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ALTERNATIVE MULTIDIMENSIONAL ECONOMIC THEORETICAL FRAMEWORKS FOR MICROECONOMICS AND MACROECONOMICS

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ABSTRACT

This paper introduces four different focuses for microeconomics and macroeconomics that are based on the uses of multidimensional graphical modeling and multidimensional mathematical modeling. The main objective of this paper is to present some classic economic theoretical approaches such as the games theory, the input-output table; indifference curves map; economic growth approaches from a multidimensional perspective. This is based on applied different multidimensional graphical modeling approaches that Econographicology offers to visualize and understand how complex and dynamic economic phenomena can be analyzed from a multidimensional perspective.

JEL: D0, E0.

KEYWORDS: Econographicology, input-output table, indifference curves maps, game theory, and economic growth.

1. THE MULTIDIMENSIONAL GAMES (MD-GAMES)

1.1. Introduction

The MD-games is willing to analyze a large number of games, players, strategies and payoffs functions from a multi-dimensional perspective. The difference between non-cooperative games and MD-games is that the concept about equilibrium from non-cooperative games which is supported by "the proof of the existence in any game of at least one equilibrium point. Other results concern the geometrical structure of the set of equilibrium points of a game with a solution, the geometry of sub-solutions, and the existence of a symmetrical equilibrium point in a symmetric game" (Nash, 1950). But in the case of the MD-games not request any equilibrium point, because all games in our model always keep in a constant dynamic imbalance state (Ruiz Estrada, 2008). We also assume that in the MD-games exist a large number dimensions and each dimension is fixed a game. Hence, each game is located in different dimensions and each dimension is moving under different speeds of time respectively, it is supported by the application of the Omnia Mobilis Assumption (Ruiz Estrada, Yap and Shyamala, 2008). Therefore, each game into the mega-space coordinate system shows that the behavior of players and the selection of optimal strategies depend on the dimension they are located. In fact, all players in different games, they are free to choose different strategies according to his dimension and timing framework by logical, natural, analytical, cooperative and non-cooperative conditions.

1.2. Introduction to The Mega-Space Coordinate System

This section of the paper is interested to show the coordinate system of the Mega-Space coordinate system follow by (see Figure 1): Universe (U) is equivalent to a Mega-Space (M). The Mega-space coordinate system is follow by the General-Spaces (GS), Sub-Spaces (SS), Micro-Spaces (MS), and JI-Spaces (See Expression 1.1 and 1.2). Finally the JI-space is a sub-coordinate system that plotting (α_h, β_z) into its Micro-Space respectively.

$$U \equiv M = (GS_i, SS_{i:j}, MS_{i:j:k}, JI_m) \quad (1.1)$$

$$m = [(X_{<i:j:k:\alpha h>}),(Y_{<i:j:k:\beta z}>)] \quad (1.2)$$

Where i = {1, 2…∞}; j = {1, 2…∞}; k = { 1, 2…∞ }; L = {1, 2…∞}; h = {1, 2…∞} and z = {1, 2…∞}.

Therefore, the Mega-Space Coordinate System start from the General-Space 0 (see Expression 1.3):

$$U \equiv M = GS_0, SS_{0:0}, MS_{0:0:0}, JI_{[(X0:0:0:0),\ (Y0:0:0:0)]}) \quad \ldots (1.3)$$

Until the General-Space infinity space ∞… (See expression 1.4):

$$GS_\infty, SS_{\infty:\infty}, MS_{\infty:\infty:\infty}, JI_{[(X\infty:\infty:\infty:\infty),(Y\infty:\infty:\infty:\infty)]})\ldots\infty \quad (1.4)$$

However, the final general function to analyze the Mega-Space Coordinate system is equal to expression 1.5. and 1.6:

$$M = f\ (GS_i, SS_{i:j}, MS_{i:j:k}, JI_m) \quad (1.5)$$

Where h = {1, 2…∞}; z = {1, 2…∞} and L= {1, 2…∞}

$$m = [(X_{<i:j:k:\alpha h>}),(Y_{<i:j:k:\beta z>})] \quad (1.6)$$

Where i = {1, 2…∞}; j = {1,2…∞}; h = {1, 2…∞} and z = {1, 2…∞}

1.3. Definition of Time in the Mega-Space Coordinate System

The basic premise of this research paper is that the Mega-Space or Universe is Multi-dimensional. This premise is supported by the second assumption where the Mega-space is running on a general time, but in the case of General-Spaces, Sub-Spaces, Micro-Spaces (see Figure 2) are running in partial times simultaneously.

Finally, the JI-spaces are running in constant times. The JI-Space is a rigid body (or a value) that just hanging into its Micro-Space respectively. When we join all JI-Spaces together can generate a linear curve or non-linear curves into its Micro-Space. The Mega-space coordinate system applied three different types of time into its graphical modeling, these types of times are the general time (wt), partial times (wp) and constant times (wk) (see Expressions 1.7 and 1.8)

$$M_{wt} = f\ (GS_{i/wp},\ SS_{i:j/wp},\ MS_{i:j:k/wp},\ JI_{m/wk}) \tag{1.7}$$

Where $h = \{1, 2\ldots\infty\ \}$ and $z = \{1, 2\ldots\infty\}$

$$m_{\ wk} = [(X_{<i/wp:\ j/wp:\ k/wp:\ \alpha h/wk>}),(Y_{<i/wp:\ j/wp:k/wp\ :\beta z/wk>})] \tag{1.8}$$

Where $i = \{1, 2\ldots\infty\}$; $j = \{1, 2\ldots\infty\}$ and $k = \{1, 2\ldots\infty\}$

