1. Introduction

As the homeland of human beings, the Earth is definitely a treasure to all of us. However, according to some scientific researches, our Earth is undergoing a very tough time in many aspects. The natural resources are exploited in an unsustainable way; the biodiversity decreases; and the water and air has been polluted. In the meanwhile, the dominators' policies are often inefficient. What's worse, an impropriate policy may even worsen the situation. To maintain the health of the Earth, we need to pay our joint effort. Before carrying out a plan, how to estimate the influence of the policy becomes the key problem to the dominators as well as the Earth.

In this paper, we aim to achieve two main goals:

- Build up a global evaluation system which can reflect the Earth's variation.
- Estimate the state of the Earth of the future and provide a proper countermeasure.

We use the concept of resonance in physics and the degree of polymerization in high polymer chemistry to establish the global network model with the theory of negative entropy and polymerization. Here, we choose 27 countries as our global system and take GDP, CO_2 emission, energy use and population as research objects. By analyzing the data of the past decades, we find out that the variations of all these four factors have their own tendency. With the increase degree of polymerization, it is good for the development of human-related elements while bad for the development of natural-related elements and vice versa. Following this pattern, the dominators will be able to put forward some beneficial and efficient policies.

2. Terminology and Definitions

To directly address the relationships of nodes, we need a feasible way to measure the level of compactness of these relationships. Let's assume that a initially isolated node have something in common with the nodes inside the group, the process of establishing the relationship between this isolated node and the nodes-group is similar to the phenomenon of resonance in physics. As a result, we can regard the high compactness as strong resonance while taking low compactness as weak resonance in this case. In this view, we decide to make a classification of the resonance between nodes. To begin with, we set up a resonance coefficient λ to represent the intensity of resonance, while let λ_1 and λ_2 ($\lambda_1 > \lambda_2$) be the judging requirement to distinguish different levels of the resonance. The partition is as follow:

- ***Strong resonance***: The resonance of nodes $\lambda > \lambda_1$, the relationship can be regarded as strong. The relationships between nodes involve many fields (economy, politics e.g.). It will have strong influence to the development of nodes in the foreseeable future. It weights 1 when calculating clustering coefficient.
- ***Weak resonance***: The resonance of nodes is often caused indirectly, with the feature that $\lambda_2 < \lambda < \lambda_1$, the relationships between nodes exist in only a few fields or occur discontinuously. It will merely have weak influence to the connected nodes. It weights 0.5 when calculating clustering coefficient.

- ***Isolated***: The resonance of nodes $\lambda < \lambda_2$. There is no the relationship between nodes and they can be nearly regarded as isolated. An isolated note develops in a separate system relies only on the feedback of itself.
- ***Clustering coefficient*****:** Featuring the degree of polymerization of vertices, the local clustering coefficient can be worked out as follow:

$$C_i = \frac{2*e_i}{k_i*(k_i-1)} \quad [1]$$

Let e_i be the number of links that exist between vertices and its neighborhood, and k_i be the number of neighbors of a vertex.
For we produce the graph as a undirected graph, taking former clarifications into account, equation (1) can be rewrite as:

$$C_i = \frac{2*(e_{is}+0.5*e_{iw})}{k_i*(k_i-1)} \quad [2]$$

In equation (2), e_{is} stands for strong resonance existed and e_{iw} represents weak resonance.
The clustering coefficient of a system can be calculated as:

$$\bar{C} = \frac{1}{N}\sum_{i=1}^{N} C_i \quad [3]$$

3. Symbol Explanation

Variables and parameters used in the model are listed in Table 1.

Table 1.
Symbol table

Parameters	Description
λ	Resonance coefficient
λ_1	Correlation constant of strong resonance
λ_2	Correlation constant of weak resonance
γ	Correlation coefficient
C	Clustering coefficient
L	Totality of links
t	Time

4. Assumptions

In order to increase the reliability of our solution, we make a few assumptions:

- To nodes we have chosen, they can represent the global network in a great extent.
- If two nodes develop in a similar trend for 20 years, we believe that there is a strong resonance between them.
- The world will develop along the previous steps in the foreseeable and there are no terrible catastrophe and great actions (such as war) taken by human.

- All the data we have collected is authoritative and accurate.

5. Methodology

There is now a common sense that everything in the globe is not isolated, consistent with this notion, we should take them together as a system. Having this precondition, we can set up our fundamental model as follow.

5.1 Lemma

The relationship between each node is complex and relevant to many factors. Therefore, based on the premise that elements may affect elements nearby, we build up a transition system to quantify the relationships of nodes. In the year t, we choose two neighboring nodes A and B randomly. (Fig 1)

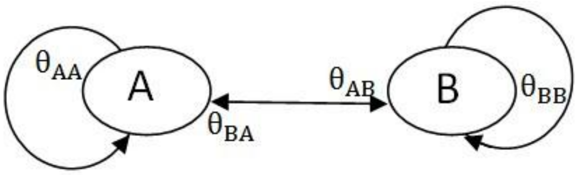


Fig 1. State shift in a net of two nodes

Assuming that these two nodes are initially separated and linked at time t=0. In order to describe the new state in year (t+1), we use a series of state transition equations as follow:

$$\begin{cases} A[t+1] = \theta_{AA} \cdot A[t] \\ B[t+1] = \theta_{BB} \cdot B[t] \end{cases}, t < t_{AB}, \quad [4]$$

And

$$\begin{cases} A[t+1] = \theta_{AA} \cdot A[t] + \theta_{BA} \cdot B[t] \\ B[t+1] = \theta_{BB} \cdot B[t] + \theta_{AB} \cdot A[t] \end{cases}, t \geq t_{AB}, \quad [5]$$

The self-feedback occurs all the time when nodes affect others, and there is a time delay of every impact. Parameter θ_{ij} represents the level of the feedback or influence between node i and j, as well as a function $F(i[t], j[t])$ which varies with present state $i[t]$ and $j[t]$. We can rewrite equation [1] as equation below:

$$A[t+1] = F_1(A[t], B[t]) \cdot A[t] + F_2(A[t], B[t]) \cdot B[t] = F(A[t], B[t]), \quad [6]$$

where F is a complex function that describes the state shift with self-feedback of one node and transition to the other nodes.

When the state transition equation of node i have an input of j[t] and the state shift of node j varies with i[t] as well, we define that i is linked to j.

If all the nodes are linked to each other, the net will transfer into a regular network with high-level resonance, in which the state of each node varies almost in the same direction in a period of time.

