RIS index, we can vary the weights we assign to political, social, economic and technological development. In this paper, we have assigned equal weights to the four different dimensions of development. The RIS index is simply the sum of the 4 triangular areas. Please refer to Ruiz and Park (2007) and Ruiz (2004) for a more comprehensive discussion of deriving the RIS index.

[6] Please refer to Hufbauer and Schott (2005) and Cameron and Tomlin (2000) for comprehensive overviews of NAFTA.

[7] Please refer to Tarling (2006) and Plummer (2006) for comprehensive overviews of ASEAN.

[8] Please refer to Preusse (2004) and Folders (2000) for comprehensive overviews of MERCOSUR.

SECTION 2

Application of the Diamond Physical Space

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CHAPTER 7

Openness Growth Monitoring Model (OGM-Model)

By Mario Arturo Ruiz Estrada and Su Fei Yap*

7.1 Openness or Trade Liberalization Measure Literature Review

The last past 25 years, many economists have tried to build alternative indicators to measure openness or trade orientation. It is important to mention that these different indicators have significant contribution in the study of openness until today. Usually, a major part of this type of work applied cross-country comparative studies to explain the link between openness and growth, productivity or income distribution. These indicators are trade dependency ratios and rate of growth exports (Balassa, 1985); the heritage foundation index (Edwards,1998.a.); Sachs and Warner Openness Index (1995); Leamer's Openness Index (Barro,1991); Trade Liberalization Index (Lopez,1990); Average Coverage of NTB –QR- (Edwards, 1998.b.); black market premium (Harrison,1996); Index of real exchange rate variability and index of real exchange rate distortion (Dollar, 1992).

After discussing the different indices, the next step is to present a new model. It is entitled "Openness Growth Monitoring Model (OGM-Model)". This OGM-Model will study the link between openness growth and income growth. It incorporates a comparison of two growth rates (openness and income). The OGM-Model offers to policy makers and researchers a new set of indicators to measure openness vulnerability, harmonization of openness and openness/income sensibility analysis.

Sebastian Edwards (1997) presented an interesting paper entitled "Trade Policy, Growth and Income Distribution." This paper applied different trade policy indices (e.g. Deviation from Actual Trade Shares; Trade Liberalization Index; Sachs and Warner Openness Index; QR; Deviation of the black market rate; black market exchange rate premium and real exchange distortions and variation) and the coefficient of GINI to prove the link between openness and income distribution. Edwards concluded that there is no evidence linking openness or trade liberalization to increases in inequality. In the case of the OM-Model, it

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is concludes that there exists evidence that openness and income have a link but only in the case of U.S.

There are differences between the methodology applied by Sebastian Edwards (1997) and the OM-Model. Edwards used different trade policy indices and income distribution (GINI coefficient) to prove the link between openness and income, but the OM-Model uses the openness growth rate and income growth rate to prove the relationship between openness and income from a different angle. Our method of analysis will show different and new types of indicators and methodology to analyze openness and income as opposed to the traditional indices in the study of trade policy.

7.2 The Openness Growth Monitoring System (OGM-Model)

The Openness Growth Monitoring System (OGM-Model) is a new analytical model for studying the impact of openness growth on the income growth in any country or region. Its application is not constrained with respect to the income level stage of the relevant country or region, regardless of whether it is a high, middle and low income level. This model applies new types of indicators to show the evolution, sensitivity and harmonization of Openness Growth, as well as, the effect of Openness Growth on the Income Growth in any type of country. It is generally a simple and flexible model.

There are two general objectives for the proposal of the Openness Growth Monitoring Model (OGM-Model): (i) to quantify and analyze openness growth; (ii) to measure the impact of Average Openness Growth rate ($\Delta\bar{O}$) on Income Growth rate (ΔY) in a specific period of time (in the short term). The OGM-Model will test prove the following a general hypothesis:

1. High openness growth does not necessarily generate income growth in any country in the short term
2. The Customs Union Scheme performs better than Free Trade Areas scheme in terms of income growth

The OGM-Model is based on a series of steps/elements in its application to study the Openness Growth and Income Growth:

(i) Degree of Openness by Production Sectors (O_i)
(ii) Average Openness rate ($\bar{O}$)
(iii) Average Openness Growth rate ($\Delta\bar{O}$)
(iv) Harmonization of Openness Growth rate (HO)
(v) Income Growth rate (ΔY)
(vi) Openness Growth Diamond Diagram
(vii) The openness diamond graph
(viii) Openness/Income Growth Rate (O:Y) Sensitivity Analysis (See Diagram 1).

Steps to Apply OM-Model

Step-1: Measurement of Degree of Openness by Production Sectors (O_i)

The Degree of Openness by Production Sectors (O_i) will present the degree of Openness in four different production sectors, namely agriculture, manufacturing, energy (fuel) and services sectors. This indicator can also show the comparative degree of

Openness of different production sectors (e.g. more Openness in agriculture sector than the manufacturing sector). The first step in the application of the OM-Model is to measure the Degree of Openness by Production Sectors (O_i) (See Diagram 10). The O_i is equal to the sum of real Exports (Xi_{-FOB}) by production sectors and the real Imports (Mi_{-CIF}) by production sectors divided by the real Gross Domestic Product value (GDP_{-real}) (see Expression 1).

(1) $\sum_{i=1}^{4} O_i$ = (Xi-$_{FOB}$ constant prices by production sector + Mi-$_{CIF}$ constant prices by production sector) / real GDP)

Degree of Openness in the Agriculture Sector (O_a)

$$(1.1) \quad O_a = (X_{a\text{-}real} + M_{a\text{-}real}) / GDP_{-real}$$

Degree of Openness in the Manufacturing Sector (Om)

$$(1.2) \quad O_m = (X_{m\text{-}real} + M_{m\text{-}real}) / GDP_{-real}$$

Degree of Openness in the Energy (Fuel) Sector (O_e)

$$(1.3) \quad O_e = (X_{e\text{-}real} + M_{e\text{-}real}) / GDP_{-real}$$

Degree of Openness in the Service Sector (O_s)

$$(1.4) \quad O_s = (X_{s\text{-}real} + M_{s\text{-}real}) / GDP_{-real}$$

<u>Analysis of Oi Rate Results</u>

The results of ΔOi reflect two possible scenarios:
(i) If ΔOi is positive (+) or high, then the country has open economy
(ii) If ΔOi is negative (-) or low, then the country has closed economy

Step-2: Measurement of Average Openness Rate ($\bar{O}$)

The $\bar{O}$ is equal to the sum of the Degree of Openness ($\sum Oi$) of all the production sectors divided by four (i.e. number of production sectors under analysis) (see Expression 3).

$$(3) \qquad \bar{O} = \sum(O_a + O_m + O_e + O_s)/4$$

Step-3: Measurement of Openness Growth Rate ($\Delta\bar{O}$)

The $\Delta\bar{O}$ is equal to the average openness rate in a given period ($\bar{O}'$) minus the average openness rate of the previous period ($\bar{O}_o$) divided by the average openness rate of the previous period ($\bar{O}_o$) (see Expression 5).

$$(5) \qquad \Delta \bar{A}O = \frac{(\bar{O}') - (\bar{O}_o)}{(\bar{O}_o)}$$

Analysis of $\Delta\bar{O}$ Results

(i) If $\Delta\bar{O}$ Rate is high, then the country experiences strong Openness Growth
(ii) If $\Delta\bar{O}$ Rate is low, then the country experiences weak Openness Growth

Step-4: Measurement of Harmonization of Openness (HO)

HO is equal to the maximum degree of by production sector minus the minimum degree of openness by production sector in the same year divided by the average openness ($\bar{O}$) (See Expression 4). This indicator also shows the trend of the liberalization process of any country from a general perspective. HO is useful in the making of policies that help to improve the harmonization of openness in all production sectors (see Diagram 1).

$$(4) \qquad HO_i = (O_{i\text{-}Max}) - (O_{i\text{-}Min}) / (\bar{O})$$
$$i = 1,2,3,4$$

Analysis of HO Results

(i) If HO is equal to 3, then its Openness Growth is proportional
: Proportional indicates a good openness in all sectors of productions.
(ii) If HO is equal to 2, then its Openness Growth is acceptable
: Acceptable indicates a good performance, but no harmony to open all sectors in the same level.
(iii) If HO is equal to 1, then its Openness Growth is non-proportional.
: Non-proportional is indicates a non-balance in the openness of the different sectors of production among all sectors.

The analysis of HO Rate can provide a general idea about the orientation of the trade policy in the trade liberalization process of any economy.

Step-5: Measurement of the Income Growth Rate (ΔY)

The ΔY is equal to the Per-capita GNI in a given period ($\Delta Y'$) minus the Per-capita GNI of the previous period (ΔY_o) divided by the Per-capita GNI of the previous period (ΔY_o) (See Expression 5). The per-capita GNI (Y) income level is based on the World Bank data classification. They are high income[1], middle income[2] and low income[3] under World Bank classification (2005).

$$(5) \qquad \Delta Y = \frac{(\Delta Y') - (\Delta Y_o)}{(\Delta Y_o)}$$

Analysis of ΔY Rate Results

The results of ΔY reflect two possible scenarios:
(i) If ▲ΔY, then there is growth in income
(ii) If ▼ΔY, then income level remains unchanged

Step-6: Plotting of Openness Diamond Graph

The Openness Diamond Graph (see Diagram 1) presents a general idea about the current global development of trade liberalization based on a new concept of graphic representation (see Figure 1). This new concept of graphic representation consists of six axes, each of which has a positive value. In the case of this research, the value in four of the axes is represented by the Degree of Openness by Production Sectors (O_i) (Agriculture Sector, Industrial Sector, Energy Sector, and Services Sector). These O_i indexes are independent variables (see Figure 1). They can be joined together to create a general area. This general area is called "Area of Coverage of Openness–ACO-". This area shows the dimension of Openness from a general perspective. For comparison purposes, ACO can be applied to different years for one country or two countries. The analysis of the ACO is based on the comparison of two periods or regions. In the case of this research paper, two periods (i.e. first period and second period) are compared. The total ACO may present three possible scenarios, namely:

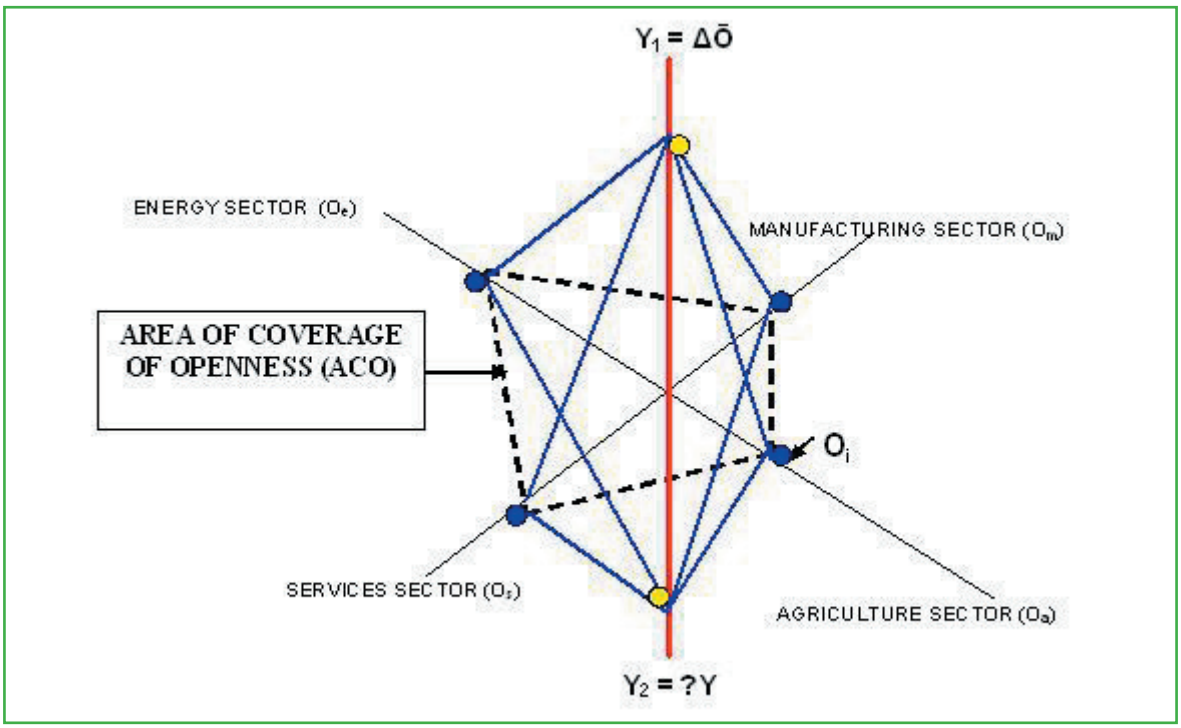
(a) Expansion (ACO' first period < ACO" second period)

(b) Stagnation (ACO' first period = ACO" second period)

(c) Contraction (ACO' first period > ACO" second period).

The fifth and sixth axes are represented by the dependent variables Y_1 ($\Delta\bar{O}$) and Y_2 (ΔY). They are positioned in the center of the graph which is the meeting point of the other four axes

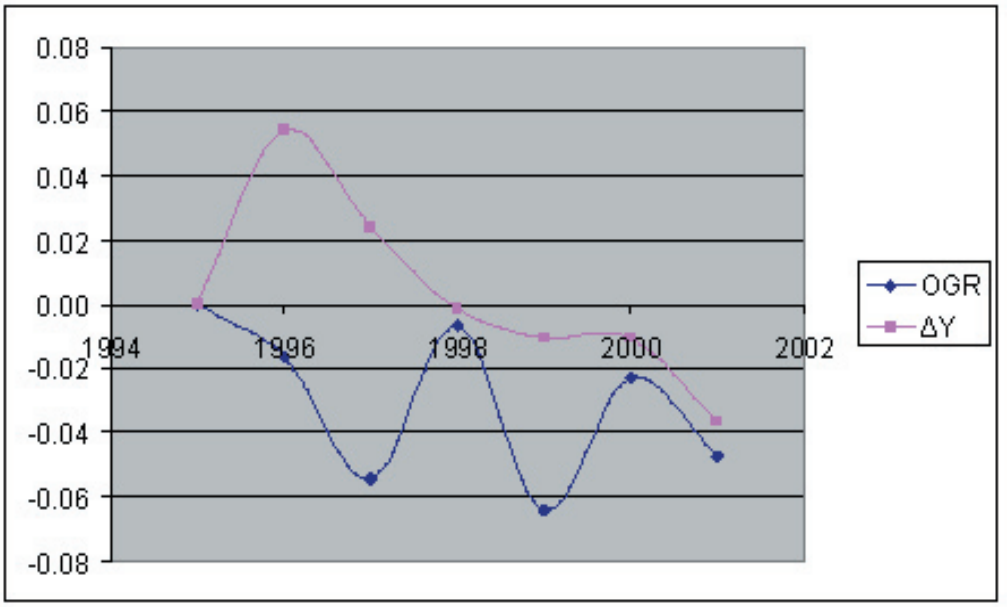
FIGURE 1
The Openness Diamond Graph



Step-7: Creation of Openness/Income Growth Rate (O:Y) Chart

Based on all the results of Average Openness Growth Rate ($\Delta\bar{O}$) and Income Growth Rate (ΔY) obtained from step-3 and step-5 respectively, a chart showing the trends of both openness growth and income growth is drawn. This chart serves the purposes in the next step (step-8). The (O:Y) chart compares the trend of the Average Openness Growth Rate ($\Delta\bar{O}$) with the trend of the Income Growth Rate (ΔY) (see Figure 2).

FIGURE 2
Openness/Income Growth Rate (O:Y) Chart (Fictitious data)



Step-8: Measurement of the Openness/Income Growth Rate (O:Y) Sensitivity Analysis

This Indicator measures how sensitive an economy is under constant changes in its openness growth (see Diagram 1). Specifically, it measures the relationship between the Average Openness Growth rate ($\Delta\bar{O}$) and the Income Growth rate (ΔY). Hence, it can be used to test if Openness Growth influences Income Growth in the country under study. It simultaneously compares the trend of Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY) trends by the years for the same country or between different countries.
The Openness/Income Growth Rate (O:Y) Sensitivity Analysis compares the trend of Openness Growth and the Income Growth (see Expression 6) based on the Openness/Income Growth Rate (O:Y) Chart (see Figure 2).