Figure 1
Mega-Space Coordinate System

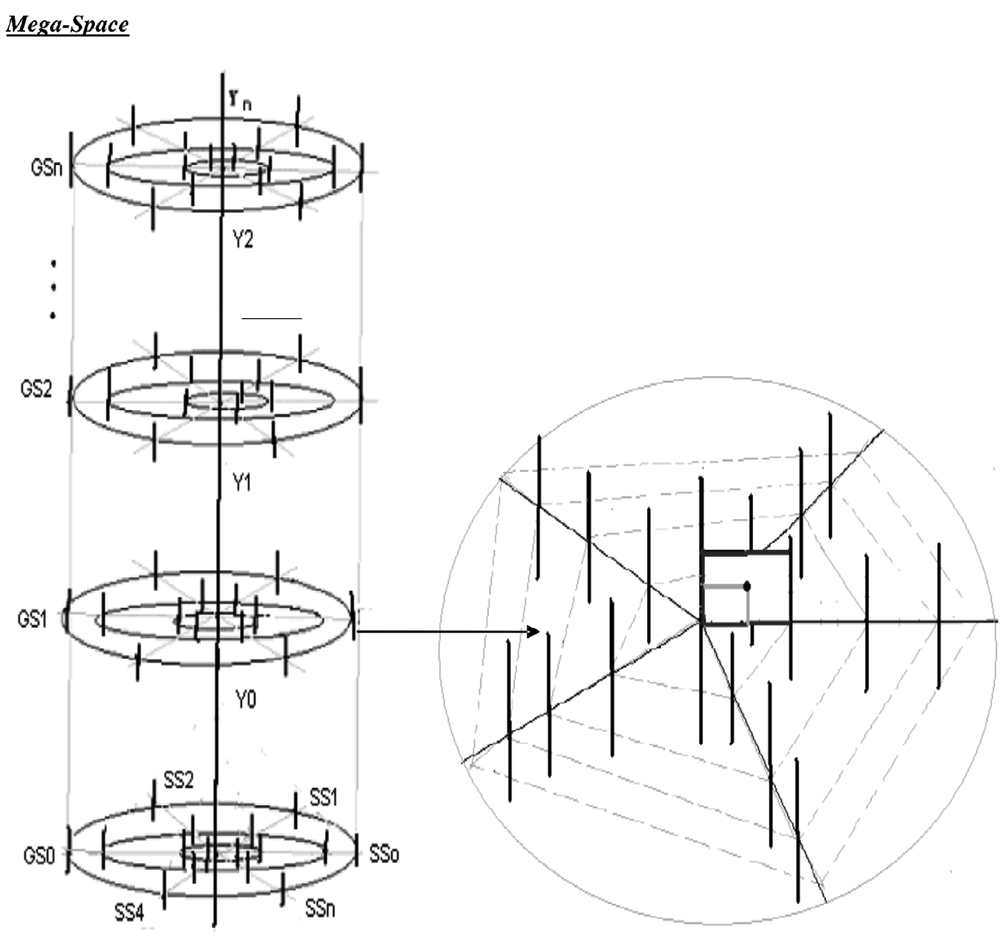
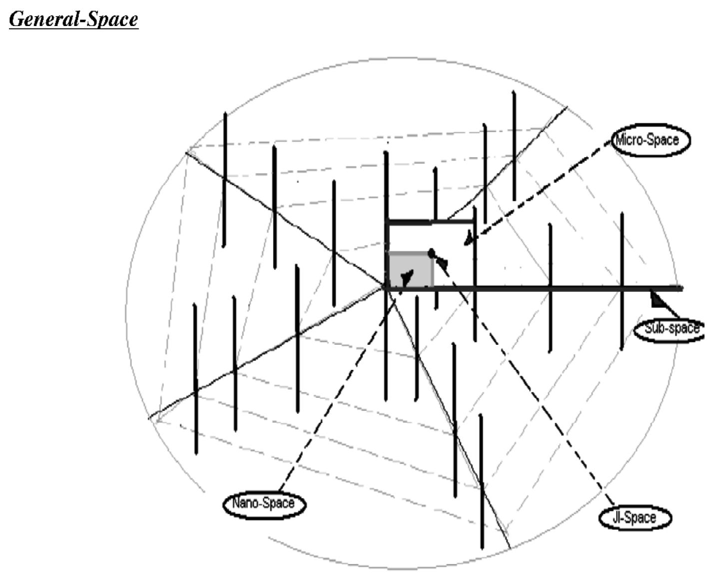


Figure 2
General-Space, Sub-Space, Micro-Space and JI-Space



1.4. How to Plot on the Mega-space Coordinate System

The Mega-Space Coordinate system plotting request four basic steps, there are follow by:

First Step: We need to choose our General-Space (GS_i) from the Mega-space coordinate system, in our case we decide to use the General Space on the third level (GS_3).

Second Step: We proceed to choose our Sub-Space ($SS_{i:j}$) from the General Space on the third level $GS_{3.}$ Finally, we choose the Sub-Space 0 ($SS_{3:0}$).

Third Step: Our Micro-Space ($MS_{i:j:k}$) is originated from the General-Space third level $GS_{3\,,}$ Sub-Space 0 ($SS_{3:0}$) and Micro-space 0 ($MS_{3:0:0}$).

Fourth Step: Finally, we start to plot our JI-Space into the Micro-Space 0 ($MS_{3:0:0}$). In our case the JI-Space is located on the $JI_{[(X<3:0:0:3>),(Y<3:0:0:3>)]}$ (see Figure 3).

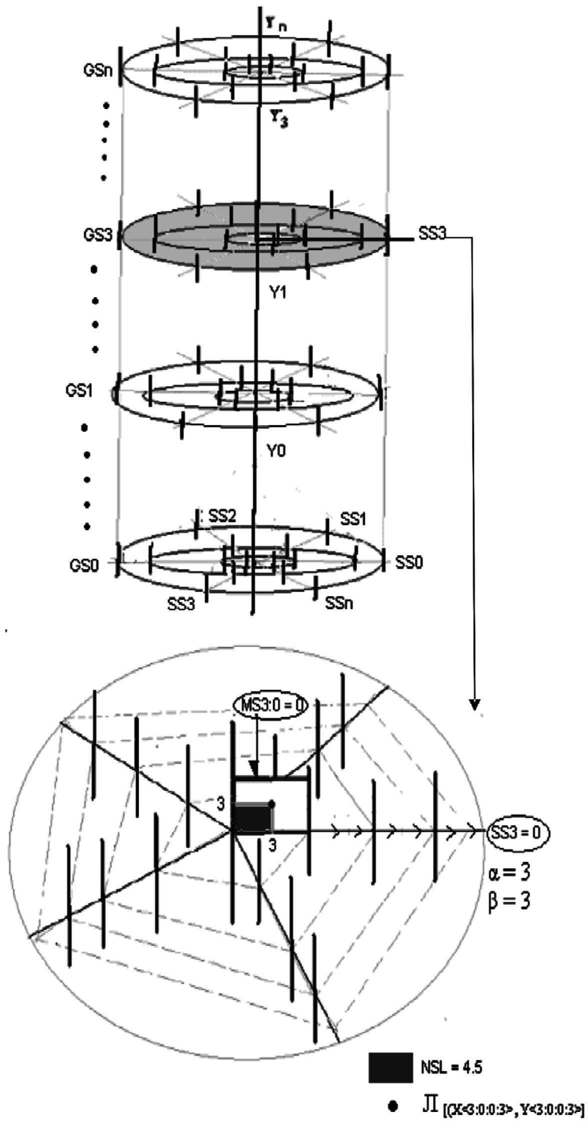
1.5. An Introduction to the Multi-Dimensional Games (MD-Games)

According to the MD-Games, it is based on the application of five basic theorems, there are follow by:

Theorem 1

We have a large number of Games (G), each game is located on different market level (i) with different number of players (j), strategies (n) and payoffs functions (JI)

Figure 3
Mega-Space Coordinate System Plotting



(see Expression 2.1). A basic premise in the MD-games is that each game has its specific dimension into the mega-space coordinate system, at the same time, all players (j) are taking different speed of time (☼) to choose its strategy (See Expression 2.2). Moreover, all players (j) have the freedom to choose any strategy (n) anytime and anywhere, but always exists the high possibility to have a coalition in some games (spaces or dimensions) simultaneously into the mega-space coordinate system.

$$G_{i:j:n:JI} \tag{2.1}$$

$$j = f(\text{☼}n) \tag{2.2}$$

$i = \{0, 1, 2, 3\ldots\infty\}$; $j = \{0, 1, 2, 3\ldots\infty\}$; $d = \{0, 1, 2, 3\ldots\infty\}$; $n = \{0, 1, 2, 3\ldots\infty\}$; $JI = \{0, 1, 2, 3\ldots\infty\}$

Theorem 2

All players (j) are exchanging asymmetric or symmetric information in real time (╬). Therefore, the MD-Games don't need a single equilibrium point, because all games and players decisions depend on a dynamic imbalance state. In fact, the MD-Games suggest the application of the Omnia Mobilis assumption for the relaxation of all games, player and strategies into each dimension in the mega-space coordinate system respectively (see Expression 2.3).

$$\text{☼}\ G_{i:j:n:JI} \text{╬}\ldots\ldots\text{╬}\ \text{☼}\ G_{i:j:n:JI} \tag{2.3}$$

Theorem 3

The decisions to choose any strategy (n) by any player (j) depend on natural conditions (S_{1k}) or vulnerability conditions (S_{2K}) or high risk conditions (S_{3K}) (see Expression 2.4).

$$n = f\ (S_{1:k}{:}S_{2:K}{:}S_{3:K}) \tag{2.4}$$

Where $k = \{0, 1, 2, 3\ldots\infty\}$

Theorem 4

On the other hand, each game works under the application of informal negotiation (NI_i) and formal negotiation (Nf) in all games and players simultaneously (see Expression 2.5).

$$\left.\begin{array}{c} \text{☼}\displaystyle\int_{i=0}^{\infty} Nf(\alpha)^{n+1} \\ \text{╬} \\ \text{☼}\displaystyle\int_{j=0}^{\infty} NI(\beta)^{n+1} \end{array}\right] \rightarrow G_{i:j:n:JI} \tag{2.5}$$

Where $i = \{1, 2\ldots\infty\}$; $j = \{1, 2\ldots\infty\}$ and $n = \{1, 2\ldots\infty\}$

Hence, the final solution of the payoff (Sf) in different game by different player can show two possible scenarios: winner player [☼S^*] or loser player [☼-S^*]. It is according to the final optimal game solution (see Expression 2.6).

$$[\text{☼}S^*] < \text{☼}Sf > [\text{☼-}S^*] \tag{2.6}$$

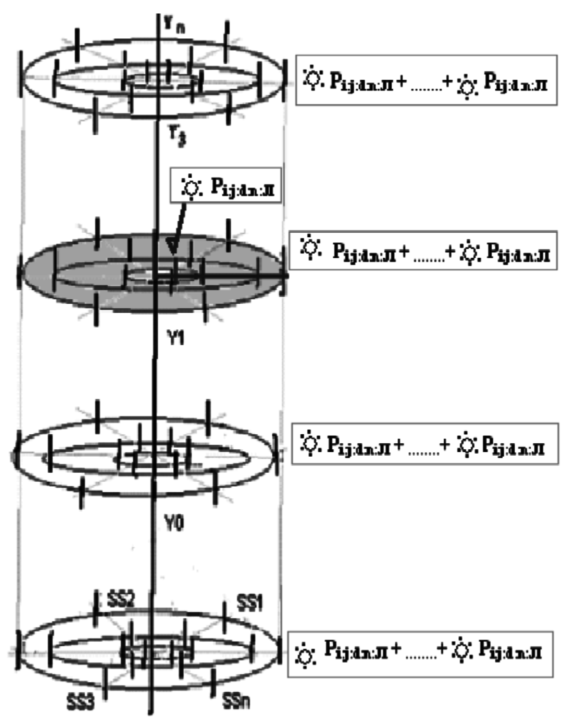
Theorem 5

The payoffs of each player (*PO*) can be positive or negative, it is according to the optimal game solution (S^*_{max}) or non-optimal game solution ($-S^*_{min}$) can get into the final process of negotiation (see Expression 2.7).

$$S^*_{max} \approx PO \approx -S^*_{min} \tag{2.7}$$

Finally, we can observe that on the mega-space coordinate system a large number of games, players, strategies and payoffs functions are interacting together into the same graphical space (see Figure 4).

Figure 4
Multi-Dimensional Games Graphical Modeling



2. THE INPUT-OUTPUT MULTIDIMENSIONAL ANALYSIS

2.1. Introduction

The modeling of the input-output models were introduced by Professor Wassily Leontief, he deals with a particular question: "What level of output should each of the n industries in an economy produce, in order that it will just be sufficient to satisfy the total demand for that product…" (Leontief, 1951). The model he proposes is a static and partial equilibrium version. Hence, the input-output analysis is not showing a general equilibrium or dynamic modeling. Therefore, the main idea to generate the input-output analysis always is simplified by three production sectors (agriculture, industry and services), in the original paper wrote by Professor Leontief the services sector appear as householders. The basic structure of the input-output table shows a large number of production sectors, but we can observe that almost all the examples are based on the uses of three sectors. This model has a serial of assumptions follow by: first assumption is that each production sector produces a single homogeneous commodity. Second assumption is that the model is working under a fixed input ratio. Third assumption is that all production sectors work under the constant returns to scale. Maybe this model looks simplistic but we can find that the great contribution of Professor Leontief is based on the economic modeling shows an alternative view, how the economy is working based on the interaction of different industries from different production sectors such as agriculture, industry and services sector and finally is to calculate the minimum of output to produce a specific commodity to satisfied the basic demand of any country. Hence, this paper proposes the uses an alternative mathematical and graphical modeling approach to study input-output analysis from a multi-dimensional perspective. Our model is called "The Input-Output Multi-Dimensional Analysis". We try to incorporate a large number of commodities "j", production sub-sectors "i" and four production sectors in our analysis. It is based on the application of Econographicology, matrix algebra, multi-dimensional partial differentiation and economic modeling in real time.