5.2 Transition System in Reality

There is a consensus that links between the nodes are not very easy to be established during the process of natural development. In order to test the feasibility of our model, we decide to make a simple example. In a case where there are four towns A, B, C and D locating in a small range of area, the natural environment of them are similar. Three towns (A, B and C) links with each other firmly in many fields (e.g. trades, population, migration), and we can take them as a primary system. In the meanwhile, D is a far less developed town isolates from the other three. The clustering coefficient of the whole system (including A, B, C and isolated D) is

$$\bar{C} = \frac{1}{4}\sum_{i=1}^{3} C_i = \frac{3\cdot 1+0}{4} = 0.75.$$

A, B and C constitute a steady and continual system where new state shift with the transition equation below:

$$\begin{bmatrix} A[t+1] \\ B[t+1] \\ C[t+1] \end{bmatrix} = \begin{bmatrix} \theta_{AA} & \theta_{BA} & \theta_{CA} \\ \theta_{AB} & \theta_{BB} & \theta_{CB} \\ \theta_{AC} & \theta_{BC} & \theta_{CC} \end{bmatrix} \cdot \begin{bmatrix} A[t] \\ B[t] \\ C[t] \end{bmatrix}, \quad [7]$$

In the year t, thanks to the support of B town, the economy in D town develops gradually. Therefore, we can take it as the initial weak link between D town and B town. Following the change in economy, we can make an anticipation that links in population, natural resource and other factors will form in the coming future as well. (**Fig 2**)

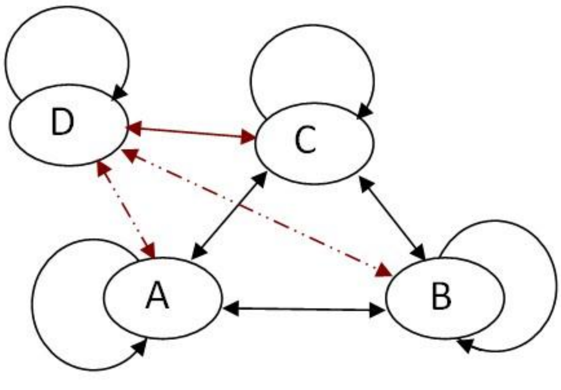


Fig 2. Introducing a new node

The state transition matrix [7] now transfers into

$$\begin{bmatrix} \theta_{AA} & \theta_{BA} & \theta_{CA} & 0 \\ \theta_{AB} & \theta_{BB} & \theta_{CB} & \theta_{DB} \\ \theta_{AC} & \theta_{BC} & \theta_{CC} & 0 \\ 0 & \theta_{BD} & 0 & \theta_{DD} \end{bmatrix}, \quad [8]$$

In the year$(t + t_{DB})$, where t_{DB} represents response time between D and B, since the links between A, B and C are still exist, part of element from D to B will affect A town and C town. However, the influence will take effect in the year after. It also improves the resonance of A and D. (we can confirm it by calculated transfer matrix in the following analysis.) We define this kind of link as weak resonance with features of vulnerability and discontinuity, and are easily broken artificially.

Let's take a further discussion on the changed clustering coefficient of the system:

Since

$$\bar{C} = \frac{1}{4}\sum_{i=1}^{3} C_i = \frac{\frac{2}{3}+\frac{5}{6}+\frac{5}{6}+1}{4} = \frac{5}{6} \ .$$

It shows a significant improvement in the clustering coefficient by connecting nodes artificially. A system with high degree of polymerization is strong in synergic development, which means they are easy to develop together in a fast speed. However, this is based on the sacrifice of self-concordance of the system. Once a member suffers frustration, it's hard for the system to recover by itself.

Therefore, whether it is beneficial to increase the degree of polymerization of the system is distinguished in judgment of different elements. For some human-related elements, the development is based on a high degree of aggregation, (for example, the economic entity and human society). While for natural elements like pollution and natural resources, its health relies to a higher extent on the ability of recover and balance by a system itself.

Human beings are able to link nodes together as well as breaking up their connections. This may be helpful when conducting policy making. For example, to prevent diffusion of desertification, authorities often take measures of planting protection forest on the boundary of deserts. It can be recognized as breaking up the link between two districts on the transmission of element sand artificially for the sake of pollution control. On the contrary, the establishment of international trades and foundations of economic entity can be regarded as connecting nodes in order to develop at a faster pace.

5.3 Mathematical Model

Frequently, factors (such as environment and population) in a global system are macroscopic concepts. Therefore, how to quantify the connection of these factors becomes the key point of building our evaluation scheme. To set up a criterion of a healthy system, we borrow the concept of *Degree of Polymerization* in *High Polymer Chemistry*. By using polymerization, we have a better access to represent the relationships of the factors discussed above. Different from the resonance coefficient λ of nodes, the degree of polymerization C is s characterization of a system that contains many nodes. Nevertheless, it is important to note that the correlation of nodes may affect the polymerization of the whole system.

Inside a steady system, nodes must have something in common more or less and they might build up contact in the common field. If we take one contact between two nodes in any field as a connection, the number of connections can represent the degree of polymerization. Therefore, system with a large number of connections has high degree of polymerization and vice versa. Note that the clustering coefficient is the measurement of the degree of polymerization.

To our knowledge, the degree of polymerization varies from factor to factor. It is important to note that a factor may be healthier if the system has higher degree of polymerization, while some other factors may be the opposite. Also, we should be aware that when a certain factor in a system becomes healthier, it may be at the cost of the other factors and have some adverse impacts to the future development of them. For example, when we consider the benefit of human beings and nature, the conflict we've talked about above will occur. We human prefer to in the cities (system with high degree of polymerization) in most cases. In this way, we are able to have a better living standard and the cities have faster economic development. However, in this case, the natural environment is undertaking an overloaded situation which is unhealthy for the long-term development. (**Fig 3**)

Fig 3. Restriction between human factors and nature

Now, we are safe to say that every single factor has its optimum interval in the polymerization axis. The optimum intervals will not be identical in different cases.

6. Global Network System

In order to establish our global system and make our solution more reliable, we decide to choose country to be our node that has larger sample as well as closer connection rather than continent. Based on this standpoint, we choose 27 countries around the world uniformly. Every continent has 3 to 6 countries chosen to ensure the general applicability and coverage of the globe. Therefore, we can represent the global system approximately through these 27 countries.

6.1 The Basic GDP Network

We acquire the data of annual growth rate of GDP from 1961 to 2010, according to the statistics of data.worldbank.org [2013]. Considering, the time period from 1961 to 2010 is such a long time, we divide it in to several shorter time periods for the analysis of the variation tendency of GDP in-depth. Using the basic curve fitting and correlation analysis of the statistics, we figure out the resonance coefficient λ of each country by the following equation:

$$\lambda_{XY} = \left| \frac{\sum_{i=1}^{N}(X_i - \overline{X})(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{N}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{N}(Y_i - \overline{Y})^2}} \right|$$

We list them in **Table 2**.