(6) Openness/Income Growth Sensitivity Analysis Rate (O:Y) = $\Delta\bar{O} : \Delta Y$

Results of (O:Y) Sensitivity Analysis

The (O:Y) Sensitivity Analysis reflects several possible scenarios:

(i) If ▲$\Delta\bar{O}$: ▲ΔY then income has high sensitivity to openness

(ii) If ▼ $\Delta\bar{O}$: ▼ΔY then income has high sensitivity to openness

(iii) If ▲ $\Delta\bar{O}$: ▼ΔY then income has low sensitivity to openness

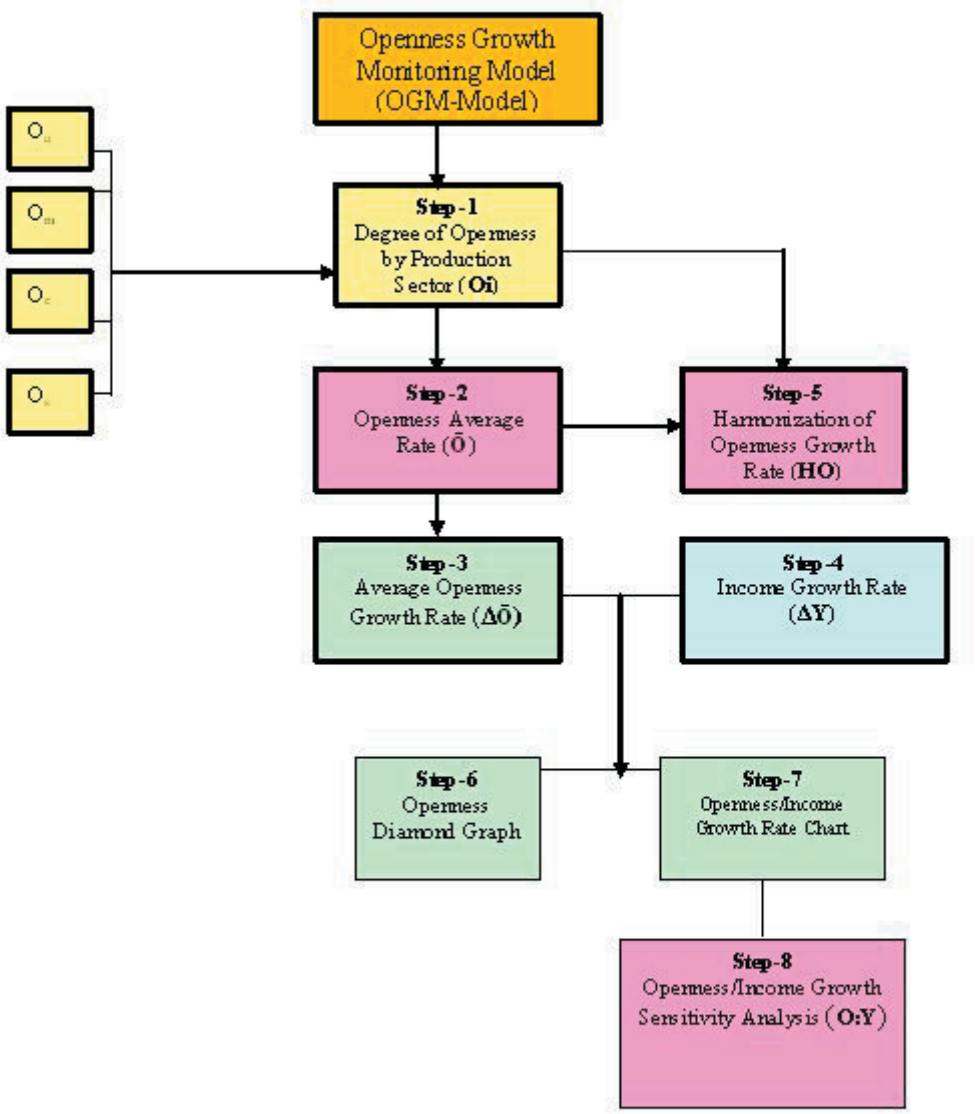
(iv) If ▼ $\Delta\bar{O}$: ▲ΔY then income has low sensitivity to openness

($\Delta\bar{O}$) : Average Openness Growth Rate ▲ : Increase

(ΔY) : Income Growth Rate ▼: Decrease

DIAGRAM 1

Steps to apply Openness Growth Monitoring System (OGM-Model)



7.3 Application of OGM-Model and Findings

For the research in this chapter, the OGM-Model (see annex) was applied to 38 different countries in seven different trading blocs between 1995 and 2001 (see Table 1). This period of time was chosen because the general objective of OGM-Model is to observe the link between the Average Openness Growth rate and Income Growth rate in the short term in this specific period of time. In the case to apply OGM-Model on regional integration to compare Free Trade Area (FTA) and Custom Union (CU) scheme, we assume that both schemes of regional integration schemes are used in different regions around the world, perhaps both scheme of regional integration did not start in the same period, but both schemes have something in common, they examine the trade liberalization in different ways.

7.4 Findings Pertaining to Correlation between Openness Growth and Income Growth

The results of the correlation between Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY) among 38 countries (equal to 100% of cases) classified into low income, middle income and high income countries. They show in the majority of high income countries, that is, 85% of cases (United States, Canada, Japan and Europe Union) and few number of middle income countries, that is 22% of cases (Argentina, Uruguay, Costa Rica, Panama), Income Growth was highly dependent on Openness Growth between 1995 and 2001 (see Table 1). For the rest of the countries in the analysis, there was no correlation between Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY) shows that a few high income countries 15% of cases (Australia, Singapore, New Zealand), a large number of middle and low income countries (around 78% of cases between 1995 and 2001). Even countries such as Singapore (see Table 1), El Salvador (See Table 1) and Chile (See Table 1), whose levels of Openness Growth were high, it did not show any correlation between Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY). These results suggest that, for some middle income countries and for all low income countries. Openness Growth cannot generate Income Growth in the short term.

In terms of the Degree of Openness by Production Sectors (O_i), it is observed that for U.S.A., Openness in the agriculture (O_a) and energy (O_e) sectors was low in the period 1995-2001. Such low level of Openness can be attributed to the high level of trade protectionism in the form of non-tariff barriers that the U.S.A. government imposed on foreign trading partners. The U.S.A., however, showed high a level of Openness in the manufacturing (O_m) and services (O_s) sectors during the same period. The low performance of the (HO) of U.S. is originates from the high protectionism of the agriculture and energy sectors (see Tables 1 and Figure 3).

It can be observed that Singapore (see Table 1) had a negative Average Openness Growth rate ($\Delta\bar{O}$) between 1995 and 2001. The reason for this negative value in the Average Openness Growth rate ($\Delta\bar{O}$) of Singapore, it is the possibility of different proportions in the growth between openness and income growth rates, in the case of countries with high level of openness. However, during this period, Singapore saw negative values in the income growth rate (ΔY). The same situation, high level of Openness Growth but low level of Income Growth is observed in the cases of middle income countries (e.g. Malaysia, Chile, Mexico, Brazil and Indonesia) and low income countries (e.g. Nicaragua and Indonesia).

The Application of the OGM-Model to most high income countries (e.g. European Union, Japan, Australia and Canada) shows that these countries had high levels of Openness in the manufacturing and energy sectors. It is understood that their agriculture and services sectors were under high levels of trade protectionism, compared to middle and low income level countries. During the same period, middle income countries (e.g. Malaysia, Thailand, Mexico, Brazil and Chile) presented different results of Openness by production sector from those of high income countries. In middle income countries, the agriculture and energy sectors had high level of Openness (O_i), but the manufacturing and services sectors maintain a high level of trade protectionism. These countries saw an increasing Average Openness Growth rate ($\Delta\bar{O}$) but proportional growth across production sectors in their Harmonization of Openness Growth rate (HO). Among middle income countries, none showed a correlation between Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY).

In low income countries (Nicaragua and Indonesia) between 1995 and 2001, the agriculture sector was under a high level of trade protectionism, but the manufacturing, energy and services sectors (see Figure 6) presented a higher level of Openness (O_i) compared to high and middle income countries (see Figures 4 and 5). On the other hand, both their Average Openness Growth Rate ($\Delta\bar{O}$) and Harmonization of Openness Growth Rate (HO) appeared to be low. The low level of $\Delta\bar{O}$ and ΔY in low income countries were due to a low level of participation in world trade on the part of these countries. Amongst low income countries none showed a correlation between Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY) in its economy between 1995 and 2001.

7.5. Findings pertaining to Regional Integration

The results between Average Openness Growth rate ($\Delta\bar{O}$) and Income Growth rate (ΔY) in Table 16 provide a means for comparing the performance of the Customs Unions and the Free Trade Area in terms of Average Openness Growth rate ($\Delta\bar{O}$). The results provide a good indication of whether Average Openness Growth rate ($\Delta\bar{O}$) under a certain regional integration scheme generates desirable Income Growth rate (ΔY) which determine the success of the scheme.

The application of the OGM-Model to the European Union (EU) under the Customs Union (CU) Scheme reveals an Average Openness Growth rate ($\Delta\bar{O}$) of -2 and a positive Income Growth Rate (ΔY) of 7. For the Free Trade Area (FTA) Scheme, North America Free Trade Areas (NAFTA) recorded an Openness Growth rate of 1 -- the highest among all trade blocs under the same scheme, and an Income Growth Rate of 4. These two results show that NAFTA had a higher level of Average Openness Growth rate ($\Delta\bar{O}$) but a lower level of Income Growth rate (ΔY) compared to the EU. In other words, the results indicate that FTA cannot yield as much Income Growth rate (ΔY) as CU even with their higher level of Average Openness Growth rate ($\Delta\bar{O}$).

The rest of the trading blocs analyzed were the Association of South East Nations (ASEAN), the Australia-New Zealand Free Trade Area (ANZFTA), the MERCOSUR and the Central America Common Market (CACM), all of which are under the FTA scheme. ASEAN had the highest Average Openness Growth rate ($\Delta\bar{O}$) of 4 and negative Income Growth rate (ΔY) of -3. ANZFTA, with its Income Growth rate (ΔY) of –0.4, showed the same high Openness Growth rate ($\Delta\bar{O}$) of 4 as that of ASEAN. MERCOSUR's Income

Growth Rate (ΔY) was as low as -1. However, it had the second highest level of Average Openness Growth Rate ($\Delta\bar{O}$) among all trading blocs analyzed: an Average Openness Growth rate ($\Delta\bar{O}$) of 3 (see Table 1). In contrast to the results obtained for EU (under the Customs Union scheme), the results for ASEAN, ANZFTA, MERCOSUR and CACM (under the FTA) constitute yet another ground for the claim in this thesis that the Customs Union scheme can generate more income growth than the FTA scheme. Equally important, all the above results testify the viability of the OGM-Model as an alternative analytical tool to analyze regional integration.

FIGURE 3
Ths Openness Growth Diamod Diagram of U.S.A.