2.2. The Input-Output Multi-Dimensional Analysis

Initially, we have a large number of "j" commodities generated by "i" number of production sub-sectors by four production sectors (see Expression 3.1). In our case we have four production sectors follow by the agriculture, light industry (manufacturing), heavy industry (under the production of capital goods) and services (see Expression 3.3, 3.5, 3.7 and 3.9). These four production sectors final output depend on the final total outputs from all production sub-sectors in each of the four production factors respectively (see Expression 3.2, 3.4, 3.6 and 3.8). For example, the agriculture sector (production sector one "S-1") exist the production of "j" number of commodities by "i" sub-sectors. A sub-sector into the agriculture sector or "S-1", we can mention the production of coffee by a large number of coffee plantations. Therefore, we assume that the production of any commodity by each sub-production sector is related to the fast technological challenges and the domestic and international demand in the market. In the other hand, we assume in our model that the innovation, research and development of new commodities under low cost production can generate high demand into different markets simultaneously. We can observe also that each production sub-sector can show unexpected high or low intensive exchange of commodities among all sub-sectors in the same production sector (see Expression 3.1), it is based on the idea that the market always keep in a dynamic imbalance state

(Ruiz Estrada, 2008), to support our argument we application the assumption Omnia Mobilis (Ruiz Estrada, Yap and Shyamala, 2008) to generate the relaxation of the exchange of commodities among all production sectors and sub-sectors in the same production sector.

$$\delta S_{lij} : \delta S_{lij} \tag{3.1}$$

Where

$i = \{0, 1, 2, \ldots, \infty \ldots\}$

$j = \{0, 1, 2, \ldots, \infty \ldots\}$

$l = \{1, 2, 3, 4\}$

l = Production sector i = sub-sector j = commodities.

The equation (1) exist two premises follow by:

(a) If $\delta S_{lij} = \delta S_{lij}$ then the final output into the exchange of this sub-production sector became 0.

(b) If $\delta S_{lij} \neq \delta S_{lij}$ then the final output into the exchange of this sub-production sector became a real or negative number.

The sector one (S-1) represent the agriculture sector, this production sector basically shows a large number of sub-sectors and each sub-sector exist the exchange of infinity number of commodities among all sub-sectors in the same production sector. The final output into the box below of each matrix can show the final output after we calculate the exchange of commodities among all sub-sectors simultaneously. The same situation is possible to be observed into the sector- 2 (light industry), sector-3 (heavy industry) and sector-4 (Services).

<u>Sector S-1</u>

Sector S_1	G_{100}	G_{101}	G_{102}	. . .	G_{10j}	S_1TO	
G_{100}	0	$[\delta G_{100}:\delta G_{101}]$		. . .	$[\delta G_{100}:\delta G_{10j}]$	ΣS_{100}	
G_{101}	$[\delta G_{101}:\delta G_{100}]$		0	. . .	$[\delta G_{101}:\delta G_{10j}]$	ΣS_{110}	
G_{102}	.	.	...	. .			
.	.	.	...	. .			
G_{10j}	$[\delta G_{10j}:\delta G1_{00}]$		$[\delta G_{10j}:\delta G_{101}]$	. . .	0	ΣS_{10j}	
S_1TI	ΣS_{100}	ΣS_{101}		. . .		ΣG_{10j}	$\boxed{\Sigma S1}$ (3.2)

Note: "G" represents commodities

$$\Sigma S_1 = f\,(0 \mp [\delta G_{100}:\delta G_{101}] \mp \ldots \mp [\delta G_{100}:\delta G_{10j}] \mp \ldots \mp [\delta G_{10j}:\delta G_{101}] \mp 0) \tag{3.3}$$

Sector S-2

Sector S_2	G_{210}	G_{211}	G_{212}	. . .	G_{21j}	S_2TO	
G_{210}	0	$[\delta G_{210}:\delta G_{211}]$		. . . .	$[\delta G_{210}:\delta G_{21j}]$	ΣS_{210}	
G_{211}	$[\Delta g_{211}:\delta G_{210}]$	0		. . .	$[\delta G_{211}:\delta G_{21j}]$	ΣS_{211}	
G_{212}	.	.	...	. .			
G_{21j}	$[\delta S_{21j}:\delta S_{210}]$	$[\delta S_{21j}:\delta S_{211}]$		...	0	ΣS_{21j}	
S_2TI	$\Sigma S2_{10}$	$\Sigma S2_{11}$		...	ΣS_{21j}	$\boxed{\Sigma S2}$	(3.4)

$\Sigma S_2 = f$ (0 f% $[\Delta g_{210}:\delta G_{211}]$ ╤…╤ $[\delta G_{210}:\delta G_{21j}]$ ╤…╤ $[\delta G_{21j}:\delta G_{211}]$ ╤ 0) (3.5)

Sector S-3

Sector S_3	G_{320}	GS_{321}	G_{322}	. . .	G_{32j}	S_3TO	
G_{320}	0	$[\Delta G_{320}:\delta G_{321}]$		. . .	$[\delta G_{320}:\delta G_{32j}]$	ΣS_{320}	
G_{321}	$[\delta G_{321}:\delta G_{320}]$	0		. . .	$[\delta G3_{21}:\delta G3_{2j}]$	ΣS_{321}	
G_{322}	.	.	...	. .			
.	.	.	...	. .			
G_{32j}	$[\Delta g_{32j}:\delta G_{320}]$	$[\delta G_{32j}:\delta G_{321}]$		...	0	ΣS_{32j}	
G_3TI	ΣS_{320}	ΣS_{321}		...	ΣS_{32}	$\boxed{\Sigma S_3}$	(3.6)

$\Sigma S_3 = f$ (0 ╤ $[\delta G_{320}:\delta G_{321}]$ ╤…╤ $[\delta G_{320}:\delta G_{32j}]$ ╤…╤ $[\delta G_{32j}:\delta G_{321}]$ ╤ 0) (3.7)