Table 2. Section of reasonance coefficient λ
of each country in growth rate of GDP

Country	China	Indonesia	Japan	Korea，Rep.	Philippines
China	1.00	0.47	0.23	0.22	0.17
Indonesia	0.47	1.00	0.41	0.74	0.37
Japan	0.23	0.41	1.00	0.58	0.53
Korea, Rep.	0.22	0.74	0.58	1.00	0.29
Philippines	0.17	0.37	0.53	0.29	1.00

Generally speaking, when it comes to the correlation, people consider the relationship between two nodes as strong correlation when correlation coefficient $\gamma > 0.8$. Although we regard the meaning of correlation coefficient γ and resonance coefficient λ as the same in most cases, however, we cannot apply this convention in the global network system. Because $\gamma > 0.8$ is not accurate enough to describe the resonance in economy. Consequently, based on the correlation coefficient in common sense, we set up the proper resonance coefficient of annual growth rate of GDP.

- Correlation constant of strong resonance $\lambda_1 = 0.5$
- Correlation constant of weak resonance $\lambda_2 = 0.4$

Now, the resonance coefficient criteria can be redefined as: strong resonance—$0.5 < \lambda \leq 1$; weak resonance—$0.4 < \lambda \leq 0.5$; isolation—$\lambda \leq 0.4$. Using the modified criteria of correlation and the correlation coefficient λ shown in, we can draw up the relational network of the annual growth rate of GDP in **Fig 4**.

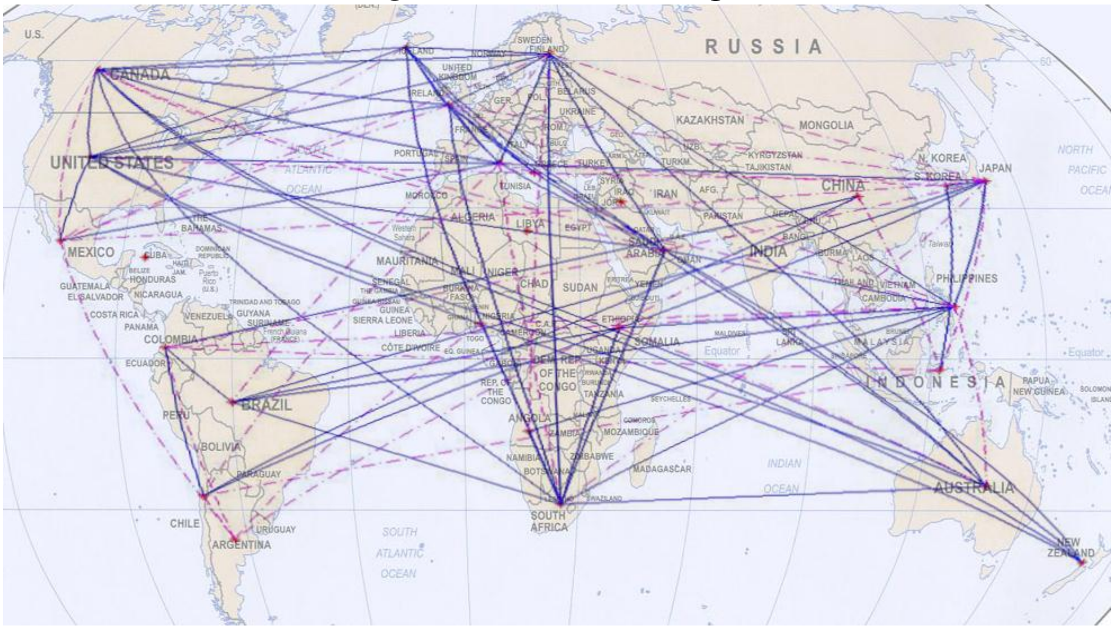


Fig 4. Global relational network of the annual growth rate of GDP from 1991 to 2010
Note that strong resonance is expressed in fully line; weak resonance is in dash line

Having the foundation of Global relational network of the annual growth rate of GDP in 1991- 2010, similarly, we can draw up the transition of global network in the past decades with an order of time period. In order to observe the variation tendency of the

GDP network clearer, we put aside the world map and analyze the networks alone. The variation is demonstrated in the rectangular coordinate **Fig 5**.

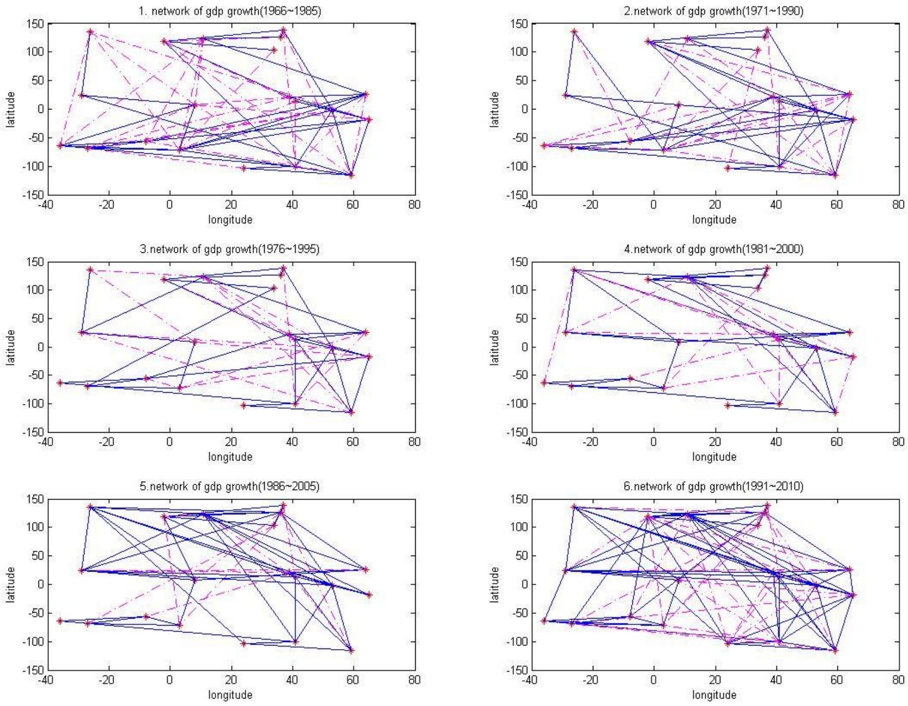


Fig 5. The world's GDP network variation in the past decades

Note that the abscissa represents the longitude while the ordinate is the latitude; strong resonance is expressed in fully line; weak resonance is in dash line.

Generally speaking, the variation of GDP of the global system shown in **Fig 5**, has reflect the changing tendency that the connections of GDP decreased in 1960 - 1990 and then increased in 1990 – 2010. However, the network diagram is complex and it is inappropriate for further analysis.