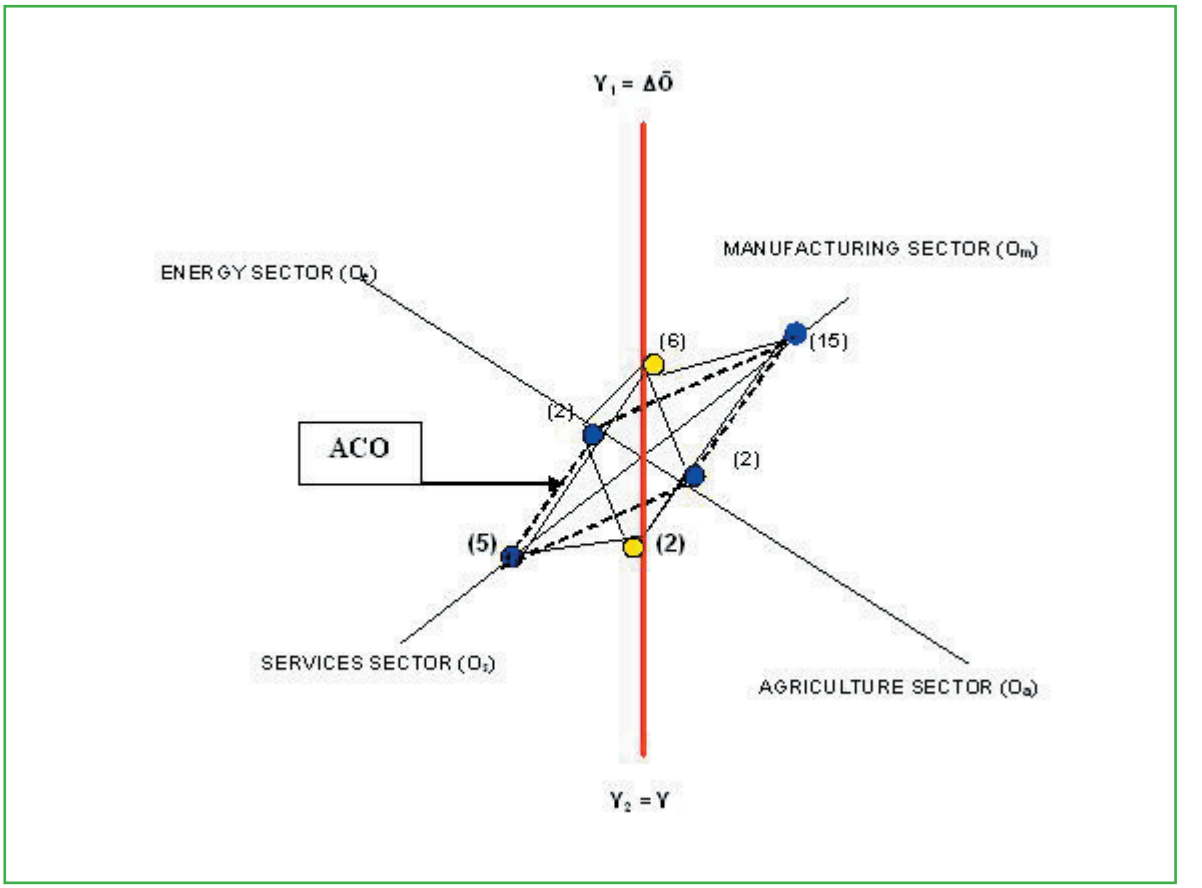


FIGURE 4
The Openness Growth Diamond Diagram for High Income Countries

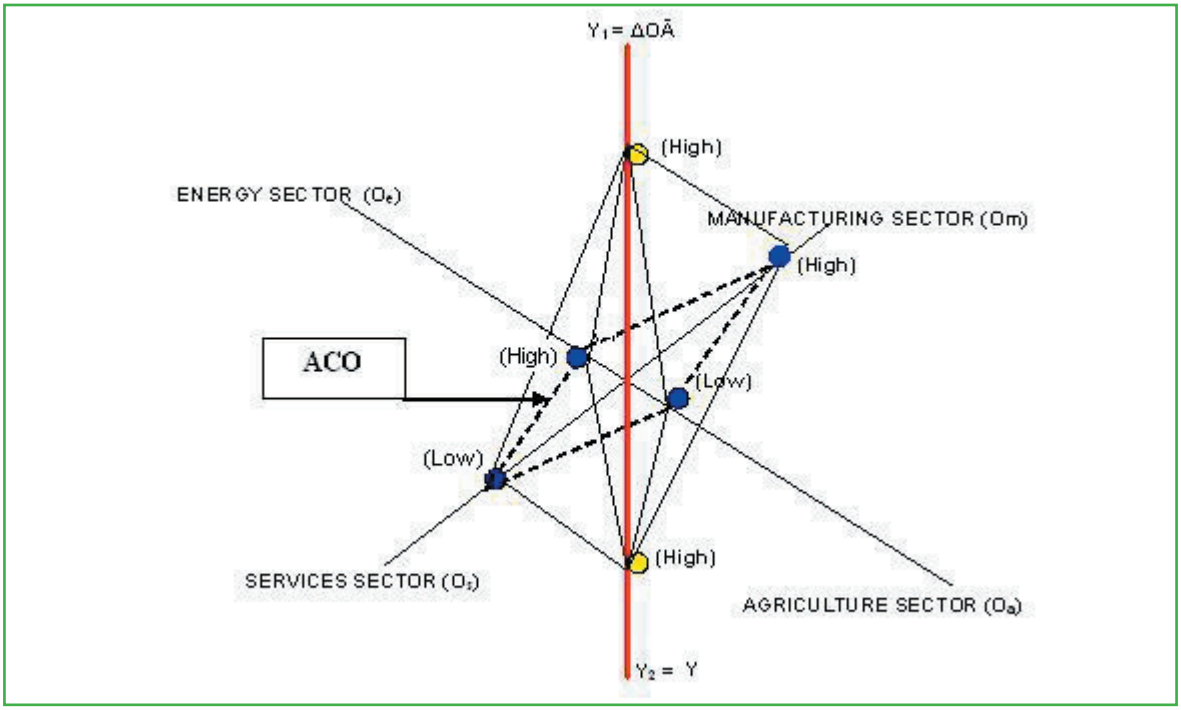


FIGURE 5
The Openness Growth Diamond Diagram for Middle Income Countries

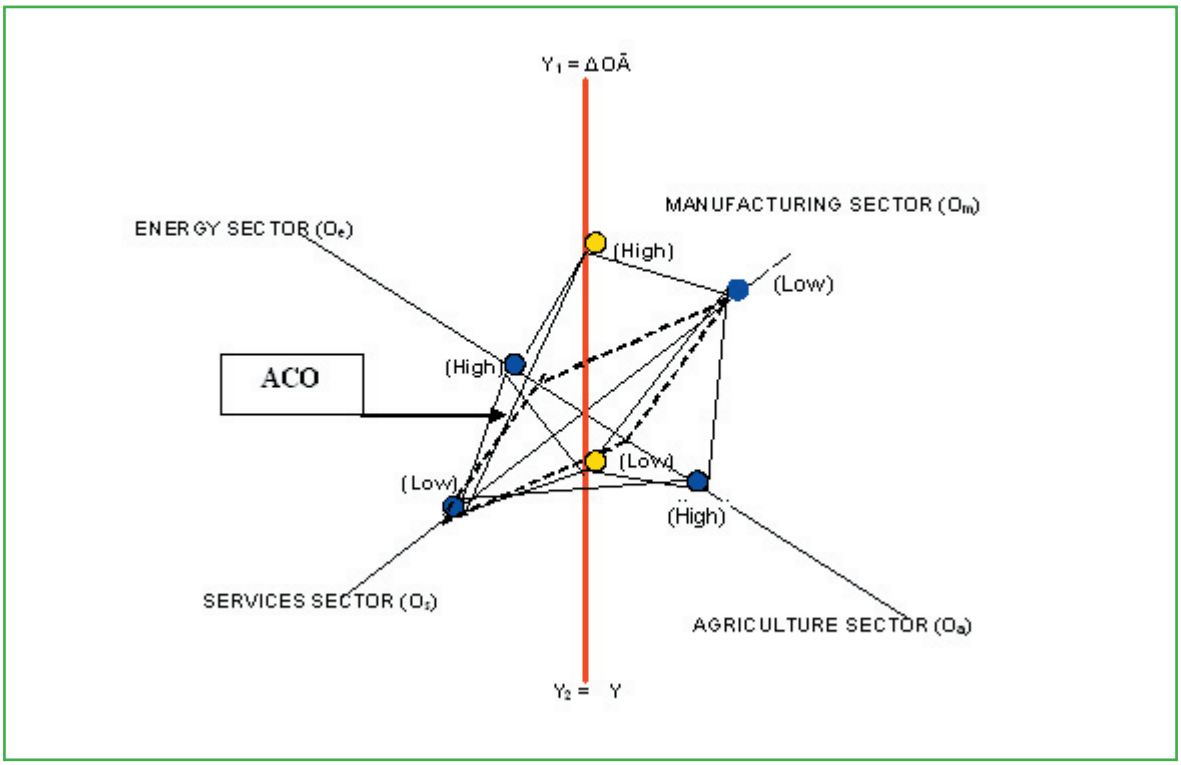


FIGURE 6
The Openness Growth Diamond Diagram for Low Income Countries

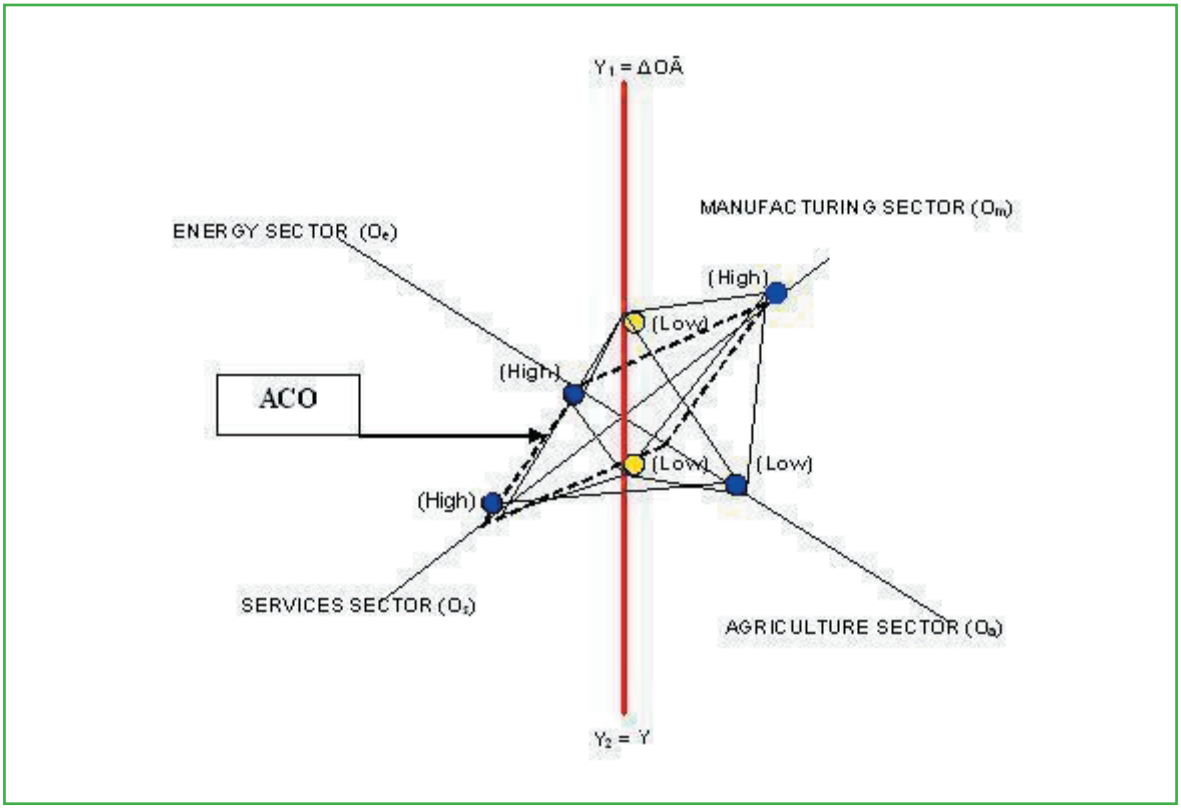


TABLE 1
Regional Blocs ΔŌ, ΔY and HO

No.	ASEAN	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
1.	INDONESIA	7	-4	1	-0,42	Low
2.	MALAYSIA	2	-3	3	-0,64	Middle
3.	PHILIPINESS	8	0,2	2	-0,64	Middle
4.	SINGAPORE	-1	-0,8	3	-0,08	High
5.	THAILAND	6	-5	2	-0,04	Middle
	Regional ΔŌ, ΔY and HO	4	-3	2		
	East-Asia	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
6.	JAPAN	3	-2	2	0,48	High
7.	CHINA	2	10	3	-0,35	Middle
8.	HONG-KONG	-1	2	3	0,37	High
	NAFTA	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
9.	CANADA	2	2	2	0,16	High
10.	MEXICO	-0,8	7	3	-0,23	Middle
11.	USA	0,4	3	2	0,81	High
	Regional ΔO, ΔY and HO	1	4	2		
	CACM	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
12.	COSTA RICA	3	4	1	0,14	Middle
13.	EL SALVADOR	3	4	3	-0,03	Middle
14.	GUATEMALA	1	3	2	-0,28	Middle
15.	HONDURAS	-1	6	1	-0,39	Middle
16.	NICARAGUA	1	2	1	0	Low
17.	PANAMA	-1	2	1	0,04	Middle
	Regional ΔŌ, ΔY and HO	1	4	2		
	MERCOSUR	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
18.	ARGENTINA	2	-1	2	0,90	Middle
19.	BRAZIL	10	-2	2	-0,77	Middle
20.	PARAGUAY	-0,1	-4	1	-0,77	Middle
21.	URUGUAY	-0,5	2	1	0,3	Middle
	Regional ΔŌ, ΔY and HO	3	-1	2		
	Rest of South America	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
22.	CHILE	1	2	2	-0,14	Middle
	ANZFTA	ΔŌ	ΔY	HO		INCOME LEVEL
23	AUSTRALIA	4	0,3	2	-0,42	High
24	NEW ZEALAND	3	-1	1	-0,60	High
	Regional ΔŌ, ΔY and HO	1	0,1	2		
	EU	ΔŌ	ΔY	HO	Correl	INCOME LEVEL
25.	AUSTRIA	-4	-2	1	0,82	High
26.	BELGIUM	-1	-1	2	0,20	High
27.	DENMARK	5	1	1	0,25	High
28.	FINLAND	5	2	2	0,28	High
29.	FRANCE	2	1	2	0,35	High
30.	GERMANY	2	3	2	0,17	High
31.	GREECE	4	1	1	-0,27	High
32.	HOLLAND	3	1	2	0,45	High
33.	IRLAND	0,2	6	2	0,15	High
34.	ITALY	4	0,3	2	0,24	High
35.	PORTUGAL	4	2	2	0,18	High
36.	SPAIN	3	0,03	2	0,23	High
37.	SWEDEN	2	0,2	3	0,10	High
38.	UK	2	5	2	0,53	High
	Regional ΔŌ, ΔY and HO	-2	7	2		
	ΔŌ: Average Openness Growth Rate			HO: Harmonization of Openness		
	ΔY : Income Growth Rate			Correl: ΔŌ and ΔY		

Source: 2003 World Development Indicators CD-Rom, World Bank

7.6. Concluding Remarks

The chapter seven concludes through the Openness Growth Monitoring Model (OGM-Model) that growth in Openness does not necessarily generate income growth. As show in the research in this thesis, between 1995 and 2001 only high income countries saw a strong link between openness growth and income growth. In the same model, the application of the OG-Model in this thesis shows that between the free trade areas (FTA's) scheme and the Custom Union (CU) scheme is a better regionalism scheme for integrating middle and low income countries. These results can help policy makers and researchers of trade issues to visualize the trends of trade liberalization and trade policy in any country or trade block.

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Notes

[1] "High-income country is a country having an annual gross national product (GNP) per capita equivalent to $9,361 or greater in 1998. Most high-income countries have an industrial economy. There are currently about 29 high-income countries in the world with populations of one million people or more. Their combined population is about 0.9 billion, less than one-sixth of the world's population. In 2003, the cutoff for high-income countries was adjusted to $9,206 or more".

[2] "Middle-income country is a country having an annual gross national product (GNP) per capita equivalent to more than $760 but less than $9,360 in 1998. The standard of living is higher than in low-income countries, and people have access to more goods and services, but many people still cannot meet their basic needs. In 2003, the cutoff for middle-income countries was adjusted to more than $745, but less than $9,206. At that time, there were about 65 middle-income countries with populations of one million or more. Their combined population was approximately 2.7 billion".

[3] "Low-income country is a country having an annual gross national product (GNP) per capita equivalent to $760 or less in 1998. The standard of living is lower in these countries; there are few goods and services; and many people cannot meet their basic needs. In 2003, the cutoff for low-income countries was adjusted to $745 or less. At that time, there were about 61 low-income countries with a combined population of about 2.5 billion people".

SECTION 3

Application of the 5-Dimensional Physical Space

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CHAPTER 8

The Gross Domestic Product Surface: (GDP-Surface)

8.1 Introduction to the Gross Domestic Product Surface: (GDP-Surface)

The construction of the GDP surface is based on the application of the MD-Cartesian space (Ruiz, 2005). The GDP-Surface is based on the uses of the national income growth rate "ΔY" (dependent variable) and the four independent variables, there are consumption growth rate"ΔX_1", investments growth rate "ΔX_2", government growth rate "ΔX_3" and net trade growth rate "(X-M) = ΔX_4" respectively in the expressions below. For demonstration purposes, the following data are used: consumption growth rate (ΔX_1); investment growth rate (ΔX_2); government growth rate (ΔX_3); net trade growth rate (ΔX_4) and the national income growth rate (ΔY) of United States from 1928 to 2004 (Bureau of Economic Analysis U.S. Department of Commerce, 2005). Steps involved in the construction of GDP surface are as follows. The general function of the GDP surface is equal to

$$\Delta Y = f\,(\Delta X_1, \Delta X_2, \Delta X_3, \Delta X_4) \tag{1.}$$

To measure each growth rate is follow by

$$\Delta X_1 = [(X_{1\text{-Final period}}) - (X_{1\text{-Initial period}}) / (X_{1\text{-Final period}})] \times 100\% \tag{2.1.}$$

$$\Delta X_2 = [(X_{2\text{-Final period}}) - (X_{2\text{-Initial period}}) / (X_{2\text{-Final period}})] \times 100\% \tag{2.2.}$$

$$\Delta X_3 = [(X_{3\text{-Final period}}) - (X_{3\text{-Initial period}}) / (X_{3\text{-Final period}})] \times 100\% \tag{2.3.}$$

$$\Delta X_4 = [(X_{4\text{-Final period}}) - (X_{4\text{-Initial period}}) / (X_{4\text{-Final period}})] \times 100\% \tag{2.4.}$$

$$\Delta Y = [(Y_{\text{Final period}}) - (Y_{\text{Initial period}}) / (Y_{\text{Final period}})] \times 100\% \tag{2.5.}$$

The GDP Surface suggests the application of four vectors to show the magnitude and direction of each ΔXi (i = 1, 2, 3, 4) to build the platform of the surface on the bottom of the multi-dimensional Cartesian space.

We have four initial vectors in the ground of the Cartesian space represented by $\ell_1, \ell_2, \ell_3, \ell_4$ (See Figure 1).

(3.1.) $\overrightarrow{\ell_1 = \Delta X_1 \Delta X_2}$

(3.2.) $\overrightarrow{\ell_2 = \Delta X_2 \Delta X_3}$

(3.3.) $\overrightarrow{\ell_2 = \Delta X_3 \Delta X_4}$

(3.4.) $\overrightarrow{\ell_4 = \Delta X_4 \Delta X_1}$

Next step is to find the vectors to join ΔX_1, ΔX_2, ΔX_3, ΔX_4 with ΔY respectively to build the main structure of the GDP surface (See Figure 2).

(4.1.) $\overrightarrow{\ell_5 = \Delta X_1 \Delta Y}$

(4.2.) $\overrightarrow{\ell_6 = \Delta X_2 \Delta Y}$

(4.3.) $\overrightarrow{\ell_7 = \Delta X_3 \Delta Y}$

(4.4.) $\overrightarrow{\ell_8 = \Delta X_4 \Delta Y}$

FIGURE 1
GDP Surface Platform

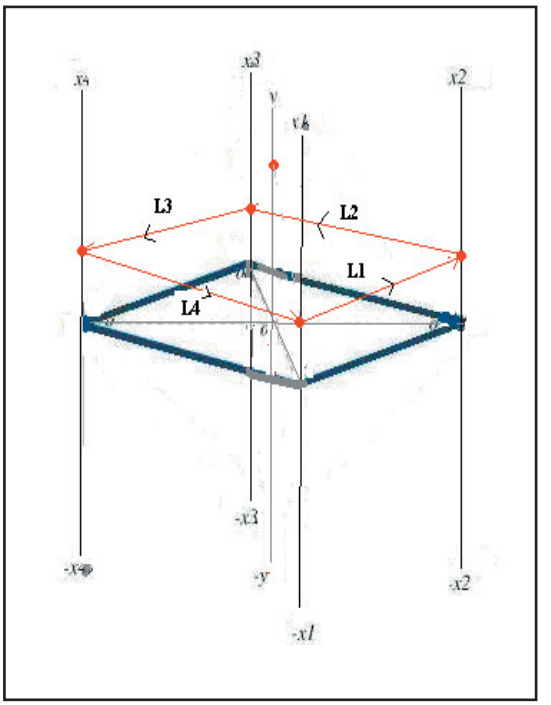
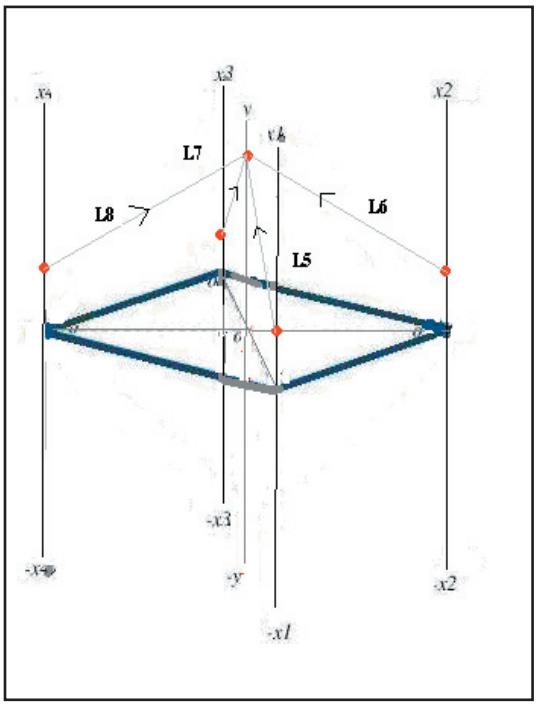


FIGURE 2
Main Structure of the GDP Surface



Finally, the GDP-surface is the sum of all vectors from vector ℓ_1 until vector ℓ_8 (See Figure 3).

$$\textbf{(5.)} \quad \textbf{GDP surface} = \vec{\ell}_1 + \vec{\ell}_2 + \vec{\ell}_3 + \vec{\ell}_4 + \vec{\ell}_5 + \vec{\ell}_6 + \vec{\ell}_7 + \vec{\ell}_8$$

The results of the GDP surface reflect three possible levels:

Level 1: Stable Macroeconomic Performance

The GDP Surface is located in the positive quadrant in the Multi-dimensional Cartesian Space. The stable macroeconomic performance all values are positive in the general function of the GDP surface (See Figure 4).

$$+\Delta Y = f\ (+\Delta x_1, +\Delta x_2, +\Delta x_3, +\Delta x_4)$$

FIGURE 3
GDP Surface

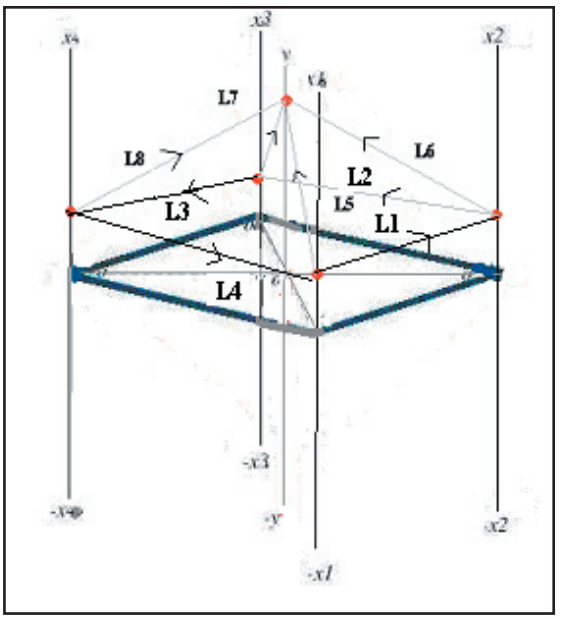
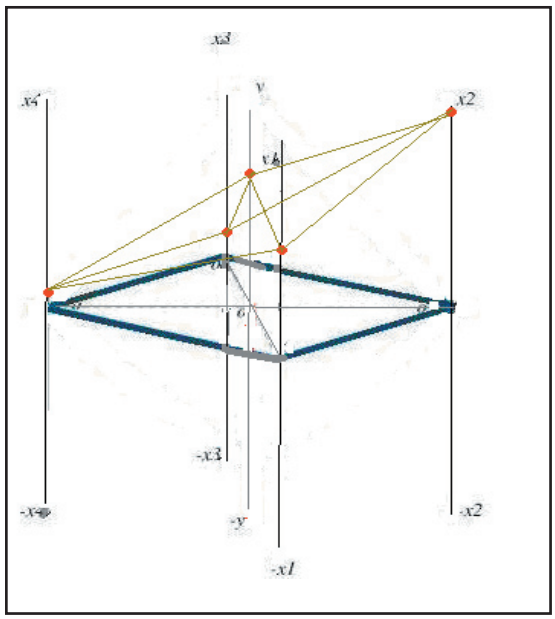


FIGURE 4
GDP SUrface under Stable Macroecoomic Performance



Level 2: Unstable Macroeconomic Performance

The GDP Surface is hovers between the positive and negative quadrant in the Multi-dimensional Cartesian Space. The unstable macroeconomic performance all values can be positive or negative in the general function of the GDP surface (See Figure 5)

$$+/-\Delta Y = f\ (+/-\Delta x_1, +/-\Delta x_2, +/-\Delta x_3, +/-\Delta x_4)$$

FIGURE 5
GDP Surface under
Unstable Macroeconomic Performance

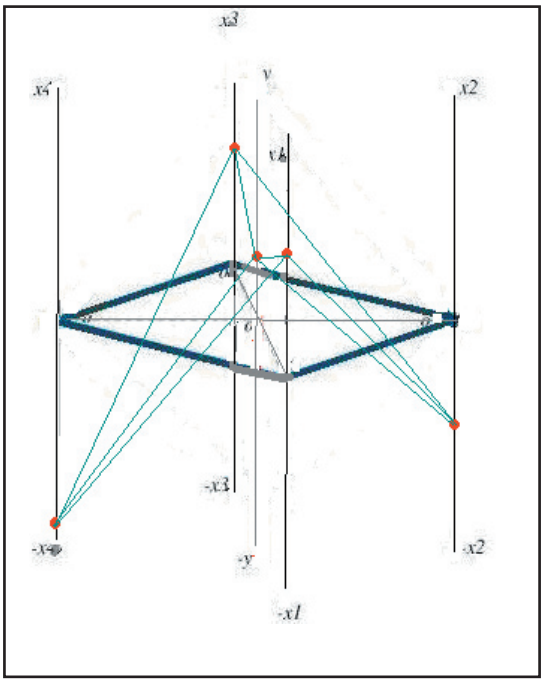
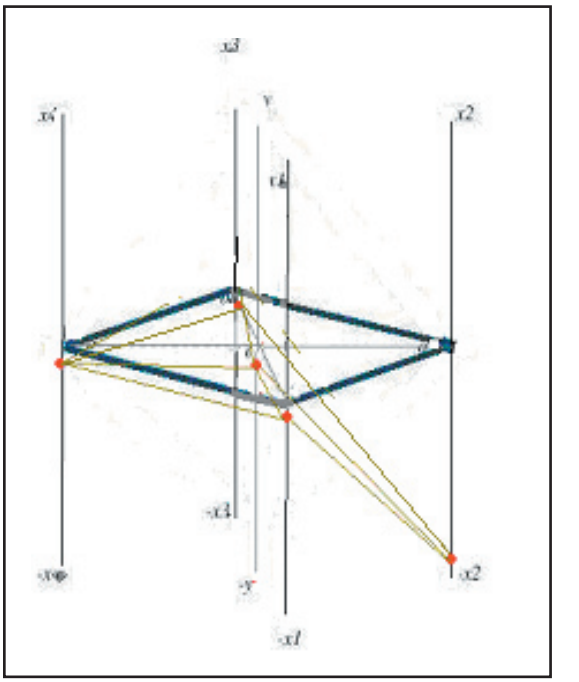


FIGURE 6
GDP Surface under Unstable
Macroeconomic Performance



Level 3: Poor Macroeconomic Performance

The GDP Surface is located in the negative quadrant or equal to 0 in the Multi-dimensional Cartesian Space. The poor macroeconomic performance all values are negative or equal to 0 in the general function of the GDP surface (See Figure 6).