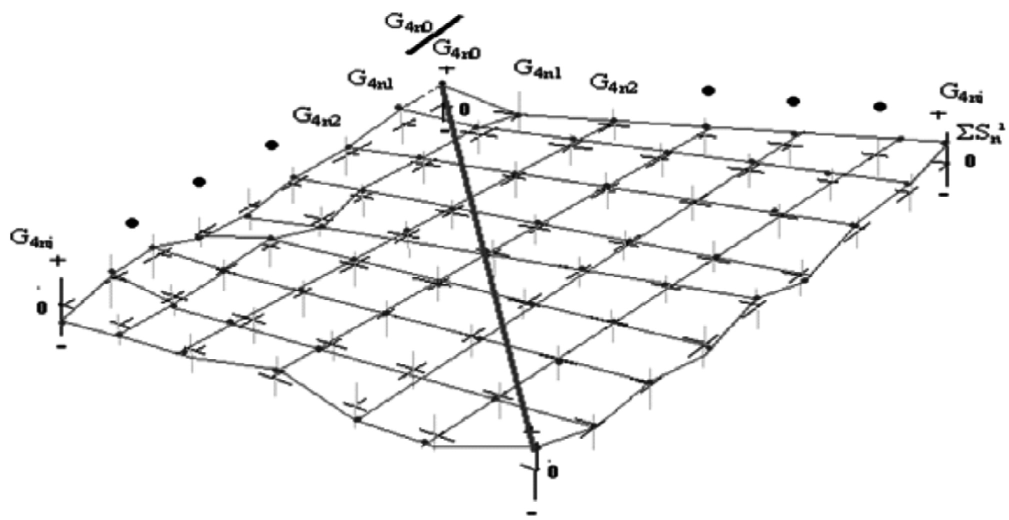
Sector S-4

Sector S_4	G_{4n0}	G_{4n1}	G_{4n2}	. . .	G_{4nj}	S_4TO	
G_{4n0}	0	$[\Delta g_{4n0}:\delta G_{4n1}]$		. . .	$[\delta G_{4n0}:\delta G_{4nj}]$	ΣS_{4n0}	
G_{4n1}	$[\delta G_{4n1}:\delta G_{4n0}]$	0		. . .	$[\delta G_{4n1}:\delta G_{4nj}]$	ΣS_{4n0}	
G_{4n2}	.	.	...	. .			
.	.	.	...	. .			
G_{4nj}	$[\delta G_{nj}:\delta G_{n0}]$	$[\delta G_{nj}:\delta G_{n1}]$		...	0	ΣS_{4nj}	
S_4TI	ΣS_{4n0}	ΣS_{4n1}		...	ΣS_{40j}	$\boxed{\Sigma S_4}$	(3.8)

$\Sigma S_4 = f$ (0 ╤ $[\delta G_{4n0}:\delta G_{4n1}]$ ╤…╤ $[\delta G_{4n0}:\delta G_{4nj}]$ ╤…╤ $[\delta G_{4nj}:\delta G_{4n1}]$ ╤ 0) (3.9)

In this part of our model, we suggest to plot each production sector into four different surfaces, to build each surface, we need to use such as reference all production sub-sector outputs can be plotted on the surface mapping coordinate system, it can facilitate to build each multi-dimensional surface for each production sector. After we plot each production sub-sector, we proceed to join all production sub-sectors by strait lines from the same production sector until we are available to build a single surface. The main idea to build the four multi-dimensional surfaces is to observe the behavior of the exchange of all production sub-sectors "i" by the exchange of a large number of commodities produced by them in the same graphical space. We would like to remark that in the center part of each surface is equal to 0. The reason is that the same sub-sector cannot sell and buy the same commodity by itself (see Figure 5).

Figure 5
A Multi-dimensional Surface by Production Sector



The input-output multi-dimensional analysis request the application of the multi-dimensional partial differentiation to observe the changes of two periods of time between the final time (t+1) and the initial time (t). Also in this part of the model, we suggest the application of the economic modeling in real time "☼" (Ruiz Estrada, 2009) that consist in successive application of differentiations to observe the changes into the four production sectors simultaneously (see Expression 3.10). And also we suggest to apply the inter-link of all production sub-sectors based on the application of the inter-link coordinate axis condition that is represented by "╦".

$$☼\Sigma S_1^i \equiv \Sigma S_1' = \delta f' (S_1)_t / \delta (S_1)_{t+1} d'S_1 ╦ \Sigma S_1'' = \delta f''(S_1)_t / \delta (S_1)_{t+1} d^2 S_1 ╦ \Sigma S_1'' = \delta f''(S_1) / \delta (S_1)_{t+1} d''S_1$$

$$☼\Sigma S_2^i \equiv \Sigma S_2' = \delta f' (S_2)_t / \delta (S_2)_{t+1} d'S_2 ╦ \Sigma S_2'' = \delta f''(S_2)_t / \delta (S_2)_{t+1} d^2 S_2 ╦ \Sigma S_2'' = \delta f'' (S_2) / \delta (S_2)_{t+1} d''S_2$$

$$☼\Sigma S_3^i \equiv \Sigma S_3' = \delta f'(S_3)_t / \delta (S_3)_{t+1} d'S_3 ╥ \Sigma S_3'' = \delta f''(S_3)_t / \delta (S_3)_{t+1} d^2S_3 ╥ \Sigma S_3'' = \delta f''(S_3) / \delta (S_3)_{t+1} d''S_3$$

$$☼\Sigma S_4^i \equiv \Sigma S_4' = \delta f'(S_4)_t / \delta (S_4)_{t+1} d'S_4 ╥ \Sigma S_4'' = \delta f''(S_4)_t / \delta (S_4)_{t+1} d^2S_4 ╥ \Sigma S_4'' = \delta f''(S_4) / \delta (S_4)_{t+1} d''S_4 \quad (3.10)$$

However, the construction and the final analysis of the input-output multi-dimensional analysis consist in plot all multi-dimensional partial differentiations from each production sector: agriculture, light industry, heavy industry and services (see Expression 3.11) on the four dimensional physical space coordinate system. (Ruiz Estrada, 2007). In fact, to join the four production sectors into the same graphical modeling, we suggest inter-link the four production sectors based on the application of the inter-link of the general coordinate condition that is represented by "╬".

$$\text{GDP-Surface} \equiv ☼S^* \equiv ☼\Sigma S_1^i ╬ ☼\Sigma S_2^i ╬ ☼\Sigma S_3^i ╬ ☼\Sigma S_4^i \quad (3.11)$$

The final output of the result input-output multi-dimensional analysis, we are calling "GDP-Surface". It is depend on the final position that the GDP-surface shows into the four dimensional physical space coordinate system. We have four possible results (see Expression 3.12, 3.13, 3.14 and 3.15) to analyze the behavior of the GDP according to the speed of exchange of goods and services (economic activity) by production sector and production sub-sectors.

$$☼S^* \equiv ☼+\Sigma S_1^i ╬ ☼+\Sigma S_2^i ╬ ☼+\Sigma S_3^i ╬ ☼+\Sigma S_4^i \quad (3.12)$$

{if $+☼S^*) \cap R_+$ then the surface ≡ Economic Growth Synchronized}

$$☼S^* = 0 \cap ☼\Sigma S_1^i = 0 ╬ ☼\Sigma S_2^i = 0 ╬ ☼\Sigma S_3^i = 0 ╬ <\& \Sigma S_4^i = 0 \quad (3.13)$$

{if $☼S^*) \cap 0$ then the surface ≡ General Economic Stagnation}

$$☼\pm S^* \cap ☼\pm\Sigma S_1^i ╬ ☼\pm\Sigma S_2^i ╬ ☼\pm\Sigma S_3^i ╬ ☼\pm\Sigma S_4^i \quad (3.14)$$