6.1.2 The Further Processing and Analysis

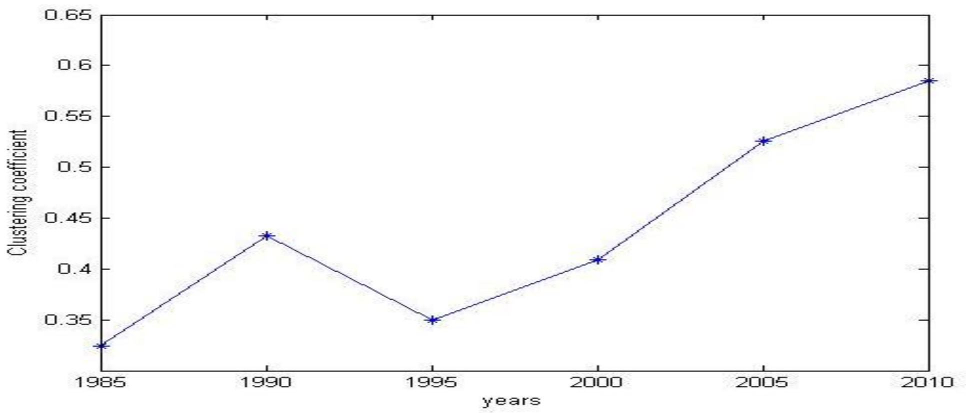
Using Clustering coefficient is an accessible way to simplify the GDP network. With the variation in the past decades in **Fig 5**, we figure out the clustering coefficient of each period of time. Here, each period is represented by its final year. For the reason of the huge amount of data, we merely list out the clustering coefficient of 2010 in **Table 3** for short.

Table 3. Clustering coefficient of global system in the annual growth rate of GDP in 2010

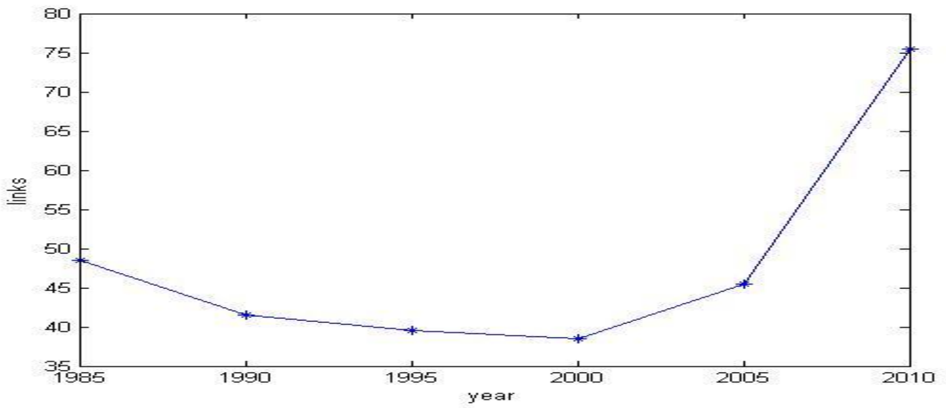
Country	Clustering coefficient	Country	Clustering coefficient
China	0. 17	United States	0. 82
Indonesia	0. 42	Argentina	0. 50
Japan	0. 29	Brazil	0. 60
Korea, Rep.	0. 50	Chile	0. 23

Philippines	0. 61	Colombia	0. 15
Iraq	0. 00	Cuba	0. 00
United Arab Emirates	0. 00	Angola	0. 00
Finland	0. 66	Ethiopia	0. 00
Greece	0. 68	Libya	0. 00
Iceland	0. 65	Nigeria	1. 00
Italy	0. 49	South Africa	0. 72
United Kingdom	0. 76	Australia	0. 88
Canada	0. 77	New Zealand	0. 00
Mexico	0. 80		
Average Clustering coefficient		0. 5850	

We take the average clustering coefficients of each period as a static state, and use the 'static state' to stimulate the variation tendency of the global system in annual growth rate of GDP in the past 40 years. Considering both clustering coefficients and totality of links are meaningful to deduce the reason of the variation law, we draw their curves in **Fig 6**.



(a)



(b)

Fig 6. (a)Variation of clustering coefficient of GDP; (b) Variation of totality of links of GDP

The clustering coefficient of the world decreased at the beginning of the 1990s and increased again in millennium while the totality of links varied in a similar way. Compared the result shown in **Fig 6** with history, we are reminded with the dissolution of the Soviet Union in 1991 and the bipolar system of international politics broke up. As a result, the world's clustering degree decreased. When it comes to 21st century, the world tends to develop into multi-polarization in economy and clustering degree increases naturally. Therefore, the tendency we infer fits well with historical law.

6.1.3 The GDP Clustering Degree in the Future

Summarized from the past data, we have inferred an appropriate curve of clustering coefficient. Based on the statistics we have got, we fit it with a logarithmic function and find that the future trend of clustering coefficient as **fig7**.

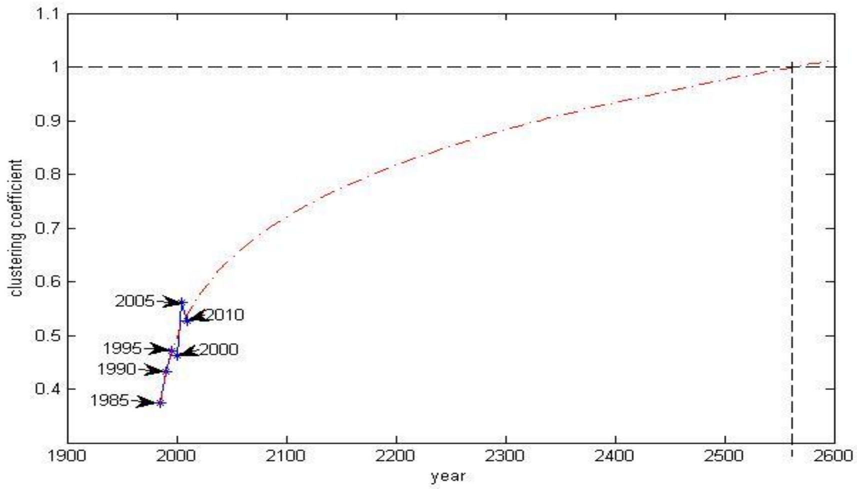


Fig7. Future trend of clustering coefficient

It reveals that in the nearby future, the degree of polymerization will reach a limitation of maximum of C of 1without human effects. This seems beneficial for the global economic system because all the nodes link with each other and develop on a uptrend all together. Unfortunately, it could be the opposite.

Let's consulting a real case occurs recent year. European Union is widely deemed as a successful economic community that brings about benefits for its member. We analyze its network transition as shown in **Fig 8**.