:

$$-\Delta Y = f\ (-\Delta x_1\ ,\ -\Delta x_2\ ,\ -\Delta x_3,\ -\Delta x_4) \text{ or } 0 = f\ (0,\ 0,\ 0,\ 0)$$

8.2 GDP-Surface: U.S. GDP Historical Trend from 1928 until 2004

The GDP surface shows how the national income growth rate "ΔY" is affected by the four independent variables, there are consumption growth rate"ΔX_1", investments growth rate "ΔX_2", government growth rate "ΔX_3" and net trade growth rate "(X-M) = ΔX_4" simultaneously. All variables are moving along with their respective axes simultaneously on the same Cartesian space. The GDP surface can show how Consumption growth rate (ΔX_1), Investment growth rate (ΔX_2), Government growth rate (ΔX_3), Net Trade growth rate (ΔX_4) and the national income growth rate (ΔY) of United States (U.S.) are moving in different directions simultaneously into the same Cartesian Space, if we observe the U.S. GDP surface period by period (from 1928 to 2004) (Bureau of Economic Analysis U.S. Department of Commerce, 2005) , the GDP surface shows different displacements into the MD-Cartesian Space.

Between 1928 and 2004, the U.S. GDP surfaces in the Level 1 or stable macroeconomic performance are located in forty periods, there are 1933/34, 1934/35, 1935/36, 1936/37, 1938/39, 1939/40, 1940/41, 1942/43, 1947/48, 1950/51, 1954/55, 1955/56, 1958/59, 1959/60,

1960/61, 1962/63, 1963/64, 1967/68, 1968/69, 1969/70, 1970/71, 1971/72, 1972/73, 1973/74, 1974/75, 1975/76, 1976/77, 1977/78, 1981/1982, 1982/1983, 1983/1984, 1984/85, 1985/86, 1986/87, 1991/1992, 1992/1993, 1993/1994, 1995/96, 1996/97 and 1998/1999 (See Figure 7).

The level 1 or stable macroeconomic performance is characterized by the positive results in all four broad categories of spending ($\Delta X_1, \Delta X_2, \Delta X_3, \Delta X_4$) and the national income growth rate (ΔY).

The U.S. GDP surfaces in the Level 2 or unstable macroeconomic performance are located in forty periods, there are 1928/29, 1929/30, 1930/31, 1931/32, 1932/1933, 1937/38, 1941/42, 1942/43, 1943/44, 1944/45, 1945/46, 1946/47, 1947/48, 1948/49, 1949/50, 1951/52, 1952/53, 1953/54, 1956/57, 1957/58, 1961/62, 1964/65, 1965/66, 1966/67, 1967/68, 1978/79, 1979/80, 1980/81, 1982/83, 1987/88, 1988/89, 1989/90, 1990/91, 1994/95, 1997/98, 1999/2000, 2000/01, 2001/02, 2002/03 and 2003/04 (See Figure 7). In this study shows that level 2 or unstable macroeconomic performance is characterized by non proportional results, comprise both positive and negative growth rate values. The GDP Surfaces in level 2 or unstable macroeconomic performance shows positive values almost in all national income growth rates "ΔY" results.

FIGURE 7:
United States GDP Surface from 1928 to 2004

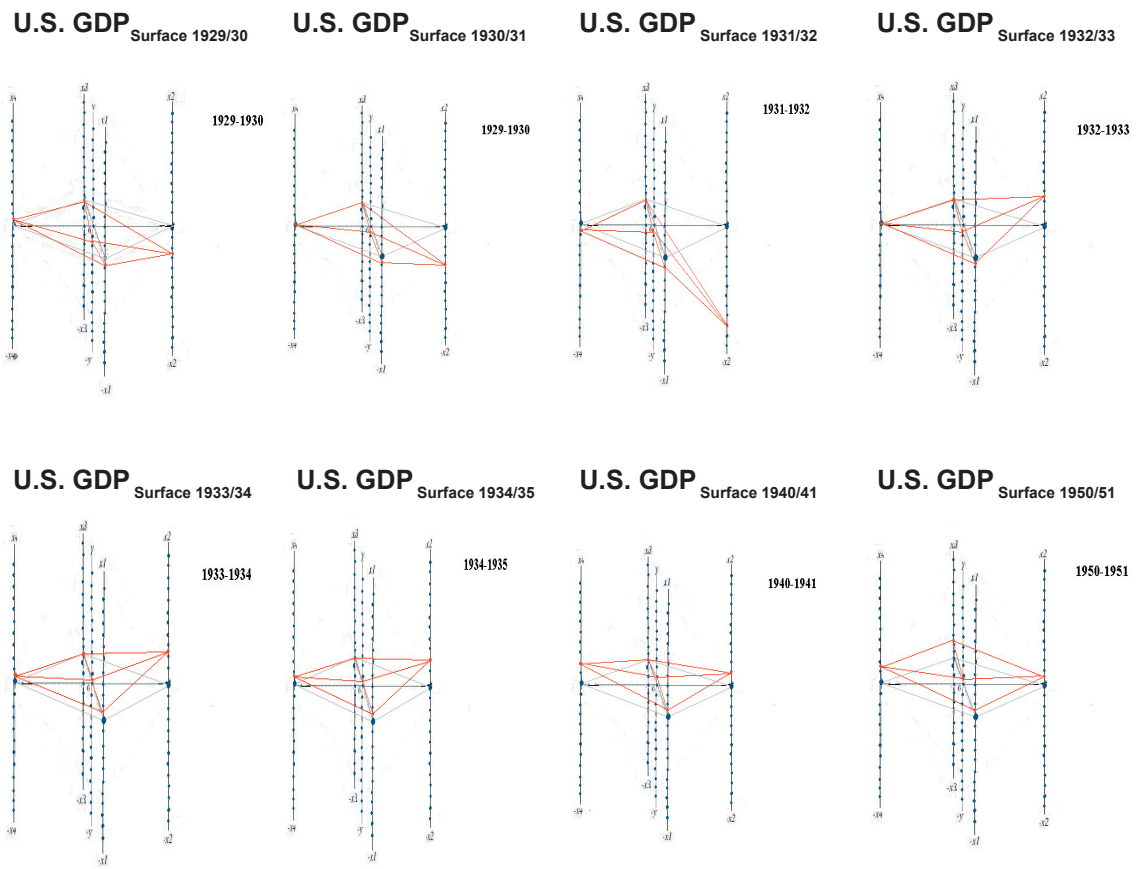
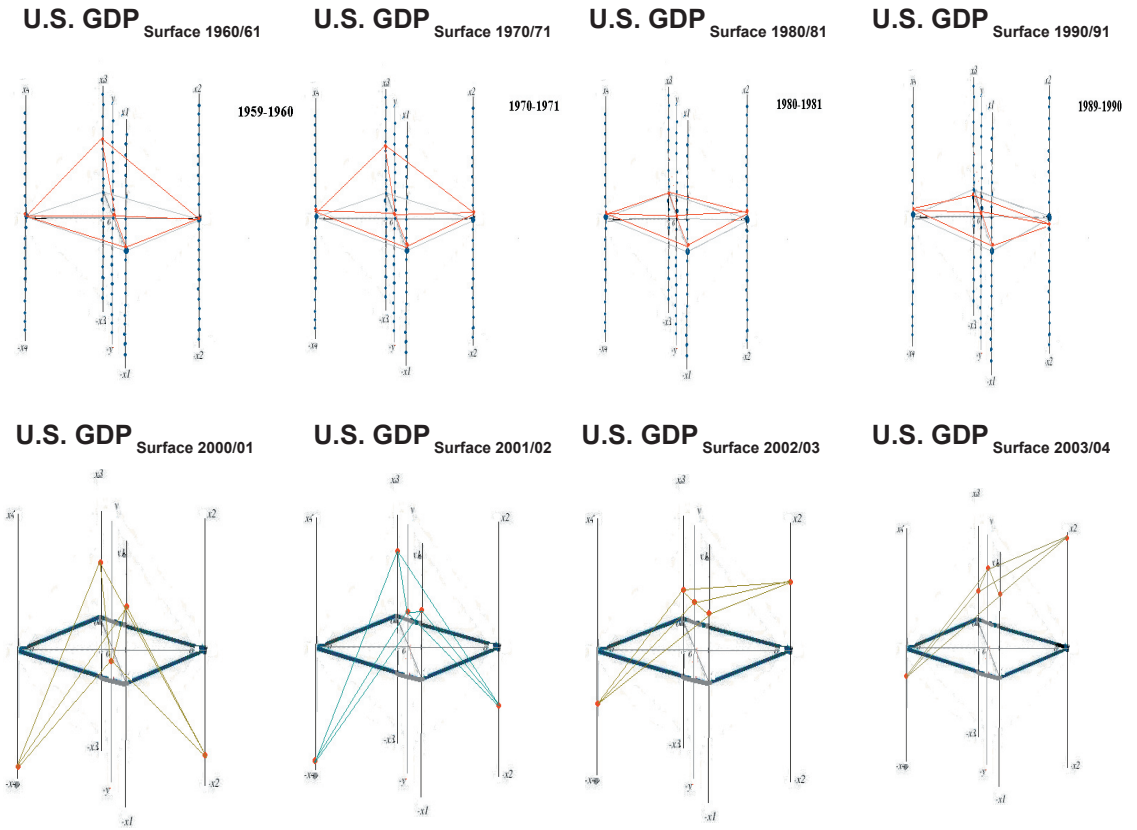


FIGURE 7 *(Continued)*



Source: Bureau of Economic Analysis U.S. Department of Commerce (2005)

Therefore, the unstable macroeconomic performance does not necessarily generate a negative impact on the national income growth rate "ΔY" in the long run. If we generate a successive slide show based on the use of each GDP surface period by period then we can observe how the GDP surface maintains a constant movement in the same MD-Cartesian Space. It is possible to observe a multi-dimensional and dynamic view of the GDP Historical trend of United States in constant movement.

8.3. Concluding Remarks

The advantage of using MD-Cartesian Space is based on large and constant storage of data and dynamic visualization of any economic phenomenon. The Multi-Dimension Cartesian Space (MD-Cartesian Space) is a different analytical tool compared to the conventional 2-D and 3-D Cartesian planes. The MD-Cartesian Space shows the global context of any economic phenomena; Hence it allows for Macro-Microeconomics focus of analysis in economics. It is an efficient analytical tool to explain complex economic phenomena from a multi-dimensional view. It is obvious that the MD-Cartesian Space in this paper is a better tool to visualize the correlation between many independent variables (X_1, X_2, X_3 … ∞) and dependent variable (Y). As such, the MD-Cartesian Space provides a good alternative basis to design new types of graphs in economics.

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SECTION 4
Application of the Infinity Physical Space

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CHAPTER 9

Beyond the *Ceteris Paribus* Assumption: Modelling Demand and Supply Assuming *Omnia Mobilis*

By Mario Arturo Ruiz Estrada, Su Fei Yap* and Shyamala Nagaraj**

9.1 Introduction

The *ceteris paribus* assumption can be considered a vital tool in the process of building economic models to explain complex economic phenomenon. This assumption translated from Latin means "all other things [being] the same". It facilitates the description of how a variable of interest changes in response to changes in other variables by examining the effect of one variable at a time. An extremely important contribution of Alfred Marshall, it supports the understanding of the application of *ceteris paribus* assumption in economic models. According to Marshall (1890):

> **"**The element of time is a chief cause of those difficulties in economic investigations which make it necessary for man with his limited powers to go step by step; breaking up a complex question, studying one bit at a time, and at last combining his partial solutions into a more or less complete solution of the whole riddle. In breaking it up, he segregates those disturbing causes, whose wanderings happen to be inconvenient, for the time in a pound called *Ceteris Paribus*. The study of some group of tendencies is isolated by the assumption *other things being equal:* the existence of other tendencies is not denied, but their disturbing effect is neglected for a time. The more the issue is thus narrowed, the more exactly can it be handled: but also the less closely does it correspond to real life. Each exact and firm handling of a narrow issue, however, helps towards treating broader issues, in which that narrow issue is contained, more exactly than would otherwise have been possible."

Marshall's approach thus allows the analyses of complex economic phenomena by parts where each part of the economic model can be joined to generate an approximation of the

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real world. This approach can be termed the Isolation Approach and according to Marshall (Schlicht, 1985) originates from two possible Isolation clauses. First the *ceteris paribus* assumption allows some variables to be considered unimportant. This clause is called Substantive Isolation. Substantive Isolation considers that some unimportant variables cannot significantly affect the final result of the economic model. Second, the *ceteris paribus* assumption allows the influence of some important factors to be disregarded. The application of the *ceteris paribus* assumption in this case is purely hypothetical; therefore the second clause is called Hypothetical Isolation. It allows parts of the model to be managed more easily.

In other words, to explain a complex economic phenomenon, the *ceteris paribus* approach considers the effect partially of each variable in a set of n variables (termed usually independent variables, X_j , j = 1, 2, . . ., n) upon a variable of interest (usually termed the dependent variable, Y). From a mathematical point of view, the *ceteris paribus* assumption in an economic model is equivalent to the partial derivative, which explains how one independent variable, say X_k, in a set of independent variables can affect the dependent variable Y while the other independent variables are being held constant. From a graphical point of view, the *ceteris paribus* assumption supports the elaboration of scenarios that can be visualized on 2-Dimensional (X,Y) space. More precisely if Y is a function of, say, X_1 and X_2, the (partial) relationship between Y and X_1 can be visualized in the 2-D space describing Y and X_1, assuming X_2 is held constant. In order to approximate real world, Marshall (1890) goes on to propose that "With each step more things can be let out of the pound; exact discussions can be made less abstract, realistic discussions can be made less inexact than was possible at an earlier stage." The real-world scenario is thus approximated by the cumulative effect of the partial effects of the X variables on Y.

With the availability of multi-dimensional graphs based on the application of Cartesian Spaces (Ruiz, 2007), it is possible to visualize what we call the Omnia Mobilis (everything is moving) assumption. The Cartesian space is used to generate is used to generate multi-dimensional-graphs with different dimensions that can be shown to move with time. But more than that, the multi-dimensional graph provides an alternative to the Marshall view of step-by-step cumulative partial approach to modeling a complex economic phenomenon.

In this paper we are concerned with the application of multi-dimensional graphs in visualizing and modeling total change in an independent in response to changes in any or all of the (many) independent variables affecting it within the same framework of space and time. The multidimensional-graph can also be used to describe dynamic and multi-functional analyses that represent changes within the total function of an economic variable. The next section discusses the application of multi-dimensional graphs to model demand and supply. The third section concludes the paper.

9.2 Visualizing and Modeling Demand and Supply Surfaces

Concerning the graphical methods for modeling demand and supply, it is necessary to mention the significant contributions of Antoine Augustin Cournot. Cournot (1897) derived the first formula for the rule of supply and demand as a function of price. He was also the first economist to draw supply and demand curves on a graph (2-Dimensional view). Cournot believed that economists should utilize graphs only to establish probable limits and express

less stable facts in more absolute terms. He further held that the practical use of mathematics in economics involves not only strict numerical precision, but also graphical visualization. Besides Cournot, other innovative economists who contributed to the analytical graph system in economic models over time were William Stanley Jevons, Marie-Esprit-Léon Walras, Vilfredo Pareto, Alfred Marshall and Francis Ysidro Edgeworth (McClelland, 1976).

In this section, we describe the application of multi-dimensional graphs to the analysis of demand and supply. The supply and demand model determines the quantity sold in the market. The usual model predicts that in a competitive market, price will function to equalize the quantity demanded by consumers and the quantity supplied by producers, resulting in an economic equilibrium of quantity. The application of multi-dimensional graphs allows the visualization and modeling of the effect of other variables on quantity demanded and supplied. With this application, the quantity sold in the market will equal quantity demanded and quantity supplied only under certain circumstances. In other cases, the quantity sold in the market will be a balance between the demand and supply quantities.