{if $☼S^*) \cap R_{+/-}$ then the surface ≡ Irregular Economic Growth}

$$☼-S^* \equiv ☼-\Sigma S_1^i ╬ ☼-\Sigma S_2^i ╬ ☼-\Sigma S_3^i ╬ ☼-\Sigma S_4^i \quad (3.15)$$

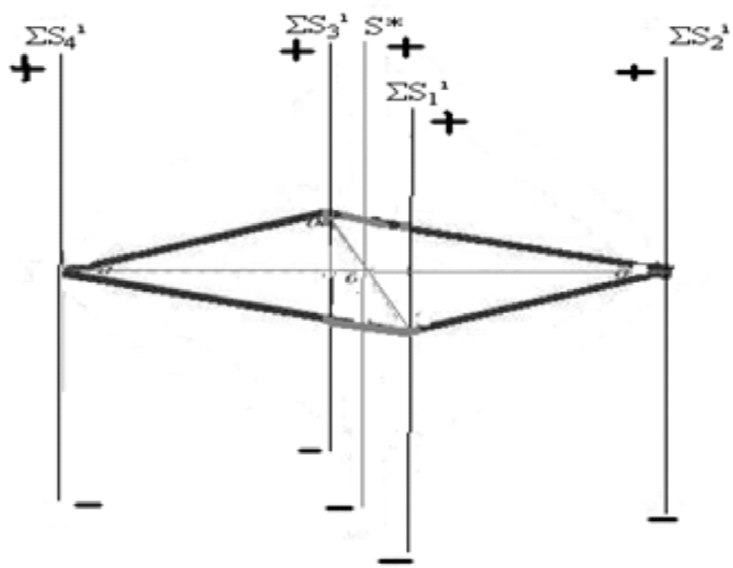
{if $☼S^*) \cap R_-$ then the surface ≡ Economic Recession}

3. THE MULTI-DIMENSIONAL INDIFFERENCE CURVES MAP

3.1. Introduction

For long time, the visualization of the indifference map (Salvatore, 2004) is based on the application of the 2-Dimensional Cartesian coordinate system (see Figure 8, Section a.). It is according to the construction of the indifference map depends on the construction of a group of indifference curves in the same graphical space. At the same time, each indifference curve tries to show all possible combinations of exchange between two goods, in our case good-x and good-y by one consumer under the application of the marginal rate of substitution (slope down of each indifference

Figure 6
I-O Multi-dimensional Graphical Analysis



curve). Hence, the marginal rate of substitution in economics terms can be explained by how much a consumer is available to sacrified its consumption of any good to get an extra unit of another good. For example, how much units of good-x I need to sacrificed to get an additional unit of good-y. It is in the case of the 2-Dimensional view, but in our case we propose the multi-dimensional indifference maps that are willing to show a large number of indifference maps into the same graphical space under the application of the Pyramid Physical Space by Ruiz Estrada (2007). Initially, we can say that the multi-dimensional indifference maps can show a large number of windows and each window is available to fix a specific indifference map. In fact, the multi-dimensional indifference maps can show different combinations between one good and n-number of goods (a,b,c….∞) simultaneously into the same graphical space. Therefore, we can observe a large number of marginal rates of substitution (MRS) into each or all windows in the multi-dimensional indifference maps. In our case, now it is possible to observe a large number of indifference maps are plotting into the same graphical space. Moreover, this paper can show clearly a new graphical approach to analyze the consumer behavior from a multi-dimensional perspective. Now we can compare how one good and n-goods can be exchanged through the visualization of different indifference curves with different marginal rates of substitution in different windows into the multi-dimensional indifference maps. The main idea is to observe how the consumer has infinity choices to get an extra additional unit of any good if he sacrificed an extra unit of any good to consume a extra unit of another good.

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

The P-Physical space (Ruiz Estrada, 2007) is a fixed point consisting of five axes ($[X_{1:n}, X_{2:n}, X_{3:n}, X_{4:n}], Y_n$) or ($X_{i:n}, Y_n$), 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 "$X_{1:n}$", "$X_{2:n}$", "$X_{3:n}$" *and* "$X_{4:n}$" and one dependent variable "Y_n" respectively. Each "$X_{i:n}$" variable ($X_{1:n}, X_{2:n}, X_{3:n}, X_{4:n}$) and "$Y_n$" variable has its individual axis. Representing the dependent variable, the fifth axis, "Y_n" is positioned in the center of the graph (in the center of the other four axes). "Y_n" has a positive value. It is the convergent point of all the other four axes $X_{1:n}$, $X_{2:n}$, $X_{3:n}$ *and* $X_{4:n}$. In other words, all "$X_{i:n}$" axes converge at the "Y_n" axis. This type of graph only works with positive values in its P-Physical Space (see Figure 7).

In the case of the P-Physical Space fixed point, all variables "$X_{i:n}$" and "Y_n" are on the positive side of their respective axes. In other words, if the value of any or all "$X_{i:n}$" changes, then the value of "Y_n" can be modified at any time. Therefore, we have two possible scenarios:

(i) Scenario A - If the value of any or all $X_{i:n}$ decreases then "Y_n" moves down.

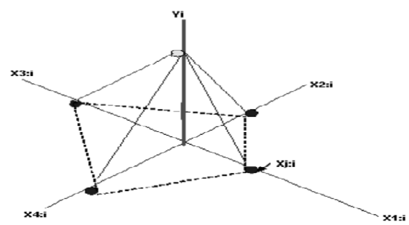
(ii) Scenario B - If the value of any or all $X_{i:n}$ increases then "Y_n" rises.

Consequently, any change in the values of any or all "$X_{i:n}$" will affect "Y_n" directly. (See Figure 1). The function used by the P-Physical Space fixed point is expressed by $Y_n = f(X_{i:n})$, *where* $X_{i:n} < +\infty$ *and* $Y_n < +\infty$. Therefore, the P-Physical Space all variables "$x_{i:n}$" and "y_n" are either on the positive side of respective axes together. In other words, if all or some "$x_{i:n}$" change(s), then the value of "y_n" can be modified any time. Therefore, we have two possible scenarios: first scenario, if all or some $x_{i:n}$ move from outside to inside, then "y_n" move down. Second scenario, if all or some $x_{i:n}$ move from inside to outside, then "y_n" move up. Therefore, any change in some or all "$x_{i:n}$" will affect "y_n" directly. (see Figure 7). The function to be used by the P-Cartesian Space is following by: $y_n = f(x_{1:n}, x_{2:n}, x_{3:n}, x_{4:n})$

3.3. The Multi-Dimensional Indifference Curves Map: Graphical Modeling

Initially, we can observe in the Figure 8 section b and section c that the Multi-dimensional Indifference Maps show a large number of windows and each window is available to be plotted an indifference map. In the central axis of the Pyramid physical space is located the good-x and in the bottom a large number of goods from good-a to the good-∞. Now, it is possible to analyze the preferences and choices of a single consumer when he/she has a large number of possibilities to choose according to his conveniences and necessities among a large set of goods in the market. The main idea to apply the multi-dimensional indifference maps is to generate an alternative graphical approach to visualize the consumer behavior and utility under different conditions and number of goods in the market simultaneously.