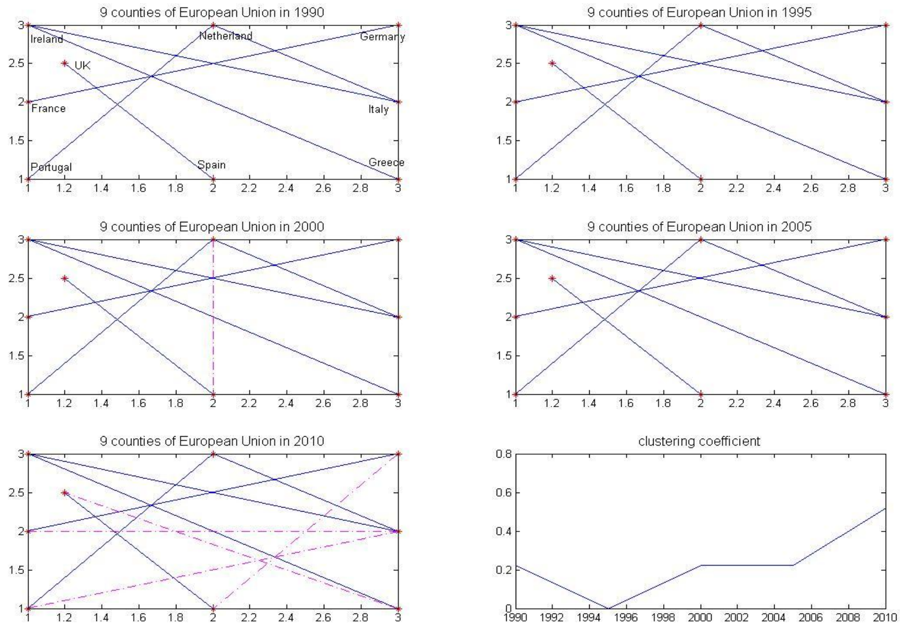


Fig 8.GDP Network in the European Union

It has a high degree of aggregation and the resonance between them grows continuously since its foundation in 1993. Developing at a fast pace, nevertheless, its capacity of recovering is decreasing and conflicts erupted recently in the form of European debt crisis. Superficially, it is caused by disorder in economics system of the countries involved. Deeply, explained by our theory, it is rooted in the long time of high clustering coefficient and large number of strong resonance between them. This pulls members originally while forces them to develop in a similar direction after a period of time. Being overloaded for a long time, the system will go to vitality in the end.

Therefore, we would like to propose a heroic suggestion that we can overcome such difficulties by controlling resonance between countries. In other word, that is to make the system out of sync. For example, authorities may carry out intermittent trades between counties instead of long-term fixed trading when the clustering coefficient increases beyond the healthy range.

6.2 Global CO_2 Emission

Based on the judging scheme we have raised, we examined the transitions of network of last two decades as Fig 9 demonstrates with the same time period as the GDP case. To further test and verify our hypothesis that degree of polymerization has influence on the global network evolution, we make comparison between world's total emissions of CO_2 and clustering coefficient of those years we examine. The relationship can be revealed by the curves below (**Fig 10**):

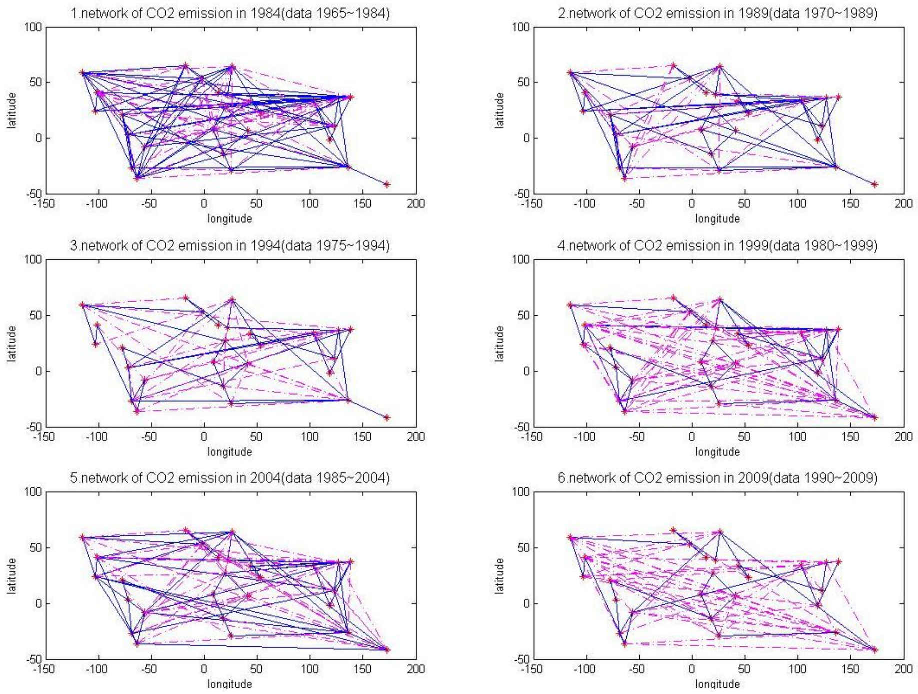


Fig 9. Network transitions of global CO_2 emission in last two decades

Just like what we address in the GDP case, we processed the statistics and worked out links and average clustering coefficient of nodes in **Table 5**:

Table 5. Totality of links and average clustering coefficient of global CO_2 emission

Years	1985	1990	1995	2000	2005	2010
Clustering coefficient	0.48	0.38	0.45	0.47	0.43	0.33
Links	93.0	58.0	51.0	66.0	76.5	52.0

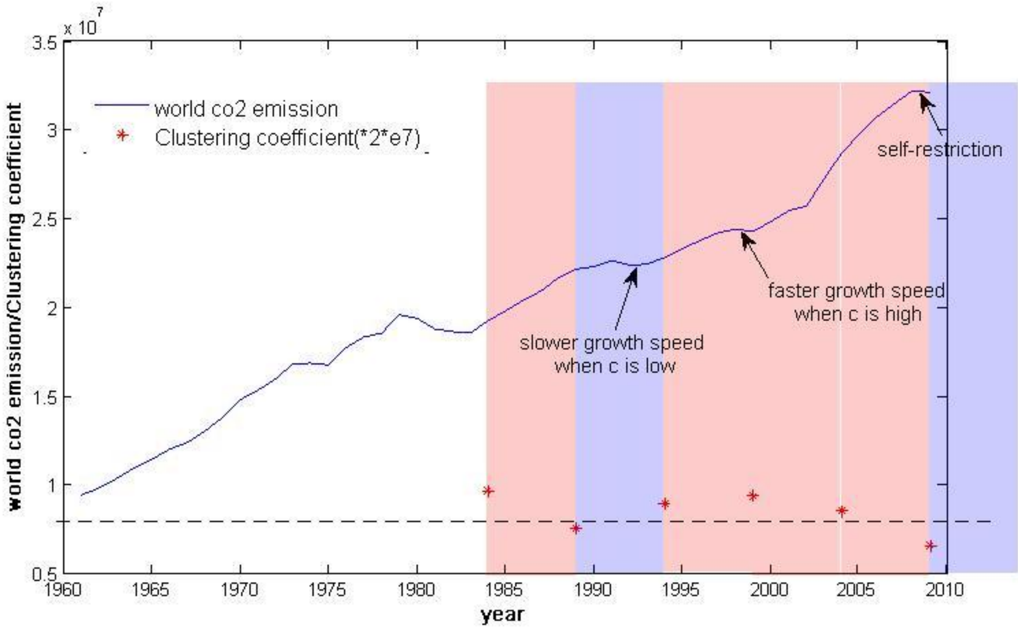


Fig 10. Relationship between the variations of world's total emissions of CO_2 and clustering coefficient