The application of the Infinity Cartesian Space (I-Cartesian Space) (Ruiz, 2006) is used to obtain demand and supply surfaces that replace the usual 2-Dimensional (and 3-Dimensional) demand and supply lines. The general function to build demand and supply cylinders is given below by:

$$Y_{C:L} = f_C([X_{C:L:j}, P_{C:L:j}, R_{C:L:j}], j = 1, \ldots, m_C)$$

Where:

$C = \{1, 2\}$ is the Cylinder, C = 1 for the demand cylinder and C = 2 for the supply cylinder

$L = \{1, 2, 3, \ldots, n\}$, $n \rightarrow \infty$, is the Level

m_C , $m_C \rightarrow \infty$, is the number of independent variables in cylinder C

$X_{C:L:j}$ is the independent variable j in cylinder C at level L lying in position $P_{C:L:j}$ with value $R_{C:L:j}$;

$P_{C:L:j}$, $0^\circ \leq P_{C:L:j} < 360^\circ$, is the position of $X_{C:L:j}$ in cyclinder C at level L;

$R_{C:L:j}$ is the radius corresponding to the $X_{C:L:j}$ in cylinder C at level L

$Y_{C:L}$ is the dependent variable, quantity demanded (C=1) and quantity supplied (C=2) at level L

Assumptions

1. Application of *Omnia Mobilis* assumption.
2. The set of independent variables affecting demand are not necessarily the same as that for supply; however price is common to both sets.
3. The set of independent variables for demand and for supply are available for the same number of levels, that is, "n". Usually the level represents time.
4. The unit of measurements of all variables is the same. For example, all variables can be measured in terms of growth.
5. Price is the independent variable $X_{C:L:1}$, located at position $P_{C:L:1} = 1^\circ$ in both cylinders and for all levels. Since price in the demand cylinder must equal price in the supply cylinder, the radius $R_{1:L:1} = R_{2:L:1}$

Definitions

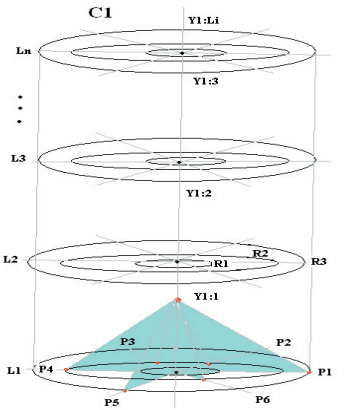
1. The Balance Line, BL_L, is the line that joins $Y_{1:L}$ and $Y_{2:L}$ at level L.
2. The Balance Point is a point on BL_L that indicates the quantity sold at level L.
3. The Balance Quantity Line (BQL) is the vertical line that connects all the Balance Points, L = 1, …, n. It forms the hinge between the demand and supply cylinders and at each level L and in each cylinder it is located at $P_{C:L:0} = 0^{\circ}$.

The Demand Cylinder

As seen from Figure 1, the demand cylinder is a series of n sub-cylinders, one for each level. For a given sub-cylinder, say for L=1, the values of the m_1 independent variables $X_{1:L:j}$ affecting demand $Y_{1:L}$ are plotted on the base of the sub-cylinder as the radii. The value of a specific independent variable at time point 1, say $X_{1:1:1}$ is plotted as $R_{1:1:1}$ the radius pictured lying on a flat surface at angle $P_{1:1:1}$ measured from 1° line used for price as its reference line. The points from the end of the radii are joined to meet in a single point on the top of each sub-cylinder at height $Y_{1:1}$, the quantity demanded at time L. The diameter of the sub-cylinder is twice the maximum radius. The demand function is expressed as:

$$Y_{1:L} = f_1([X_{1:L:j}, P_{1:L:j}, R_{1:L:j}], j = 1, \ldots, m_1)$$

FIGURE 1
Demand Cylinder



The Supply Cylinder

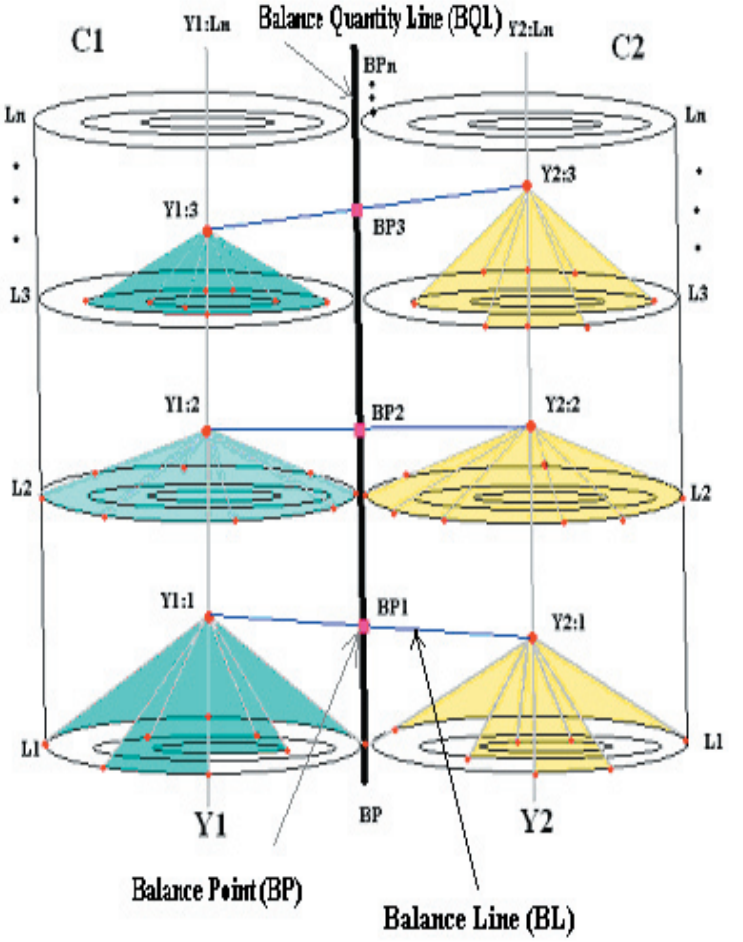
Similarly, the supply cylinder is a series of n sub-cylinders, one for each level. For a given sub-cylinder, say for L=1, the values of the m_2 independent variables $X_{2:L:j}$ affecting demand $Y_{2:L}$ are plotted on the base of the sub-cylinder as the radii. The value of a specific independent variable at time point 1, say $X_{2:1:1}$ is plotted as $R_{2:1:1}$ the radius pictured lying on a flat surface at angle $P_{2:1:1}$ measured from 1° line used for price as its reference line. The points from the end of the radii are joined to meet in a single point on the top of each sub-cylinder at height$Y_{2:1}$, quantity supplied at time L. The diameter of the sub-cylinder is twice the maximum radius. The supply function is expressed as

$$Y_{2:L} = f_2([X_{2:L:j}, P_{2:L:j}, R_{2:L:j}], j = 1, \ldots, m_2)$$

The Demand and Supply Surfaces

The demand and supply surfaces are placed side by side as shown in Figure 2, the sub-cylinder for level L for demand being adjacent to the sub-cylinder for level L for supply. The maximum height of the sub-cylinders at level L will be the maximum of $Y_{1:L}$ and $Y_{2:L}$. The demand and supply surfaces are then two oblique cylinders consisting of sub-cylinders of varying diameters. The two cylinders are hinged on a common line located at position $P_{C:L:0} = 0^{\circ}$. This common line is called the Balance Quantity Line (BQL) and connects all the Balance Points which show the quantities sold in the market at all the different levels.

FIGURE 2
Demand and Supply Cylinders



The Balance Line, Balance Point and Changes in Demand and Supply

The balance line, BL_l, is the line that connects $Y_{1:L}$ and $Y_{2:L}$ in sub-cylinder L. This line may be linear as shown in Figure 3 or non-linear. The quantity sold in the market lies somewhere on this line given by the Balance Point, BP_L. The quantity sold is thus viewed as a "balance" between demand and supply quantities. Thus,

$$BP_L = g(Y_{1:L}, Y_{2:L})$$

In other words, the quantity sold in the market is a function not only of the common price but also of all the factors that affect supply and demand. This suggests that demand and supply quantities can remain in disequilibrium at time L.

Example

If we assume that BL_L is a straight line, then its slope is given by

$$S_L = \left| Y_{1:L} - Y_{2:L} \right| / \left| \max_j \{R_{1:L:j}\} + \max_j \{R_{1:L:j}\} \right|$$

As demand or supply changes from one level to the next, the slope of the line will change. The Balance Point, however, may or may not change as that depends on the joint effect of all variables that affect quantity. In order to understand the Balance Line, it is useful to consider three scenarios:

Scenario 1: Only one independent variable, price; demand equals supply
Scenario 2: More than one independent variable; demand equals supply
Scenario 3: More than one independent variable; demand does not equal supply

Figure 3 shows the demand and supply surfaces for each of these scenarios for levels L=1, 2 and 3 with assumed data.

Scenario 1

In this case, the two cylinders will be of same diameter and will be straight cylinders, that is, the mid-points of the cross-sectional circles will be on the same line. Quantity demanded equals quantity supplied, and the quantity sold in the market is the equilibrium quantity under the *ceteris paribus* assumption. With $Y_{1:1} = Y_{2:1}$, $S_L = 0$. The Balance Line is thus a horizontal line (See figure 3).

The demand and supply functions are

$$Y_{1:1} = f_1([X_{1:1:1}, P_{1:1:1,} R_{1:1:1}]) \qquad Y_{2:1} = f_2([X_{2:1:1}, P_{2:1:1,} R_{2:1:1}])$$

The graph for level L=1 is:

Demand Cylinder

$Y_{1:1} = 4$
$R_{1:1:1} = 3$ (price)

Supply Cylinder

$Y_{2:1} = 4$
$R_{2:1:1} = 3$ (price)

The slope of the Balance Line is

$$S_L = (4-4)/(3+3) = 0/9 = 0$$

The Balance Point showing the quantity sold in the market at level 1 is

$$BP_{1=} Y_{1:1} = Y_{2:1} = 4$$

Scenario 2

Since $Y_{1:2} = Y_{2:2}$, the slope of the Balance Line will be zero and quantity demanded equals quantity supplied and the quantity sold in the market equals the equilibrium quantity under the *ceteris paribus* assumption. In this situation, the quantity sold under the *omnia mobilis* assumption does not differ from that under the *ceteris paribus* assumption. That is, the other variables besides price have the same effect as price on the quantity supplied or demanded (see figure 3).

The demand and supply functions are

$$Y_{1:2} = f_1([X_{1:2:j}, P_{1:2:j}, R_{1:2:j}], j = 1, \ldots, 9) \qquad Y_{2:2} = f_2(X_{2:2:j}, P_{2:2:j}, R_{2:2:j}], j = 1, \ldots, 9)$$

The graph for level L=2 is:

Demand Cylinder	Supply Cylinder
$Y_{1:2} = 5$	$Y_{2:2} = 5$
$R_{1:2:1} = 5$ (price)	$R_{2:2:1} = 5$ (price)
$R_{1:2:2} = 5$	$R_{2:2:2} = 5$
$R_{1:2:3} = 5$	$R_{2:2:3} = 5$
$R_{1:2:4} = 5$	$R_{2:2:4} = 5$
$R_{1:2:5} = 5$	$R_{2:2:5} = 5$
$R_{1:2:6} = 5$	$R_{2:2:6} = 5$
$R_{1:2:7} = 5$	$R_{2:2:7} = 5$
$R_{1:2:8} = 5$	$R_{2:2:8} = 5$
$R_{1:2:9} = 5$	$R_{2:2:9} = 5$

The slope of the Balance Line is

$$S_L = (5-5)/(5+5) = 0/10 = 0$$

The Balance Point showing the quantity sold in the market at level 2 is

$$BP_2 = Y_{1:2} = Y_{2:2} = 5$$

Scenario 3

Finally consider Scenario 3, where $Y_{1:3} \neq Y_{2:3}$. In this case, the diameters of each sub-cylinder for the two cylinders would be different; the cylinders become oblique. Then the Balance Line will slope down towards the sub-cylinder with the lower quantity. The quantity sold will be shown by the Balance Point, a point on this line determined by all the independent variables in both the demand and supply cylinders. In this situation, the quantity sold under the *omnia mobilis* assumption differs from that under the *ceteris paribus* assumption (see Figure 3).

The demand and supply functions are

$$Y_{1:L} = f_1([X_{1:3:j}, P_{1:3:j}, R_{1:3:j}], j = 1, \ldots, 9) \qquad Y_{2:L} = f_2(X_{2:3:j}, P_{2:3:j}, R_{2:3:j}], j = 1, \ldots, 9)$$

The graph for level L=3 is:

Demand Cylinder	Supply Cylinder
$Y_{1:3} = 5$	$Y_{2:3} = 4$
$X_{1:3:1} = 5$ (price)	$X_{2:3:1} = 5$ (price)
$X_{1:3:2} = 3$	$X_{2:3:2} = 4$
$X_{1:3:3} = 5$	$X_{2:3:3} = 2$
$X_{1:3:4} = 5$	$X_{2:3:4} = 4$
$X_{1:3:5} = 6$	$X_{2:3:5} = 4$
$X_{1:3:6} = 3$	$X_{2:3:6} = 4$
$X_{1:3:7} = 5$	$X_{2:3:7} = 5$
$X_{1:3:8} = 5$	$X_{2:3:8} = 6$
$X_{1:3:9} = 6$	$X_{2:3:9} = 5$

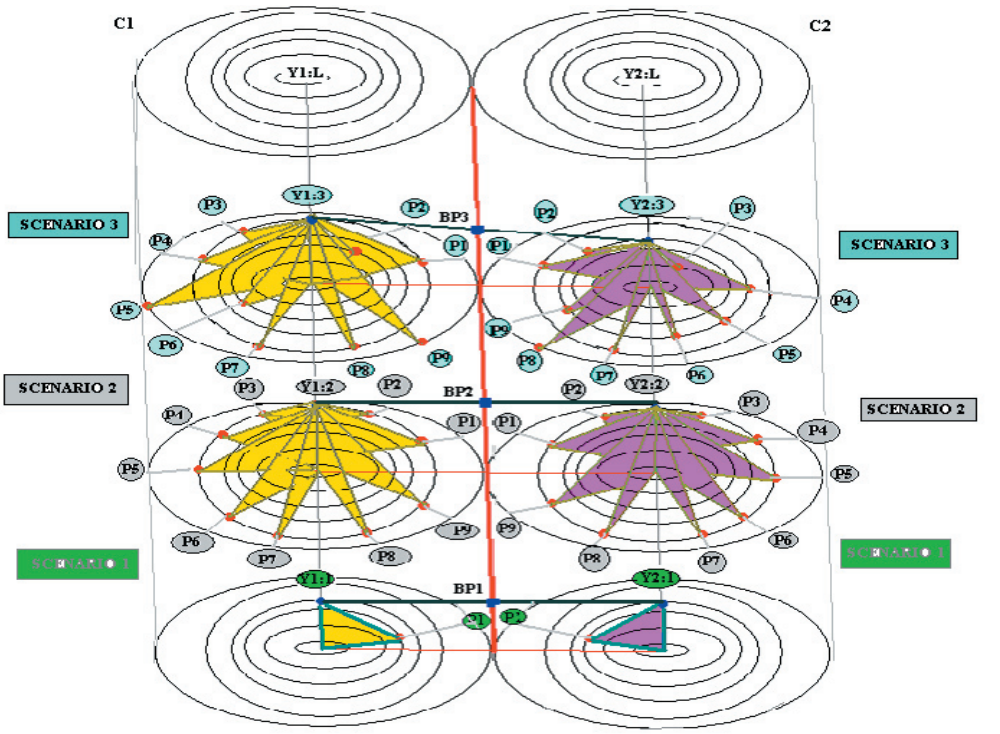
The slope of the Balance Line is

$$S_L = (5-4)/(6+6) = 1/12$$

The Balance Point showing the quantity sold in the market at level 3 will lie between 4 and 5.

$$BP_3 \neq Y_{1:3} = 5 \text{ and } BP_3 \neq Y_{2:3} = 4$$

FIGURE 3
Demand and Supply Surfaces Application



9.3 Concluding Remarks

The use of the *ceteris paribus* assumption is linked to the type of graphs used such as 2-Dimensional and conventional 3-Dimensional graphs. The multi-dimensional graph goes beyond the traditional approach to allow the visualization of the *omnia mobilis* (everything is moving) assumption and further provides an alternative to modeling total change in a dependent variable. In order to demonstrate the applicability of multi-dimensional graphs we have used it in the context of demand and supply. The approach shows that quantity sold in the market is not necessarily equal to the quantity demanded or supplied when the effect of independent variables other than just price is taken into account. Quantity demanded and supplied are mostly in disequilibrium and the quantity sold is a joint function of all the independent variables that affect supply and demand.

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CHAPTER 10

Demand and Supply Surfaces

10.1 Introduction

For many centuries many economists have opportunity to use different graphical methods to explain different economics phenomenon based on the application of 2-Dimensional or so far 3-Dimensional Cartesian Planes. This is a case in which the analytical graph system is used in economics, where the form of the graph gives an idea of the possible class of the functions describing the relationship between X and Y variables. As far as the application of the analytical graphical method in economics is concerned, it is necessary to mention the major contribution of Antoine Augustin Cournot. Cournot (1838) derived the first formula for the rule of Demand and Supply as a function of price. He was also the first economist to draw the Demand and Supply curves on a graph (2-Dimensional view). Cournot believed that economists should utilize graphs only to establish probable limits and express less stable facts in more absolute terms. He further held that the practical use of mathematics in economics involves not only strict numerical precision, but also graphical visualization. Besides Cournot and Jevons, other innovative economists who contributed to the analytical graph system in economics over time were Leon Walras, Vilfredo Pareto, Alfred Marshall and Francis Ysidro Edgeworth (McClelland, 1975).

In our case, this paper is interested to apply a new graphical method is called Econographicology (Ruiz, 2007). The rationale of Econographicology revolves around the efficacy of multi-dimensional (MD) graphs in the storage of meta-database and the visualization of multi-variable data behavior based on the application of Cartesian spaces (or MD Cartesian coordinate system). The main idea is to use some of the MD Cartesian coordinate system that Econographicology offer. The Cartesian Space will be used is called "Infinity Cartesian Space (I-Cartesian Space)" (Ruiz, 2006). The I-Cartesian Space will be applied in the construction of the Demand and Supply surfaces.