Figure 7
Pyramid Physical Space



(Xji , Yi)	X1i	X2i	X3i	X4i
Yi	P1 = (3,2)	P2 = (2,2)	P3 = (1,2)	P4 = (3,2)

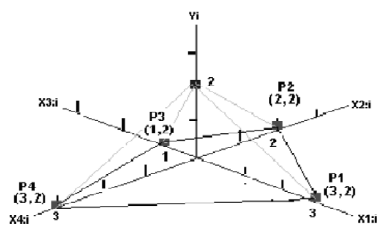
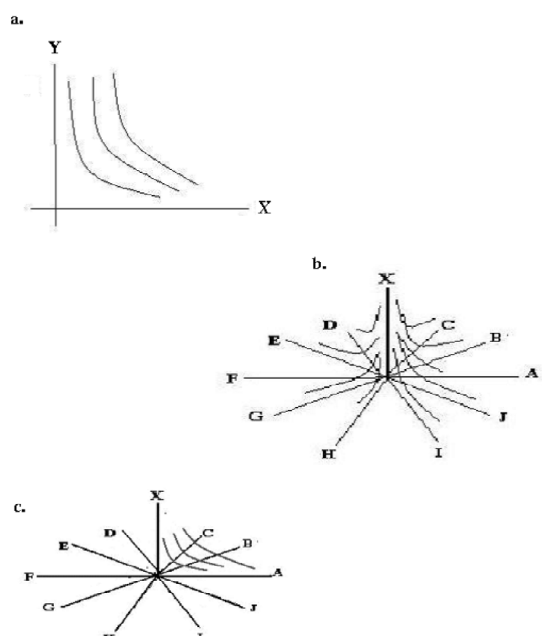


Figure 8
The Multi-dimensional Indifference Maps



4. THE ECONOMIC DESGROWTH

4.1. A Short Review about Economic Growth

For long time different thinkers and economists try to figure about the origins and behavior of the economic growth through the formulation of a large number of theories and models. We can mention that the platform of different economic growth theories and models are based on the uses of production factors, restrictions, assumptions and conditions to explain how economic growth works or behave from an empirical and theoretical perspective such as the classical growth economic theory by Smith (1776) and Ricardo (1817); neo-classical economic growth theory by Solow (1956), Swan (1956) and Meade (1961); Keynesians: Keynes (1936); endogenous economic growth theory: Lucas (1988) and Romer (1986); post-Keynesian: Kalecki (1936), Hicks (1981) and Kaldor (1959). All these theories always are looking for the origins, reasons and conditions to how maximize the economic growth by any nation from an expansionist point of view. We are referring to expansionist point of view when we try to find mechanisms (policies) and conditions (incentives) to generate a good performance or expansion in the performance of any economy from a production, spending and distribution perspective. However, our idea about economic growth is totally different from because we are analyzing economic growth from a contractionist point of view.

It is mean that always any country in its GDP formation is going to lose some or all growth in different proportions according to the sizes of its leakages that affect the final performance of the final GDP of any nation. The main idea is to keep a constant GDP performance by control all possible older and newer leakages can affect directly or indirectly on the final performance of the GDP in any nation. In fact, our view about economic growth is totally different from the traditional view because we propose a new form to understand the complex and dynamic behavior of the GDP performance. Originally, we have two different approaches of economic growth are considering the idea of economic growth. Firstly, the traditional view that we need to assume the existence of a constant expansion of the GDP from inside (a small growth) to outside (a large growth). On the other hand, our idea about economic growth is opposite from the traditional view about economic growth because always we assume that in the process of the GDP formation exist the possibility of constant contraction from outside (a possible large growth) to inside (a small growth). This possibility of contraction of the GDP in its process of formation we are called "economic desgrowth (ä)". According to the economic desgrowth we try to figure the contractionist point of view that the GDP can suffer into the process of formation into a determined period of time. Hence, in the case of the policy modeling orientation for economic desgrowth is not necessary of pro-incentives policies such as the case of the traditional economic growth thinking. In the specific case of the economic desgrowth policy modeling is based on the regulation and sustainability policies into the process of the GDP formation in a determined period of time that usually is one year.

Therefore, economic desgrowth encourage to keeps a constant control on the expansion or appearance of new leakages in the process of the GDP formation in any nation.

4.2. Introduction to Economic Desgrowth Model

Initially, we are defining the economic desgrowth (δ) "as an indicator that can show different leakages originated from non-controlled events that can affect on the GDP formation among a period of one year". The quantification of the economic desgrowth (δ) is based on the uses of intervals of probability between zero and one (see Expression 4.1).

$$f(X_{n+1}) \text{ exist } [0,1] \; \forall \; X \in \Omega \qquad (4.1)$$
$$P(X_{n+1}) = \Sigma \, R_+ \in X_n$$
$$\Sigma \, \mathrm{R}_+ \, \varepsilon \, X_{n+1} = 1$$

According to the economic desgrowth (δ), we need to assume that exist an irregular oscillation into different periods of time by apply the simple rule of irregular series (X_n) as a function of n (see Expression 4.2).

$$X_{n+1} = f(X_n) \qquad (4.2)$$

Additionally, we assume that the world economy always keep in a permanent chaos under different levels of vulnerability according to different magnitudes of irregularities. Therefore, we have a large number of irregular series under expression 4.3 and 4.4:

$$X_{n+1} = T(X_n) = \begin{cases} 2X_n \\ 2 - 2X_n \end{cases} \qquad (4.3)$$

$$X_{n+1} = T(X_n) = T(X_n)/B(X_n) \Rightarrow \begin{matrix} 2\,X_n \\ 2 - 2X_n \end{matrix} \begin{cases} (0 \le \mathrm{X_n} \le 1) \\ (0 \le X_n \le 1) \end{cases} \qquad (4.4)$$

The economic desgrowth (δ) request to apply X_{n+1} random intervals to make possible analyze possible unexpected results from different non-controlled events that cannot be predicted and monitored easily from the traditional methods of linear and non-liner mathematical modeling. It is because we assume from beginning that the world economy keep in a permanent chaos. At the same time, we are looking to include the Lorenz transformation assumptions to facilitate the analysis of the economic desgrowth (δ) in this specific model.