The curvature of the figure changes constantly, nevertheless, the curve of the world's CO_2 emissions generally forms an uptrend. We divide the growing periods with different clustering coefficient we have worked out (**Fig 10**). The curve changes at a faster speed with higher clustering coefficient (areas marked in red), while at a slower pace when clustering coefficient is low (areas in blue). It may even have self-restriction to help recover from a terrible situation when clustering coefficient drop beyond a value. Considering that policies to control CO_2 emissions have been put into force constantly during recent years and various type of new energy have been exploited to reduce the use of high-carbon energy, it can be defined that many countries (nodes) have changed their trends in CO_2 emissions and add the degree of disorder in CO_2 emission system. With large quantity of strong links (resonance) turning to weak ones and even broken up, the system's ability of recovery strengthens. On the contrary, this may to some extent lead to restriction in development of economics. In addition, it undoubtedly builds up new network of other kinds of energy resources. Our strategy is more inclined to control the CO_2 emission in the districts of high degree of polymerization, as well as finding new energy to 'break links or keep the form of weak resonance from turning strong.

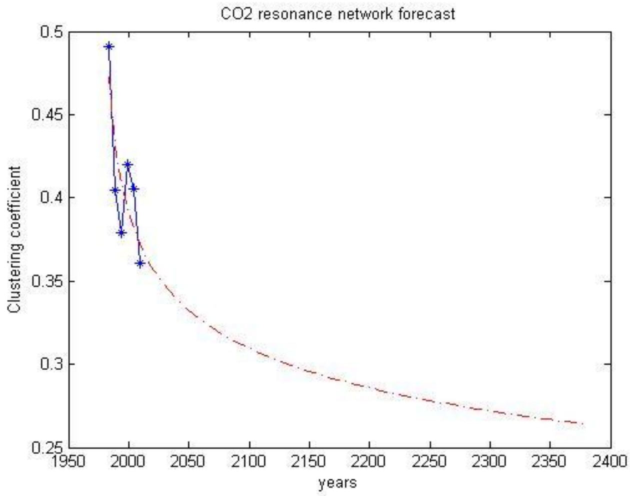


Fig 11. Forecast of future trend

The forecast shows that if we continue putting effort in controlling CO_2 emissions, the capacity of self-recovery of the environment would rise in the nearest future.

6.3 Global Energy Use

To the global energy use, we acquire the data from 1971 to 2010 from world bank.org [2013]. Similarly, we divide them into several periods and represent each period by its final year. Applying the same method as the two cases above, we draw up the network of different time periods (Fig 11).

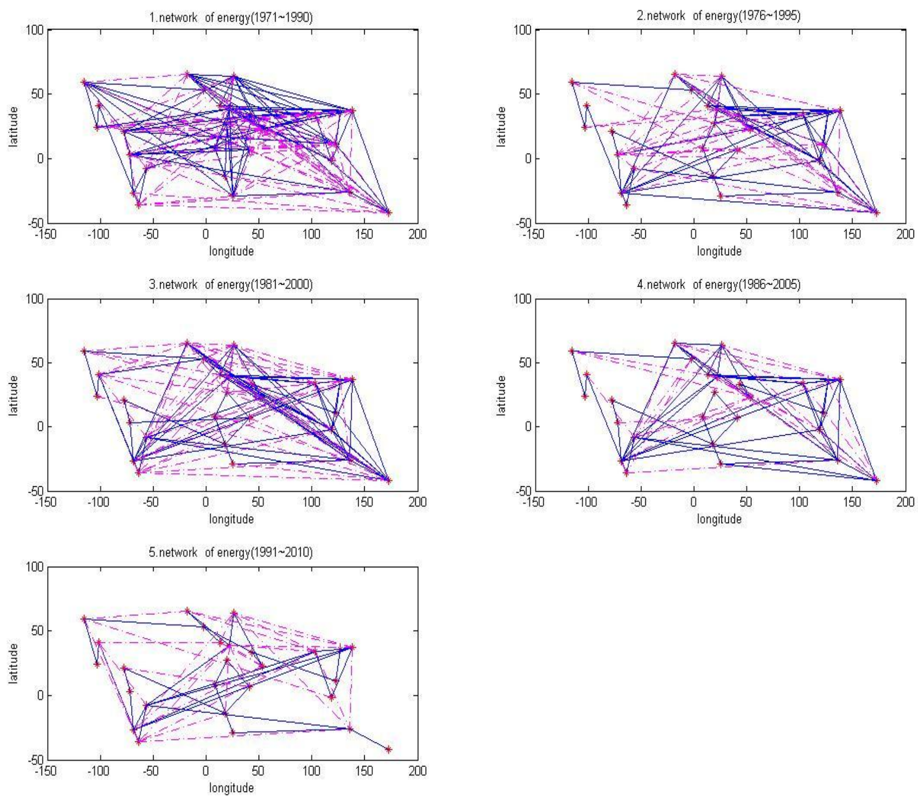
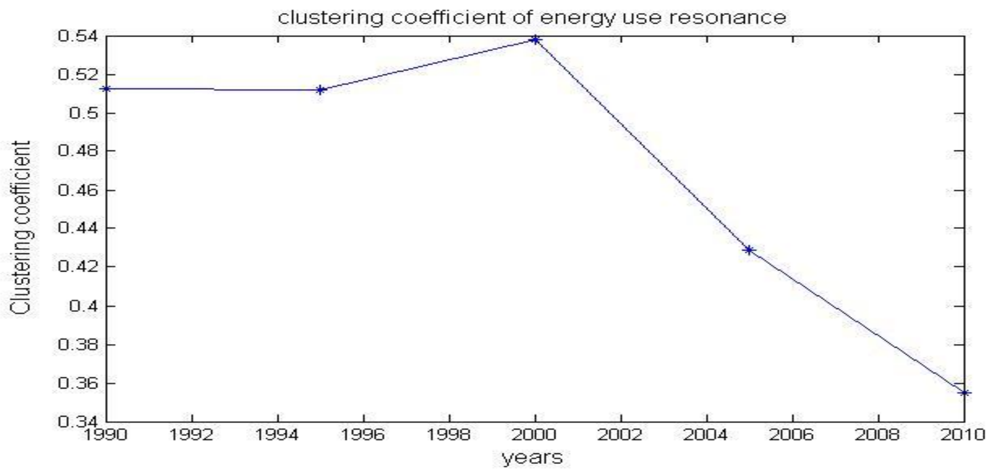