10.2 The Demand and Supply Surfaces

10.2.1 Introduction

In our optical conceptualization of Demand and Supply curves by 2-Dimensional view is continue using by economist until our days, in the case of the demand curve shows the inverse relationship between prices and quantity demanded for any good or service can be represented on a simple graph, this graph can show the relationship between price and quantity-demanded is inverse according to the Law of Demand (people buy more, when its prices falls), it can be observed on the downward slope effect. In the case of Supply Curve showing amounts of a good or service that producers are willing and able to make available for sale at each of a series of possible prices during a specific period of time. In the case of the Supply curve can show the relationship between prices and quantity-demanded is

proportional according to the Law of Supply (sellers produce more, when its prices rise), it can be observed on the upward slope effect (McConnell and Brue, 2002).

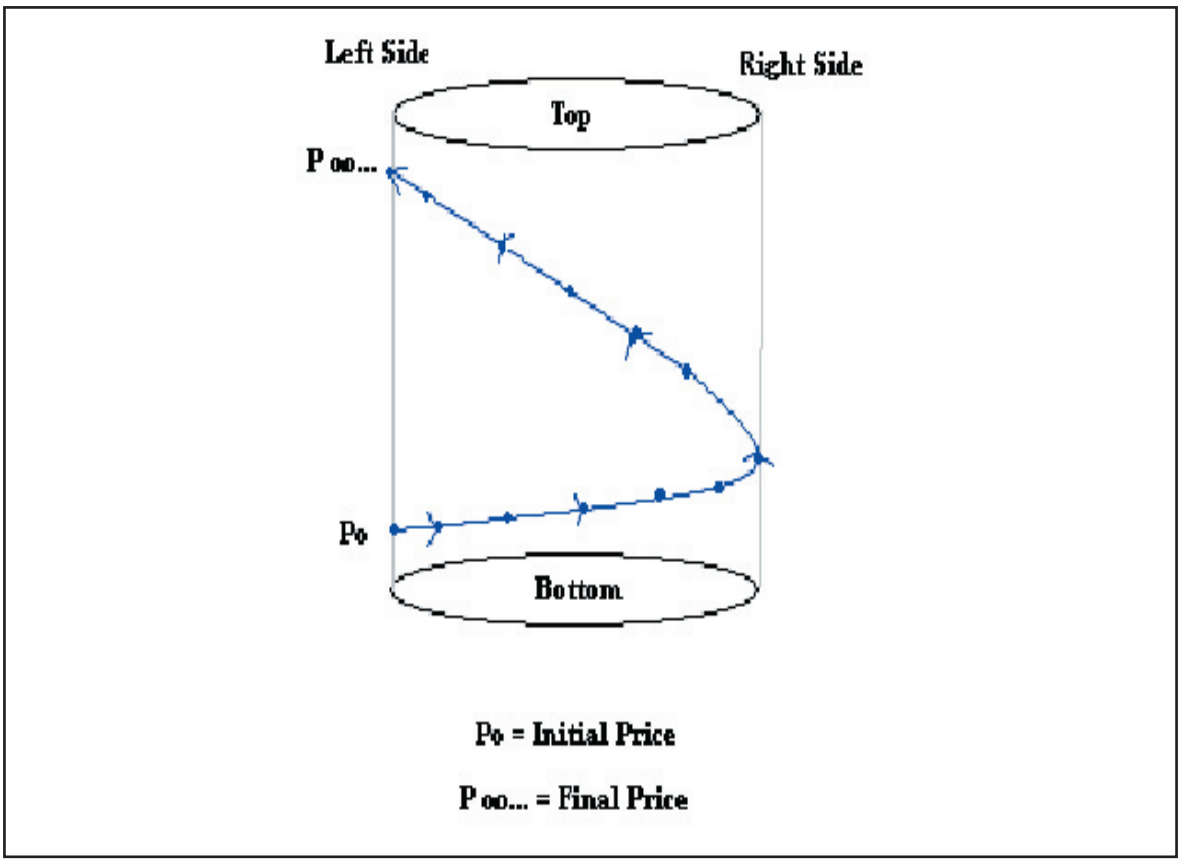
Steps to Draw Demand and Supply Surfaces

To build the Demand and Supply surfaces view is following by five basic steps, there are:

a) First Step: The General Prices Curve (GP-Curve)

The initial stage in the construction of the general prices curve start by the creation of the first quadrant in the I-Cartesian Space, the construction of the first quadrant is based on join each price line or each "Y_i" axis *(Y_0, Y_1, Y_2, Y_3... Y_∞)* until all price lines or all "Yi" axes together can generate a single cylinder (or the first quadrant) on the top of the I-Cartesian Space, each price line has values between 0 and ∞…Therefore, we can start to plot each value price on each price line. Finally, if we proceed to join each value price was plotted in each price line on the first quadrant of the I-Cartesian Space from the bottom left side of the quadrant (**Po**) to the top right side (**P∞…**) then we can start to observe the general prices curve. The general prices curve has an upward slope trend (See Figure 1). We conclude that the GP-Curve behavior shows a geometrical progression and no arithmetic progression according to the traditional demand and supply curve from 2-Dimensional view.

FIGURE 1
General Prices Curve



b) Second Step: Quantity-Demanded and Quantity-Supplied Curves

In the second quadrant of the I-Cartesian Space show the quantity demanded and quantity-supplied curves. We have two possible scenarios in the process to draw quantity-demand and quantity-supplied curves.

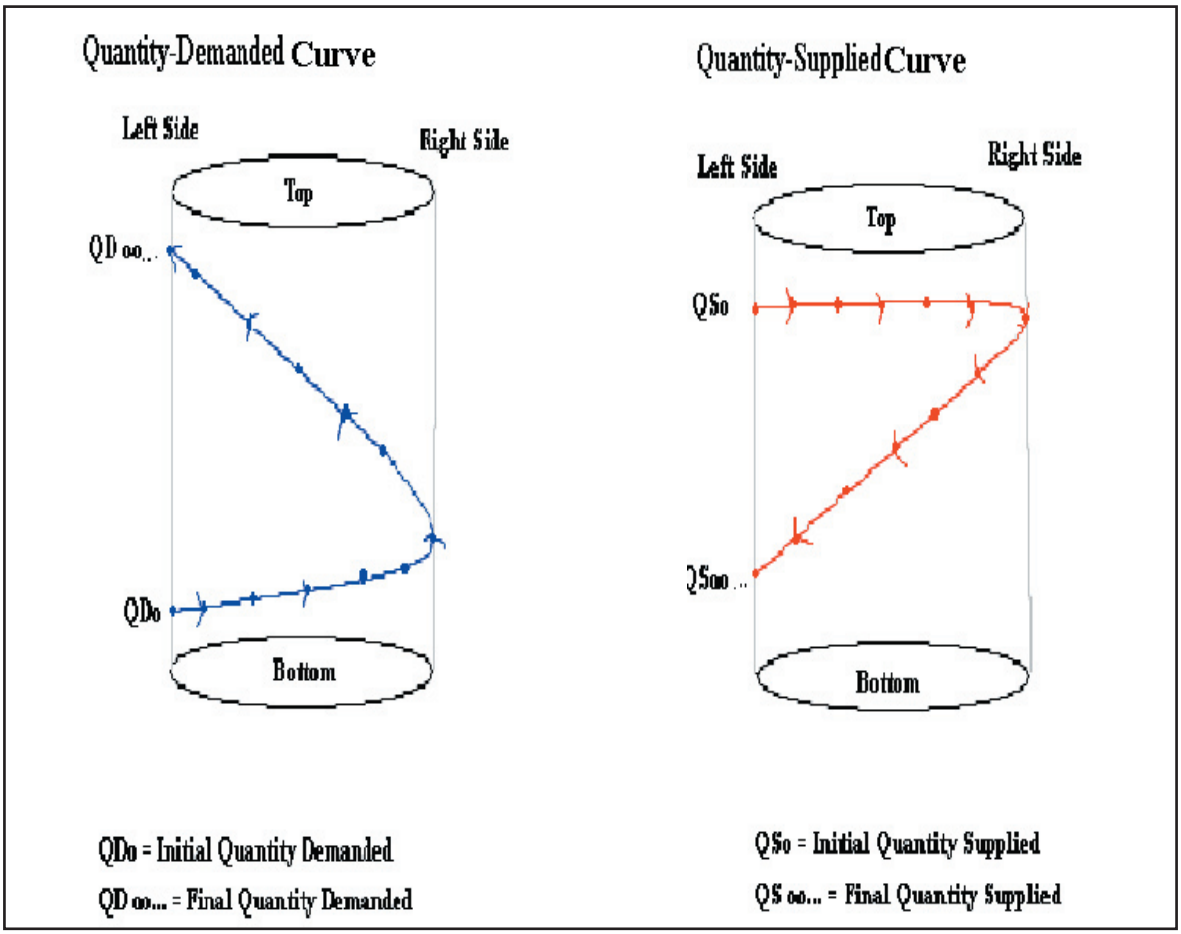
First scenario, the quantity-demanded curve is plotting from the bottom left side (**QD**o) to the top right side (**QD∞…**) in the second quadrant of the I-Cartesian Space (See figure 2). The quantity-demanded curve shows an upward slope trend.

Second scenario, the quantity-supplied curve is plotting from the top left side (**QSo**) to the bottom right side (**QS∞…**) in the second quadrant of the I-Cartesian Space. The quantity-supplied curve shows a downward slope trend (See Figure 2).

c) Third Step: The Demand Surface

Our classic visualization of the Demand curve (2-D) is fixed the quantity-demanded on the horizontal axis "X" and price on the vertical axis "Y". In the case of the demand surface, the demand surface is fixed between two quadrants in the I-Cartesian Space. In the

FIGURE 2
Quantity-Demanded and Quantity-Supplied Curves



initial stage to build the Demand surface, the first quadrant is formed by the general prices curve from Po to P∞…The second quadrant is formed the quantity-demanded curve from QDo to QD∞…Finally, the construction of the Demand surface is based on join each price value from the general prices curve on the first quadrant with each value of the Quantity-Demanded curve located under the second quadrant in the I-Cartesian Space respectively. We can observe that the Demand surface look like a large band with spiral linear behavior (See Figure 3). The Demand surface continue following the law of Demand, all else equal, as prices falls, the quantity demanded rises, and as prices rises, the quantity demanded falls. The Demand surface shows a downward slope trend, but in different position in the I-Cartesian Space.

The difference between the demand curve from 2-Dimensional view and Demand surface is that the Demand curve 2-D only offers one buyer and one good or service into its analysis. In the case of the Demand surface open the possibility to visualize many buyers (infinity number of buyers) and one good or service in different level of prices.

d) Fourth Step: The Supply Surface

The Supply surface is following similar steps to be plotting such as the demand surface. It is plotted between two quadrants in the I-Cartesian Space. The Supply surface continue following the law of supply, as prices rises, the quantity-supplied rises; as prices falls, the quantity supplied falls. The Supply surface continues with an upward slope trend, but in different graphical position than we can observe in 2-D view. In the initial stage to build the Supply surface, the first quadrant is formed by the general prices curve from Po to P∞…The second quadrant is formed the quantity-supplied curve from QSo to QS∞…

Finally, the construction of the Supply surface is based on join each price value from the general prices line on the first quadrant with each value of the Quantity-Supplied curve

FIGURE 3
Demand Surface

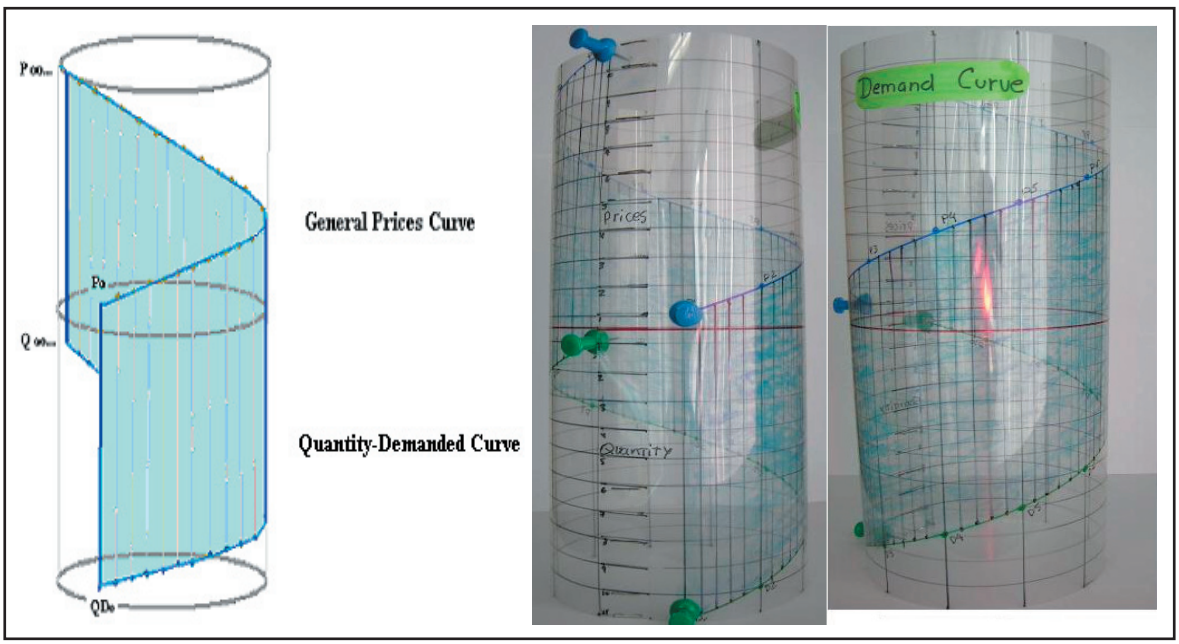
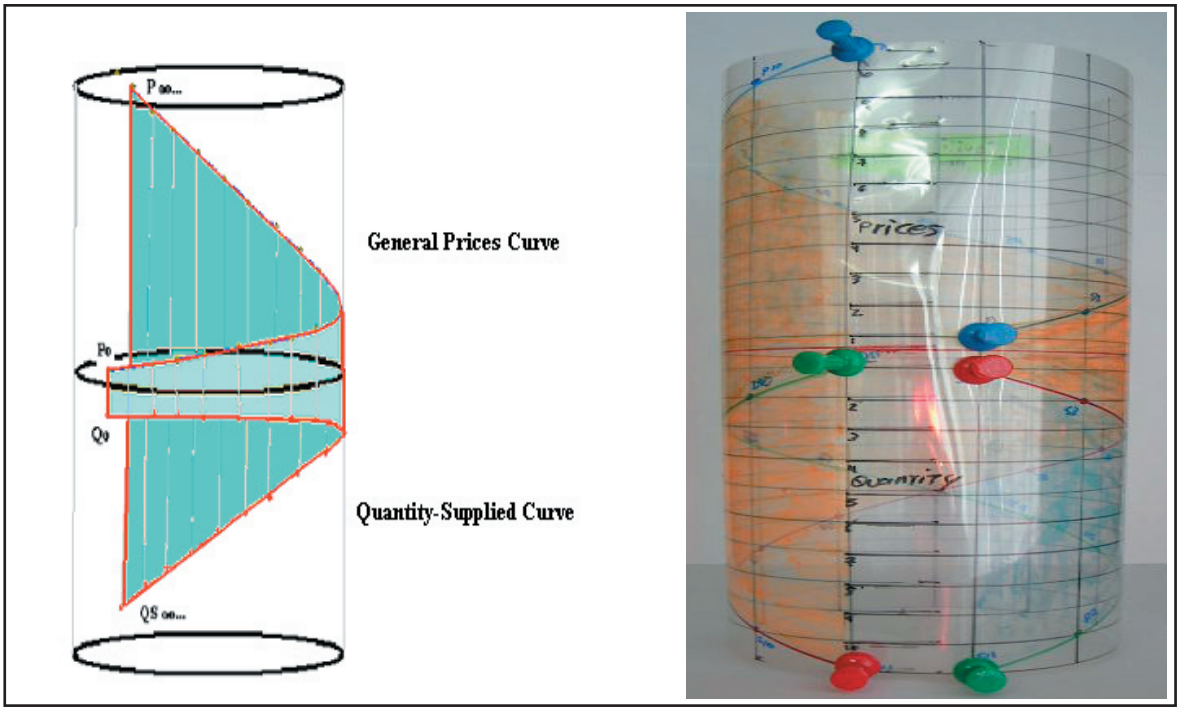


FIGURE 4
Supply Surface



located under the second quadrant in the I-Cartesian Space respectively. We can observe that the Supply surface look like a large band with spiral behavior (See Figure 4).

The difference between the Supply curve from 2-Dimensional view and Supply surface is that the Supply curve 2-D only offers one seller and one good or service into its analysis. In the case of the Supply surface open the possibility to visualize many sellers (infinity number of sellers) and one good or service in different level of prices.

e) Fifth Step: Multi-dimensional Market Equilibrium

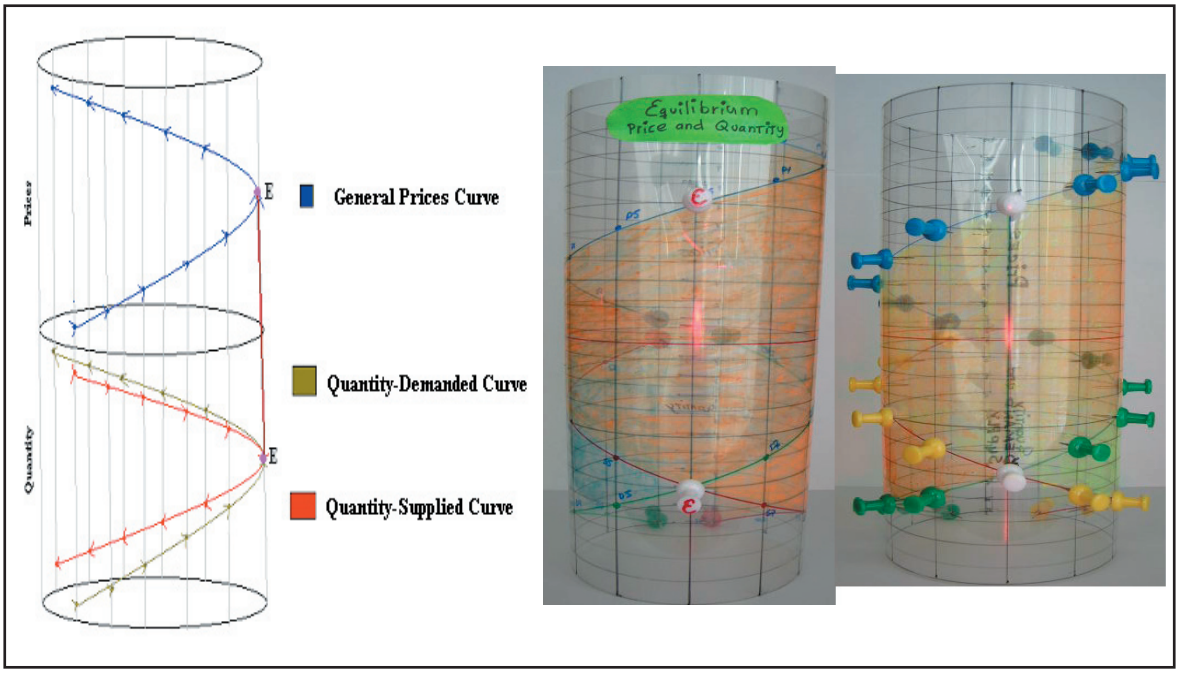
Finally, when we join first quadrant (general prices curve) on the top and second quadrant (quantity-demanded and quantity-supplied curves) in the bottom, we have a single quadrant divided in two sub-quadrants. The first quadrant is who affect the behavior of all values on the second quadrant that is sharing by quantity-demand and quantity-supplied curves.