4.2.1. Measurement of the Economic Desgrowth (δ)

Firstly, the measure of the economic desgrowth (δ) is based on the application of large number of multi-dimensional partial derivatives in real time (☼). It is according to the uses of a large list of non-controlled events probability between the present time (this year) and the past time (last year) (see Expression 4.5).

$$\Delta\beta i = ☼\delta\beta i_{t+1} \,/\, ☼\delta\beta i_{t} \geq n \text{ where } n = \{-\infty\ldots,-1, 0, 1,\ldots\infty+\} \qquad (4.5)$$

$$-\Delta\Omega = \begin{pmatrix} ☼\partial\beta_{1(t+1)}/\partial\beta_{1(t)} & ☼\partial\beta_{2(t+1)}/\partial\beta_{2(t)} & ☼\partial\beta_{3(t+1)}/\partial\beta_{3(t)} & ☼\partial\beta_{4(t+1)}/\partial\beta_{4(t)} \\ ☼\partial\beta_{5(t+1)}/\partial\beta_{5(t)} & ☼\partial\beta_{6(t+1)}/\partial\beta_{6(t)} & ☼\partial\beta_{7(t+1)}/\partial\beta_{7(t)} & ☼\partial\beta_{8(t+1)}/\partial\beta_{8(t)} \\ ☼\partial\beta_{9(t+1)}/\partial\beta_{9(t)} & ☼\partial\beta_{10(t+1)}/\partial\beta_{10(t)} & ☼\partial\beta_{11(t+1)}/\partial\beta_{11(t)} & ☼\partial\beta_{12(t+1)}/\partial\beta_{12(t)} \\ ☼\partial\beta_{13(t+1)}/\partial\beta_{13(t)} & ☼\partial\beta_{14(t+1)}/\partial\beta_{14(t)} & ☼\partial\beta_{15(t+1)}/\partial\beta_{15(t)} & ☼\partial\beta_{16(t+1)}/\partial\beta_{16(t)} \end{pmatrix} \qquad (4.6)$$

Note: (*t*) = present period of time and (t+1) = next period of time

Therefore, our model the number of non-controlled events is equal to sixteen growth rates such as natural disasters ($☼\beta_1$), corruption ($☼\beta_2$), epidemics ($☼\beta_3$), financial crisis ($☼\beta_4$), international trade crisis ($☼\beta_5$), war ($☼\beta_6$), social conflicts ($☼\beta_7$), evasion of tax ($☼\beta_8$), violence ($☼\beta_9$), limitations of infrastructure ($☼\beta_{10}$), political instability ($☼\beta_{11}$), unemployment ($☼\beta_{12}$), inflation ($☼\beta_{13}$), black markets ($☼\beta_{14}$), revolutions ($☼\beta_{15}$), pollution ($☼\beta_{16}$). Each growth rate is applied multidimensional partial differentiation (∂) in real time (☼) respectively (see Expression 4.6). Secondly, to measure the negative GDP growth rate vulnerability propensity matrix ($-\Delta\Omega$) is focused on find a single determinant (Δ) from a matrix four by four under the uses of sixteen different possible non-controlled events that was mentioned before (see Expression 7). Finally, the measurement of the economic desgrowth (δ) is based on multiply the negative GDP growth rate vulnerability propensity matrix ($-\Delta\Omega$) by the GDP forecasting growth rate (GDP_f) (see Expression 4.7).

$$\delta = (GDP_f) \times (-\Delta\Omega) \qquad (4.7)$$

The modeling of the economic desgrowth request the application of the Omnia Mobilis assumption by Ruiz Estrada (2011) to generate the relaxation of all leakages calculation (non-controlled events) that can generate a considerable reduction of the GDP final formation.

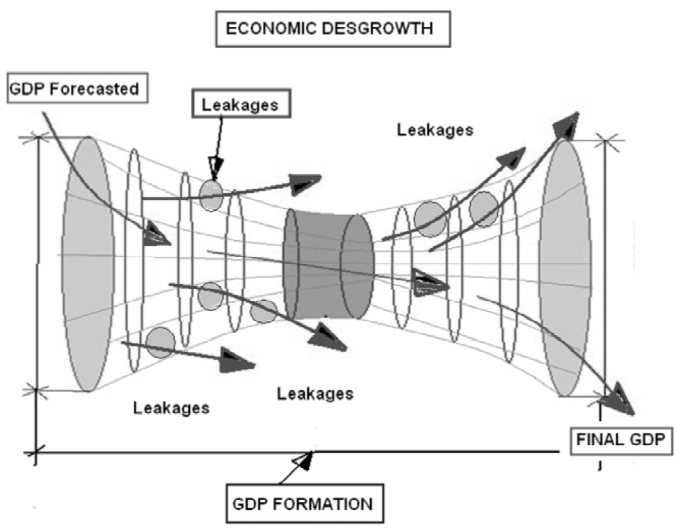
Thirdly, if we finish calculate the economic desgrowth then it is possible to start to evaluate the impact of all leakages that can generate less economic growth on any country. Therefore, the final GDP is equal to the forecasting GDP minus the final GDP follow by expression 4.8.

$$GDP_{final} = GDP_f - GDP_{desgrowth} \qquad (4.8)$$

4.3. The Visualization of the GDP Desgrowth

According to Figure 9 is possible to observe that in the process of the GDP formation that its initial stage starts with the GDP forecasted that can be affected its original size by the possible appearance or existing of multi-leakages into the process of the GDP formation until we can arrive to the final GDP. The main point in discussion in this part of our paper is that the reduction of the final GDP is directly connected to the different leakages in the process of the GDP formation. Our argument is that the control of all possible leakages in the process formation of the GDP is depend on the regulation and sustainability policies in the short run (one year). Moreover, if we keep low final GDP growth rates in the long run then this mean that the leakages are expanding so fast that we can lose control on them. If we lose control to manage all these leakages then our economic desgrowth can damage severely the final GDP always. The final result became materialized by fast growth rates of poverty and economic parasitism. The economic parasitism is defined "when major part of the population is inactive for long periods of time from the labor market, at the same time, this can generate conformism and sedentary among large part of the unemployed labor of any country". Finally, the conformism and sedentary among the unemployed labor is going to have a several repercussion on the low productivity and the production of non-competitive good and services for the domestic and international market.

Figure 9
Economic Desgrowth



5. CONCLUSION

This paper will introduce four basic economic theoretical frameworks that can help to analyze and visualize microeconomics and macroeconomics from a multidimensional perspective. The main objective of this paper was to demonstrate that is possible the application of multidimensional graphical modeling approaches that are offering by Econographicology. Additionally, this paper tries to study the possibility to have better understanding about microeconomic and macroeconomics for the new generations of economists around the world. This is based on the application of multidimensional graphs respectively.

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In memory of my mother "*Ms. Graciela E. Estrada Orellana*"

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