Fig 12. Network transitions of global energy use in last two decades

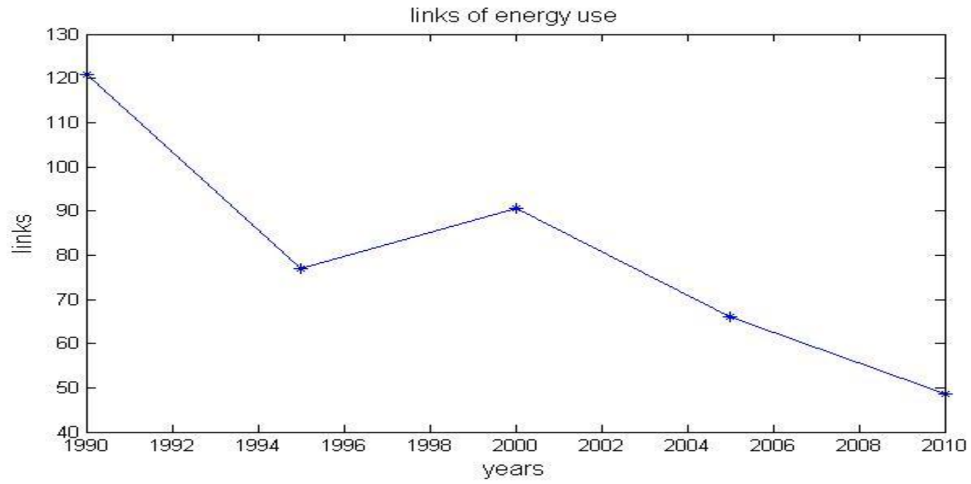
In this way, clustering coefficient and links in the energy network can also be figured out in Table 6. We also depict them in the order of years in Fig 12 so as to investigate their inner pattern.

Table 6. Totality of links and average clustering coefficient of global energy use

Years	1990	1995	2000	2005	2010
Clustering coefficient	0.512396	0.512027	0.538159	0.428832	0.355129
Links	121	77	90.5	66	48.5



(a)



(b)

Fig 13. (a)Variation of clustering coefficient of energy use;
(b) Variation of totality of links of energy use.

From **Fig 13**, we discover that the correlations between the countries in our global system have undergone a decrease since the year 2000. Knowing from the news, many countries come to realize the importance of optimizing the energy structure to reduce the dependence on oil. With the rapid development of energy technology, new energy is no longer inaccessible. Solar energy, wind energy and natural gas have come into our daily life. Also, the technology of primary energies is improved, which lead to the increase of their use ratio. It is exact the reason of new energy and primary energy development, so that countries themselves have self-sufficiency more or less in energy field. Hence the tendency of clustering coefficient of energy use in **Fig 13** can be easily demonstrated. There is no doubt that the policy-making agency should keep the pace of developing new energy as well as improving the old technology.

6.4 Population Growth

Similarly, we obtain transfer of population resonance networks as shown in **Fig 14.** It is demonstrated by the graphs that more and more country are taken into resonance of population growth. We examine the statistics of the world's population growth and find that it grows steadily with polymerized center locates on Asian, Africa, and South American countries.

During the future prediction, we find that the resonance between countries is strengthening, which means if we do not take steps soon, it will transform into unrecoverable situations.

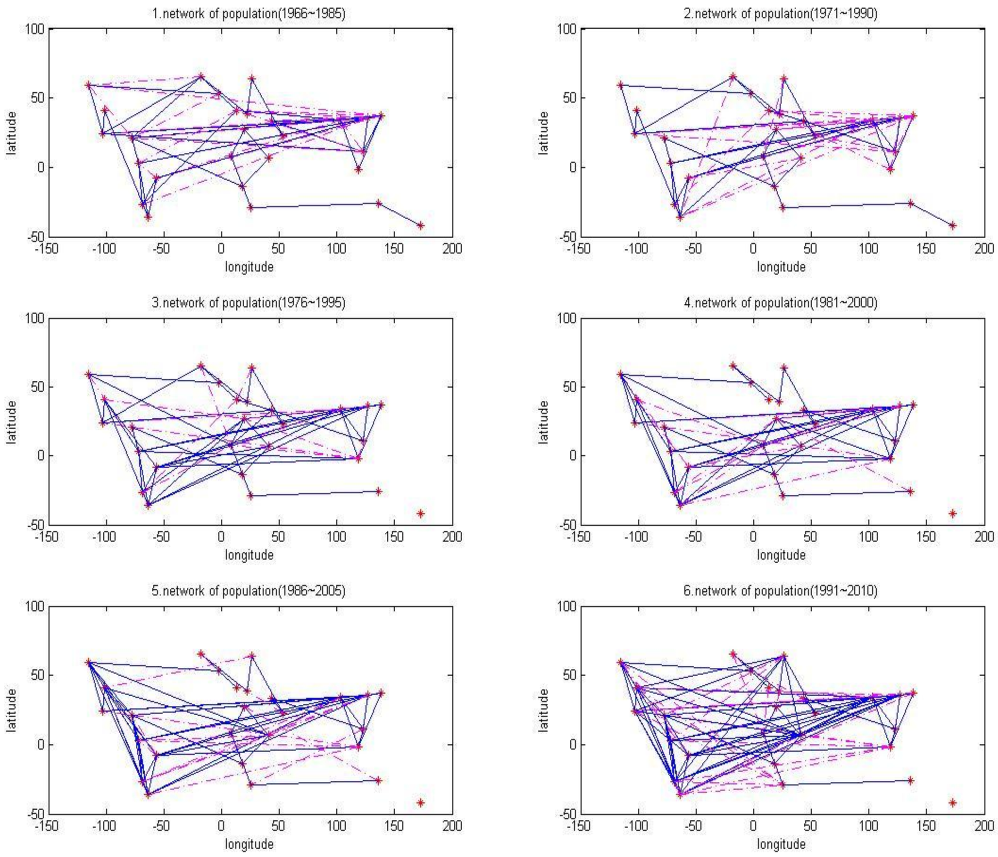


Fig 14. Network transfer of population

Also we draw up the future trend of population growth in **Fig 15**.