The multi-dimensional market equilibrium, it can be visualized when Demand and Supply surfaces intercept in some point between the first and second quadrant of the I-Cartesian Space. Finally, the interception point between Demand and Supply surfaces join with a specific price and quantity value among both quadrants of the I-Cartesian Space (See Figure 5).

10.3 Concluding Remarks

According to our research MD-graphs open a new opportunity to visualized economics from a new perspective of analysis from a multi-dimensional view. We can prove that the I-Cartesian Space offers an alternative Multi-Dimensional Cartesian coordinate systems to

FIGURE 5
Multi-dimensional Market Equilibrium



facilitate the study of any economic phenomena, whether macro-level or micro-level, and whether the analyses are short-term or long-term.

To sum up, Multi-Dimensional graphs seems set to play an important role in research as well as the teaching-learning process of economics through the series of new methods and techniques of constructing graphs detailed throughout this paper. We can observe that the Demand and Supply surfaces, there are:

- ✓ The prices behavior in the long run has a geometrical progression (spiral line) and no arithmetic progression (single line) trend according to the 2-Dimensional view
- ✓ Two long bands with spiral trend represent the Demand and Supply curves from MD view, but in the case of 2-Dimensional view, it is draw by two single lines.
- ✓ The prices can affect the quantity demanded and supplied, but also quantity demanded and supplied can affect prices behavior at the same time.
- ✓ The application of MD-graphs can help to reduce the application of Ceteris Paribus into the economics analysis in the short and long run.
- ✓ Supply and Demand surfaces can show how many and different markets behave simultaneously.

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SECTION 5

Application of the Multi-functional Pictorial Physical Space

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CHAPTER 11

Is the Market in a Dynamic Imbalanced State?

11.1 Introduction

In the study of market equilibrium from partial or general view by different theories, models and theorems, there are represented graphically in 2-Dimensions under the application of the Cartesian plane coordinate system (X,Y). The partial equilibrium shows how the independent variable "Y" (price) can affect directly on the dependent variable "X" (quantity demand) in the same graph. The partial equilibrium analysis by Marshall (1890) is supported by the assumption of Ceteris Paribus (all other things [being] the same). The idea to apply Ceteris Paribus is to insolating the rest of variables (different prices and products) can affect on the dependent variable "X" (quantity demand). In other hand, the general equilibrium assumes different prices and large number of products need to be in equilibrium in its initial stage according to Léon Walras (1874), but we also can observe that the general equilibrium from a graphical point of view continue with a strong dependency under the application of 2-D Cartesian plane.

Moreover, the application and uses of 3-Dimensional graphs and 2-D manifolds become more common among academics and researchers to explain and analyze the market equilibrium. Therefore, this research is focused to apply multi-dimensional Cartesian spaces to facilitate the visualization of complex theories, models and theorems related to the market equilibrium from a multi-dimensional view. However, we are considered into our analysis the graphical visualization of the IS-LM model by John Hicks (1934); Hicks developed a large number of pictorial diagrams to demonstrate economic principles and techniques of the economic analysis. The idea to build the IS-LM model is originated from the unclear Keynesian theory never made clear the relationship between the goods market and money market. According to Hicks, the goods market and money market need to achieve equilibrium simultaneously.

The IS curve represents the equilibrium of goods market and the LM curve shows the equilibrium of money market respectively (Pressman, 2006). If we analyzed the graphical display of both curves in the 2-D Cartesian plane (X,Y); the IS curve (goods market) need to be draw on two different 2-D Cartesian planes separately. First 2-D Cartesian plane shows the relationship between interest rate (independent variable "Y") and investment (dependent variable "X"). The second 2-D Cartesian plane is fixed by the IS curve (goods market), it is based on the relationship between interest rate (independent variable "Y") and output level

(dependent variable "X"). In the case of the LM curve (money market) also is draw in two different 2-D Cartesian planes. The first 2-D Cartesian plane in the construction of LM curve is based on the relationship between interest rate (independent variable "Y") and money demand/supply (dependent variable "X") and the second 2-D Cartesian plane is possible to be observed LM curve (money market), it is based on the relationship between interest rate (independent variable "Y") and output level (dependent variable "X").

Finally, we can observe that in the initial state to build these two curves (IS-LM) are plotted separately in different 2-D Cartesian planes in the first quadrant. Therefore, we are not available to observe different steps in the construction of each curve (or market) in the same space and time, each curve (or market) only can be displayed separately, but it is possible to visualize both markets in equilibrium until both curves (IS-LM curves) join in the same 2-D Cartesian plane. The IS-LM curve from a graphical view also can help to visualize the effect of fiscal policy on the goods market performance through the IS curve allocation in its quadrant.

On another side, the monetary policy effect on the money market performance through the LM curve allocation into its 2-D Cartesian plane respectively. In fact, this paper proposes the application of MFP-Cartesian spaces to join all curves (or sub-markets) in the same Cartesian space to visualize the market behavior as a whole. The MFP-Cartesian space will open the possibility to generate a multi-dimensional visual effect to observe all or some possible changes of all sub-markets (goods sub-market, money sub-market, exports sub-market, labor sub-market and technological sub-market) in the same space and time. Finally, the MFP-Cartesian space is available to show eleven independent variables and fifteen dependent variables in the same Cartesian space. At the same time, the MFP-Cartesian space can offer the possibility to observe clearly how large numbers of dependent variables interact with its independent variable simultaneously.

11.2 The Application of Multi-Functional Pictorial Cartesian Space (MFP-Cartesian Space) in the Graphical Modeling of Dynamic Imbalanced State of the Market

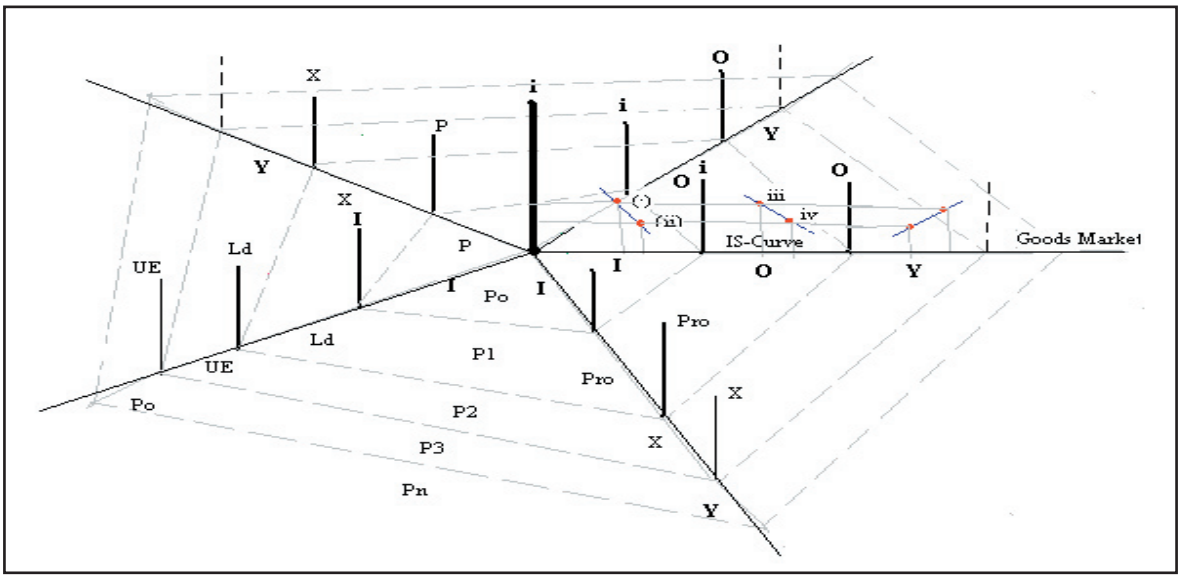
The MFP-Cartesian space (see Ruiz, 2006) will accommodate into its analysis five sub-markets in the same Cartesian space. The MFP-Cartesian Space comprises five sub-markets are fixed into five general axes (A_0, A_1, A_2, A_3 and A_4) in different perimeters levels (PL_0, PL_1, PL_2 and PL_3…) and large number of windows refractions[1] (W_0, W_1 ,…, W_n …). We assume that the market is divided by five sub-markets are: good sub-market -IS curve-, money sub-market -LM curve-,exports sub-market –PE curve-, labor sub-market –IL curve- and technological sub-market –IT curve- respectively. The main reason to dismember the market into five sub-markets is to visualize how different sub-markets work together simultaneously. However, the idea to exclude exports sub-market (PE curve) and technological sub-market (IT curve) from goods sub-market (IS curve) is originated by the necessity to observe separately how the exports sub-market and technological sub-market dynamicity and vulnerability. Another reason to take out exports and technological sub-markets from goods sub-market is to propose an alternative methodology to apply in the policy modeling and policy implementation and evaluation. This approach can show a different analytical approach from the traditional IS-LM model (goods market and money market). The idea to dismember the exports sub-market and technological sub-market from the goods sub-

market by parts, it is to have a better understanding of exports sub-market and technological sub-market behavior independently. Finally, the last assumption in this approach suggests that all sub-markets are in a permanent movement all the time in the same space (graph). Therefore, MFP-Cartesian space is available to generate this multi-dimensional effect to visualize several numbers of sub-markets in the same time and space.

a) The Goods Sub-Market Analysis under General Axis 0 (A_0): IS Curve

The first analysis section is the study of goods sub-market under the general axis (A_0). The A_0 is divided by three windows refraction (see Expression 1). The first window refraction on the general axis 0 (A_0) shows the relationship between the interest growth rate (i) and the investment growth rate (I) to build the first curve, the same curve is moving in different positions into the same window refraction continuously. The changes into the same curve or different positions of the curve in the first window refraction, it is depend on the interest growth rate (i) behavior. To show some examples about possible changes into the same curve in the first window refraction on the A_0, we like to mention two possible scenarios follow by: (i) First scenario, if the interest growth rate (i) increases then the investment growth rate (I) fall. (ii) The second scenario, if interest growth rate (i) decrease then the investment growth rate (I) rise. The second window refraction on A_0 exhibit the construction of IS curve, the IS curve is based on the relationship between the interest growth rate (i) and the output growth rate (O). Moreover, the IS curve show two scenarios follow by: (iii) First scenario, if the interest growth rate (i) increase then the output growth rate (O) fall and (iv). Second scenario, if the interest growth rate (i) decrease then the output growth rate (O) rise (see Figure 1). Finally, the A_0 show the relationship between the income growth rate (Y) under different levels of output growth rates (O). The IS curve assumes that it is in a permanent movement into its windows refraction respectively, it is based on the application of Omnia Mobilis assumption (everything is moving) by Ruiz, Shyamala and Yap (2007). The IS curve

FIGURE 1
The Goods Sub-Market Analysis under the General Axis 0 (A_0): IS Curve



in the short or long run can find anytime its "*momentum of balance synchronization stage"* together with the another four sub-markets (money sub-market –LM curve-, exports sub-market –PE curve-, labor sub-market –IL- and technological sub-market –IT curve-). The goods sub-market under general axis 0 (A_0) is fixed in three different windows refractions follow by:

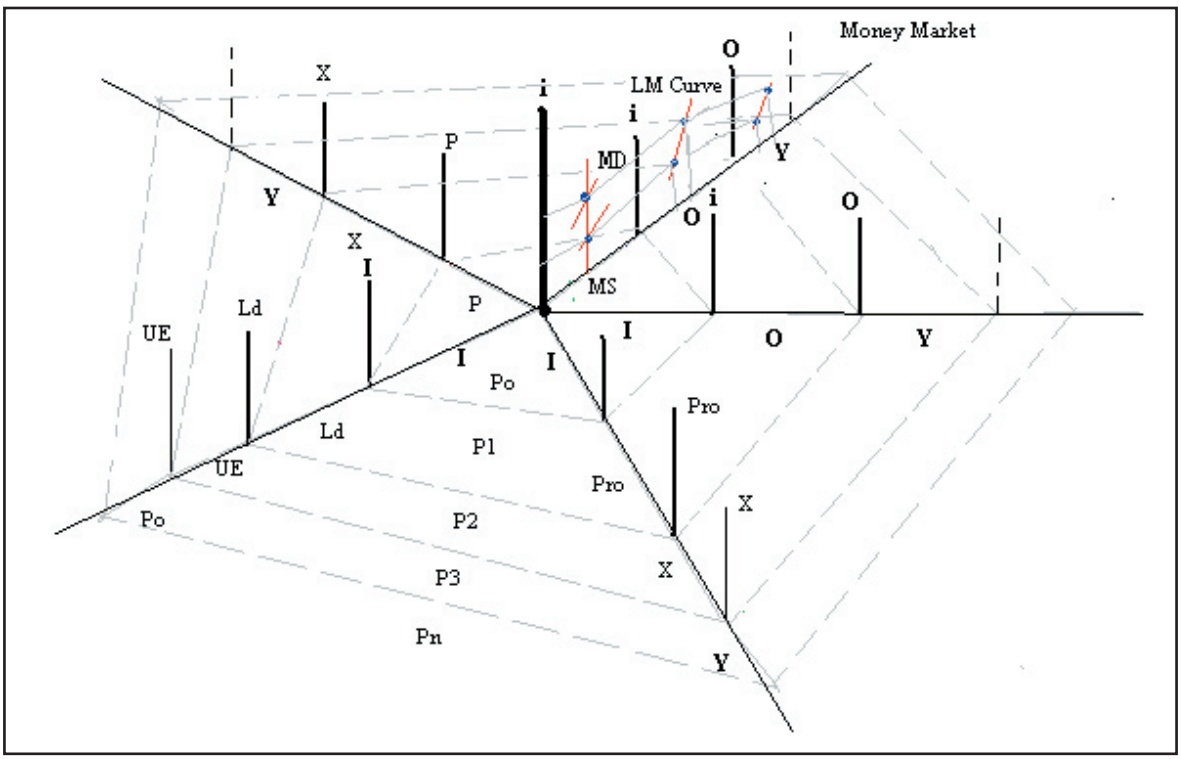
$$\textbf{(1)} \qquad A_0 = /I = f\ (i)/\ ® / O = f\ (i)/\ ® / Y = f\ (O)/$$

b) **The Money Sub-Market Analysis under General Axis 1 (A_1): LM Curve**

The second analysis is based on the application of the LM curve to study the money sub-market. The construction of the LM curve is based on three windows refraction spaces (see Figure 2). The first window refraction space represents the relationship between the interest growth rate (i) and the money demand/supply growth rates (Md/s). Basically, this paper apply a basic assumption in the construction of LM curve: The money demand growth rate and the money supply growth rate are in permanent imbalance state all the time.

Therefore, the money demand growth rate does not necessarily be equal to the money supply growth rate. The second window refraction space, on the other hand, it shows the relationship between the interest growth rate (i) and the output growth rate (O) that LM curve is constructed. The LM curve (money sub-market) show infinity possibilities to be located in different places into the second window refraction in the short or long run.

FIGURE 2
The Money Sub-Market Analysis under the General Axis 1 (A_1): LM Curve



To simplify the LM curve (or money sub-market) behavior, the LM curve can show two scenarios. (i) First scenario, if the interest growth rate (i) increase then the output growth rate (O) rise. Finally, (ii) the second scenario, if the interest growth rate (i) decrease then the output growth rate (O) fall respectively. In the same general axis 1 (A_1)
on the third window refraction is included the relationship between the income growth rate in different levels of output (see Expression 2).

The LM curve can find its "*momentum of balance synchronization stage"* together with IS, PE, IL and IT curves simultaneously. The *momentum of balance synchronization stage* is depends on the relaxation of these five sub-markets originated from the economic, social, political, technological natural & environment forces behavior. Therefore, the LM curve is moving all time (never stop) into its windows refraction. It is based on the application of Omnia Mobilis assumption (Ruiz, Shyamala and Yap, 2007) to simulate a real time environment. The money sub-market under general axis 1 (A_1) is fixed into the three windows refraction follow by:

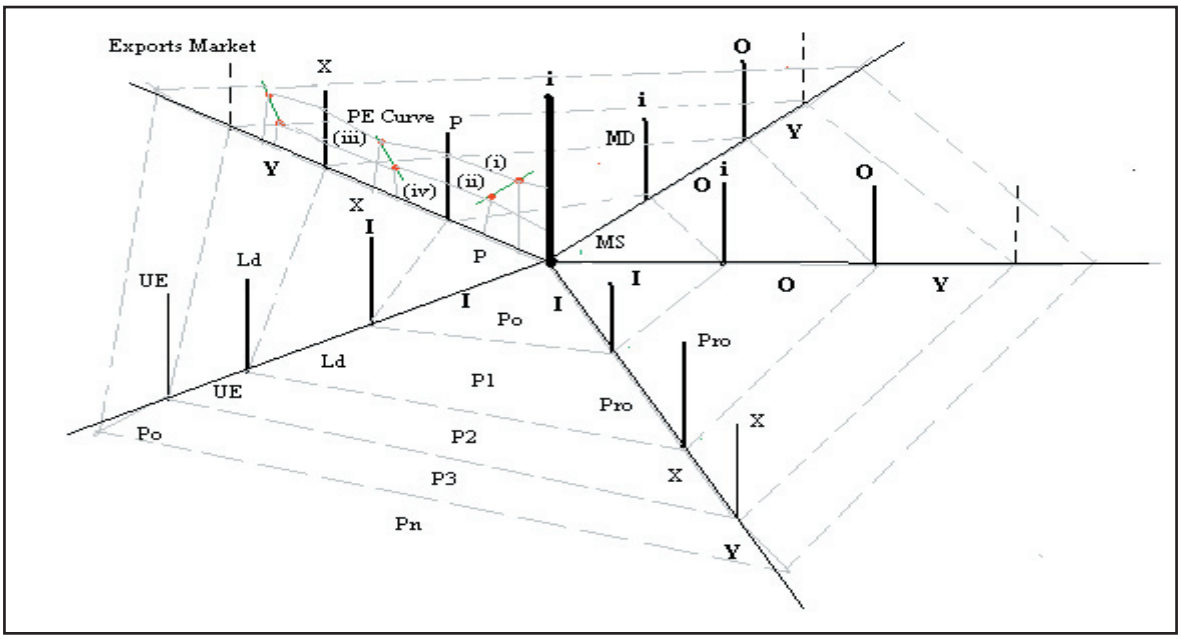
(2) $$A_1 = /M_{d/s} = f\ (i)/ \ ® \ /O = f\ (i)/ \ ® \ /Y = f\ (O)/$$

c) The Exports Sub-Market Analysis under the General Axis 2 (A_2): PE Curve

The third section of the MFP-Cartesian Space show the analysis of exports sub-market through the production/exports (PE) curve (see Figure 3). The PE curve will explain how the interest growth rate (i) can affect the production growth rate (P) and the exports growth rate (X) respectively. We assume the three windows refractions apply Omnia Mobilis assumption. It is to keep all the windows refraction on A_2 in permanent movement in the same space and time. To show some simple examples about possible scenarios, how the interest growth rate (i) can affect on the production growth rate (P) and the exports growth rate (X) behavior, the first window refraction space shows the relationship between the interest growth rate (i) and the total production growth rate (P). The total production growth rate (P) is equal to the total sum of the agriculture output growth rate, the industry output growth rate and the services output growth rate respectively. The relationship between the interest rate/total production growth rates can show two possible effects. (i) The first effect, if the interest growth rate (i) increases then the total production growth rate (P) falls. And (ii) second effect, if the interest growth rate (i) decrease then the total production growth rate (P) rise. In the second window refraction space show the production/exports (PE) curve based on the relationship between the total production growth rate (P) and the exports growth rate (X). (iii) If the total production growth rate (P) increase then the exports growth rate (X) rise, or (iv) if the total production growth rate (P) decrease then the exports growth rate (X) fall in the economy (See Figure 3). In the last window refraction in the same general axis 2 (A_2) shows the relationship between the income growth rate (Y) in different levels of exports growth rate (X) (see Expression 3). Finally, the PE curve also searching for its "*momentum of balance synchronization stage"* anytime together with IS, LM, IL and IT curves simultaneously anytime. The exports sub-market under general axis 2 (A_2) is fixed in three windows refraction follow by:

(3) $$A_2 = /P = f\ (i)/ \ ® \ /X = f\ (P)/ \ ® \ / Y = f\ (X)/$$

FIGURE 3
The Exports Sub-Market Analysis under the General Axis 2 (A_2): PE Curve



d) The Labor Sub-Market Analysis under the General Axis 3 (A_3): IL Curve

The labor sub-market is represented graphically by the investment/labor demand (IL) curve. All windows refraction on the general axis A_3 applied the Omnia Mobilis assumption (everything is moving). This part of the paper is interested to show how the interest growth rate (i) can affect the investment growth rate (I), the labor demand growth rate (Ld) and the unemployment growth rate (UE) from a multidimensional and dynamic perspective. Basically, the first window refraction space is a depiction of the relationship between the interest growth rate (i) and the investment growth rate (I).

We have two scenarios, there are: (i) First scenario, if the interest growth rate (i) increase then the investment growth rate (I) fall. (ii) Second scenario, if the interest growth rate (i) decrease then the investment growth rate (I) rises in the first window refraction. In the second window refraction is focused on the relationship between the investment growth rate (I) and the labor demand growth rate (Ld) becomes obvious. (iii) If the investment growth rate (I) increase then it can generate a high labor demand growth rate (Ld), but (iv) if the investment growth rate (I) decrease then it can only generate a low labor demand growth rate (Ld) into the labor market (See Figure 4).

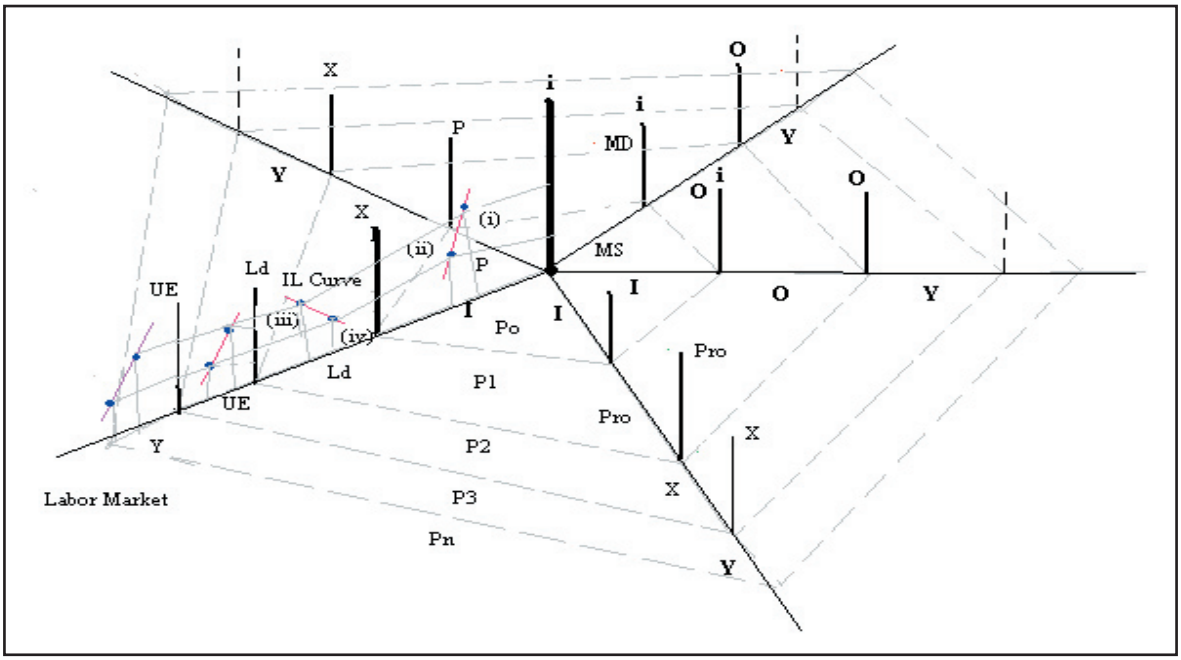
The third window refraction on A_3 shows a downward slope in the relationship between the labor demand growth rate (Ld) and unemployment growth rate (UE). Finally, in the last window refraction on the general axis 3 (A_3), it is showing the relationship between the income growth rate (Y) under different levels of unemployment growth rate (UE) (see Expression 4).

The IL curve also can find its "*momentum of balance synchronization stage"* anytime together with IS, LM, PE and IT curves simultaneously. The *momentum of balance synchronization stage* among the five markets is unexpected and faster according to economic,

political, technological, social and natural & environment forces behaviors. The labor sub-market under general axis 3 (A_3) is fixed into four windows refraction follow by:

(4) $A_3 = /I = f\ (i)/ \ ® \ /Ld = f\ (I)/ \ ® \ / \ UE = f\ (Ld)/ \ ® \ / \ Y = f\ (UE)/$

FIGURE 4
The Labor Sub-Market Analysis under the General Axis 3 (A_3): IL Curve



e) **The Technological Sub-Market Analysis under the General Axis 4 (A_4) Level: IT Curve**

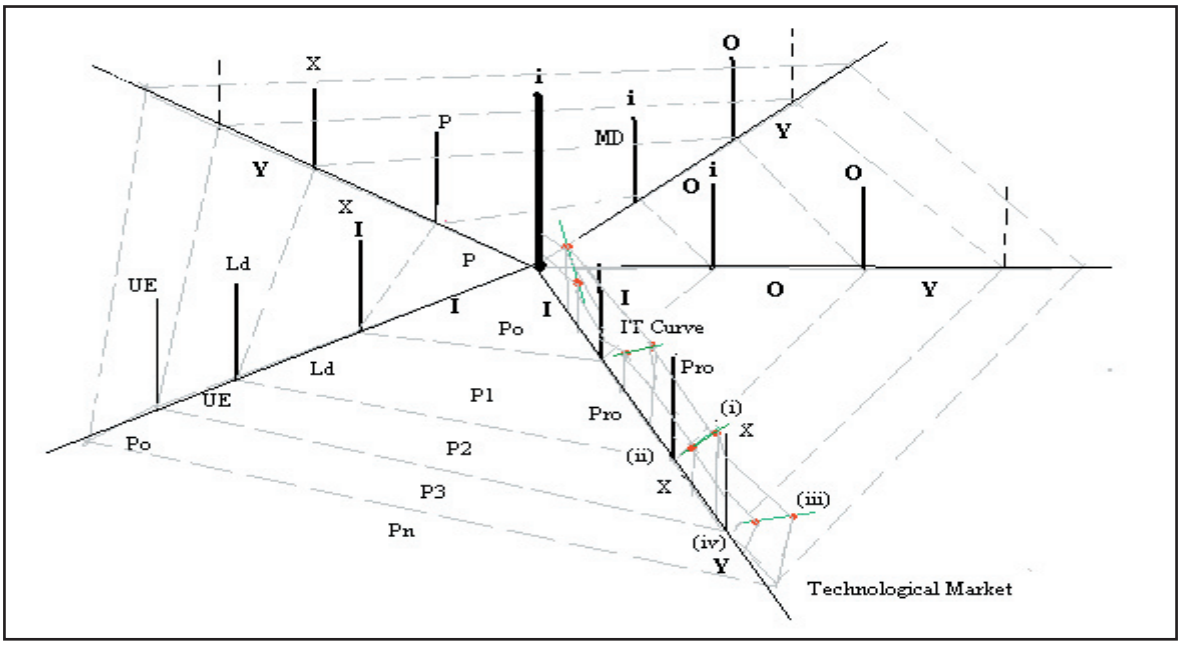
Lastly, the study of the technological sub-market under the general axis (A_4) is divided by four windows refraction (see Expression 5). The first window refraction on the general axis 4 (A_4) shows the relationship between the interest growth rate (i) and the investment growth rate in technology (I). The second window refraction in the same general quadrant (A_4) shows the relationship between the productivity growth rate (Pro) in different levels of investment growth rate in technology (I). Successively, the third window refraction show how the productivity growth rate (Pro) can affect on exports growth rate (X) directly. It can be observed by two possible scenarios follow by: (i) First scenario, if the productivity growth rate (Pro) increase then the exports growth rate (X) rises. (ii) The second scenario, if the productivity growth rate (Pro) decreases then the exports growth rate (X) fall (see Figure 5).

The last window refraction on A_4 exhibits the relationship between the income growth rate (Y) based on different levels of the exports growth rates (X). Moreover, the third window refraction show two scenarios follow by: (iii) First scenario, if the exports growth rate (X) increases then the income growth rate (Y) rise. (iv) the second scenario, if the exports growth rate (X) decrease then the income growth rate (I) fall (see Figure 5). The

IP curve assumes that is in a permanent movement into its windows refraction respectively under the application of Omnia Mobilis assumption. The IS curve can find its "*momentum of balance synchronization stage"* together with the another four sub-markets (goods sub-market –IS-, money sub-market –LM curve-, exports sub-market –PE curve- and labor sub-market –IL-) anytime. The technological sub-market under the general axis 4 (A_4) is fixed into four windows refraction respectively follows by:

$$\textbf{(5)} \qquad A_4 = /I=f(i)/ \text{ ® } /Pro = f(I)/ \text{ ® } /X=f(Pro)/ \text{ ® } /Y=f(X)$$

FIGURE 5
The Technological Sub-Market Analysis under the General Axis 4 (A_4): IT Curve

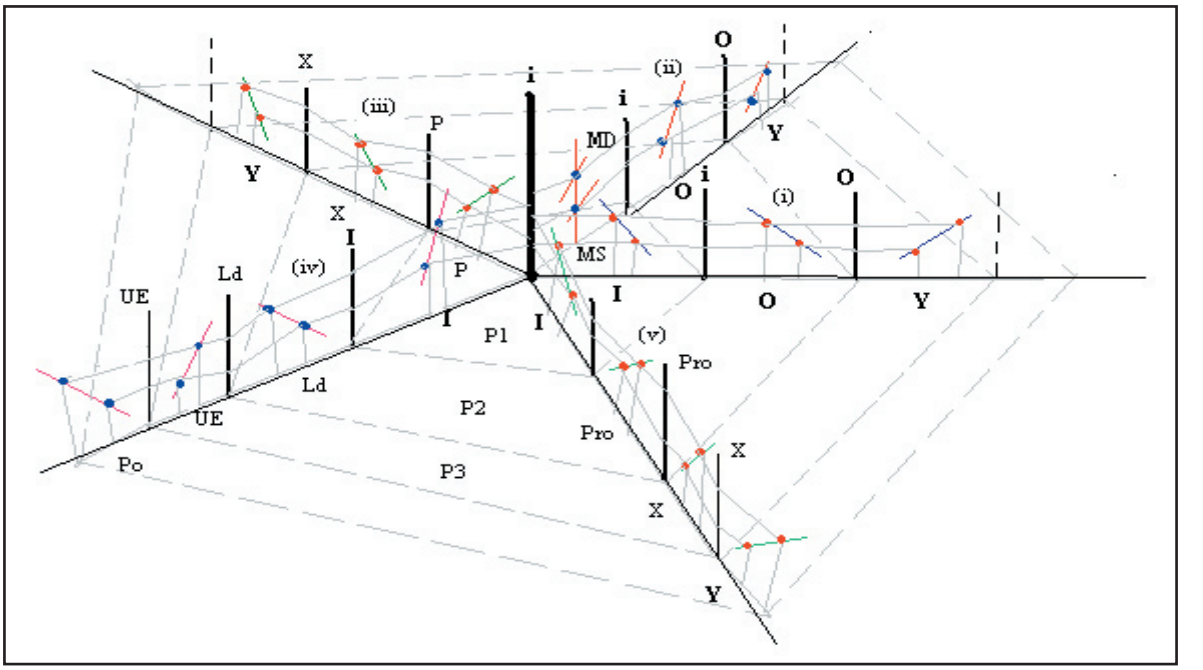


f) Dynamic Imbalance State (DIS)

In broad terms, the MFP-Cartesian Space provides a platform to analyze five different sub-markets that are incorporated in the same Cartesian space: (i) goods sub-market (IS curve), (ii) money sub-market (LM curve), (iii) exports sub-market (PE curve) and (iv) the labor sub-market (IL curve) (v) the technological sub-market (IT curve) (See Figure 6). It is assumed that all sub-markets are operated simultaneously in the same space and time; thereby presenting the Dynamic Imbalance State (DIS) that will support all possible sub-market environments under study. The DIS is based on the application of Omnia Mobilis assumption (everything is moving).

The dynamic imbalanced state is not chaos; it is an unconditional and unexpected complex sensitive reaction of all sub-markets that it is generated by different economic, political, social, technological, natural & environment forces simultaneously under uncertain expectations. Therefore, the goods sub-market (IS curve), money sub-market (LM curve), exports sub-market (PE curve), labor sub-market (IL curve) and technological sub-market (IT curve) does not necessarily need to be in equilibrium simultaneously, because all markets

FIGURE 6
The Dynamic Imbalance State (DIS)



are in a dynamic imbalanced state. Moreover, this paper assumes that *the momentum of balance synchronization stage* is a short fleeting transitional state that in any unpredictable moment can appear spontaneously among the five sub-markets anytime. Therefore, the equilibrium state will be replaced by "*the momentum of balance synchronization stage"*, the time to appear "*the momentum of balance synchronization stage"* depend on the relaxation of the five sub-markets anytime.

This paper argument is that the market equilibrium does not a static and isolated phenomenon, it is a transitional and evolutionary stage cannot be controlled and determined arbitrarily. We need to remember that the study of the market equilibrium, it is not a natural phenomenon can be measured or demonstrate exactly by sciences. The market equilibrium is in a dynamic imbalance state all the time, where the market is defined as the interaction among humans to satisfy necessities in different levels, it is depend on two basic conditions: First, the economic, social, political, technological and natural & environmental forces behavior. Second, it is the historical period of time and the efficient allocation of resources to maximize human necessities (profit or consumption). Therefore, the market behavior cannot be forecasting easily because the all forces mentioned before, there are unpredicted and uncertain in time and space

11.3 Concluding Remarks

This chapter concludes that the market is in a dynamic imbalanced state (DIS) from a graphical point of view. The DIS was applied on the sub-five markets (goods, money, exports, labor and technological) to simulate in a permanent movement state. We assume that all sub-markets behavior does not need to be in equilibrium, because all sub- markets keeps into a dynamic imbalance state at all the time. Finally, if the five sub-markets can find

anytime its *momentum of balance synchronization stage* then the market does not necessarily need to be in equilibrium simultaneously, because the five sub-markets are in a dynamic imbalanced stage. The *momentum of balance synchronization stage* depend on the relaxation of the five sub-markets originated by economic, political, social, technological and natural & environment forces behavior. Therefore, it is a fleeting and unpredictable momentum that can appear spontaneously among the five sub-markets (goods, money, exports, labor and technological) anytime.

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Notes

[1] The Window Refraction Space is a concept based on the joining of different quadrants in the same vector address

Almost all sciences (pure and social), continue using 2-D mensional and 3-Dimensional graphical models for its analysis until today. It is based on the application of the classic 2-Dimensional and 3-Dimensional Cartesian coordinate systems to help visualize the behaviour and the trend of simple and complex phenomenon. This book is aimed at proposing a multi-dimensional graphical modelling approach under the application of Multi-dimensional physical spaces. These multi-dimensional physical spaces are available to store a large amount of data within the same graphical space at the same time. Finally, the book tries to generate a deep transformation on the visualization and analysis of data for a better understanding of complex phenomenon behaviour.

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