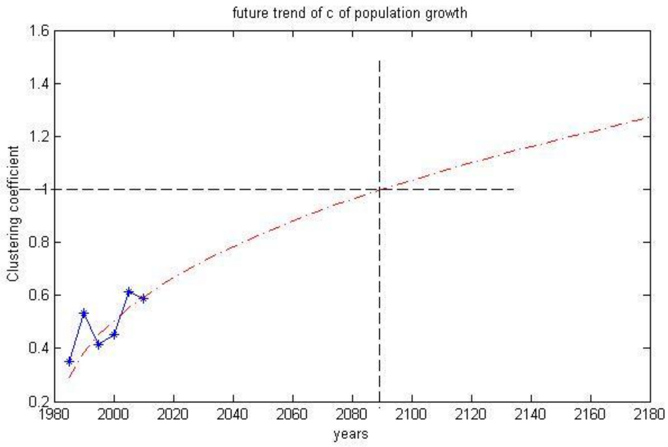


Fig 15. Trends of resonance in population growth

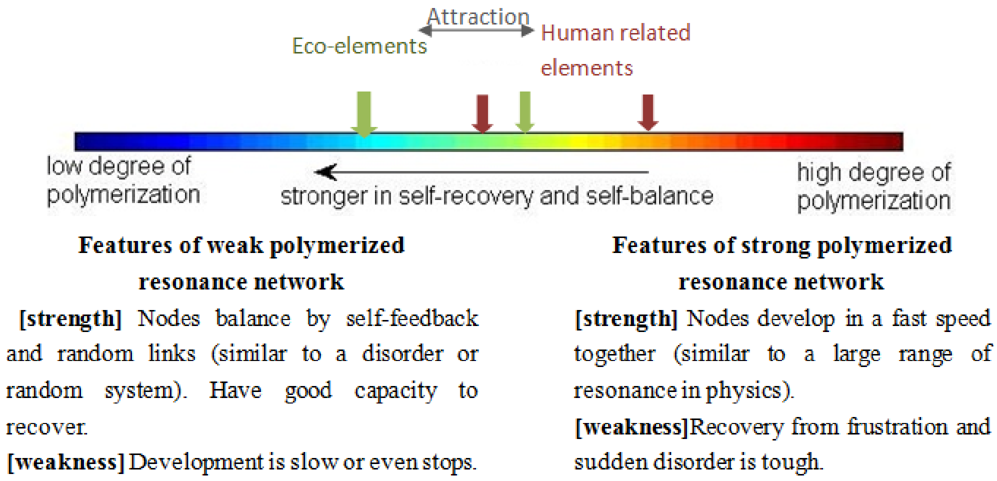
7. Sensitivity Analysis

When we build up the global network, we have ignored some uncertain factor. Here we analyze the rationality of our neglects in a dialectical way.

- The actual representative of nodes. We choose only 27 countries in the global system, both developed and undeveloped. There is no doubt that some of the important countries are out of our list and we admit that they will have some impacts to the accuracy of our result more or less. However, considering the chosen countries have their special character, the influence of ignoring some countries selectively is small. That is to say, our conclusion is still convincing.
- The resonance constant in reality. We have defined three relationships of the nodes: strong resonance, weak resonance and isolation. To a pair of nodes, which relationship them belong to depends on the correlation constant of strong resonance λ_1 and weak resonance constant λ_2 . Different from the convention, we determine these two constant by analyzing the operation of the real world. Hence, we let strong resonance constant $\lambda_1 = 0.5$; weak resonance constant $\lambda_2 = 0.4$. Although the constant is determined by limited data and with some personal subjectivity, it can reflect the objective law of development in a certain extent. Also, since variation pattern we infer fits well with the historical events and national policy, we believe the resonance constants λ_1 and λ_2 are credible.

8. Conclusion

Our network model is established with the foundation of strong resonance. We choose individual countries as our node to build up a network characterizing two types of resonance. The parameter of degree of polymerization describes the extent to which resonance impact the system by restricting either its ability of recover or its capacity of synergetic development.



Similarly, data of a well recycled ecosystem can be a good assistance dealing with measurement of ecosystem. Elements of humanity and nature restrict each other in the clustering coefficient's movement to either side. In other word, a better development of human society is often at cost of worsen the environment. Therefore we hold the opinion that the health clustering coefficient of all elements would be in a very small interval. Most of predictions and suggestions are given based on the resonance theory we have carried out. And to sum up, a policy maker needs to analysis where his new scheme may link the nodes, and judging the effect of policy by its effect to the clustering coefficient of resonance network.

9. Strengths and Weaknesses

- **Strength**

We set up the net work from a different perspective of resonance and the degree of polymerization in macroscopic. Yet it does not mean that we ignore the interaction between these factors. On the contrary, we have avoided the complicated discussion of element transfer. Moreover, we start a new method of explaining the relationship of nodes by the resonance in the global network. Resonance can also be explained as synergistic effect of various factors.

To examine our networks again, it is shown that many networks reveal different results from normal networks founded by analyzing every factor's transition through knowledge of every field. However, the judgment can still be set up when acquiring enough statistics needed.

- **Weakness**

For lacking data of global system development during the past long period of time, we do not work out the specific 'healthy interval'. In addition, we cannot confirm that the connection between global resonance network and the development of the global systems is universal without these data. Thus we raise more an idea than a detailed project which is safe in theory. However, inspired by *Negative entropy theory* and partly proved by ourselves, we believe that our ‘reverie’ makes sense to some extent.

10. Reference

[1] Anthony D. Barnosky, Elizabeth A. Hadly, Jordi Bascompte, Eric L. Berlow, James H. Brown,Mikael Fortelius, Wayne M. Getz, John Harte, Alan Hastings, Pablo A. Marquet, Neo D.Martinez, Arne Mooers, Peter Roopnarine, Geerat Vermeij, John W. Williams, RosemaryGillespie, Justin Kitzes, Charles Marshall, Nicholas Matzke, David P. Mindell, Eloy Revilla,Adam B. Smith. "Approaching a state shift in Earth's biosphere,". *Nature*, 2012; 486 (7401): 52 DOI: 10.1038/nature11018

[2]Donella Meadows, Jorgen Randers, and Dennis Meadows. *“Limits to Growth: The 30-year update”*, 2004.

[3]Robert Watson and A.Hamid Zakri. UN Millennium Ecosystem Assessment Synthesis Report,United Nations Report, 2005.

[4]University of California - Berkeley. "Evidence of impending tipping point for Earth.",*ScienceDaily*, 6 Jun. 2012. Web. 22 Oct. 2012.

[5]Jonathan D. Phillips. “Global and local factors in earth surface systems” *Ecological Modelling* 149 (2002) 257–272

[6]UNdata. http://data.un.org/Explorer.aspx?d=EDATA, 2013.

[7]Dawn Holland, Dirk Willem te Velde. “The effects of EU aid on receiving and sending countries-- A modelling approach” ,2012.

[8]USA.com. http://www.usa.com/, 2013.

[9]Climate Change Knowledge Portal,http://sdwebx.worldbank.org/, 2013.

[10]United States Environmental Protection Agency. http://www.epa.gov/, 2013.

[11]Duncan J. Watts, Steven H. Strogatz. “Collective dynamics of‘small-world’ networks”, *Nature*, VOL 393, 4 JUNE 1998.