A PROPOSAL OF THETICAL ECONOMY AND ANTITHETICAL ECONOMY BY USING OPERATIONS RESEARCH TECHNIQUES

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Abstract

In this paper, the author Kinoshita proposes Thetical and Antithetical economies in macroeconomics by utilizing the technique of operations reserach (OR). The author also states the economy naturally goes through a bubble economic phase, followed by its bursting, when it moves from Thetical Economy to Antithetical Economy. Thus, the author analyzes and identifies how each of the four economic phases (Thetical Economy, bubble economy, the bursting of the bubble, Antithetical Economy) is to be formed. The author also believes that the two major economic events in the past, or the prolonged recession in Japan over the last 20 years, and the global downfall in stock prices triggered by the 2008 U.S. sub-prime loan crisis, which adversely affected general consumers, presented significant difficulties within the study of economics. It is the position of this paper that Japan's recession and the U.S. sub-prime loan crisis have revealed a new fundamental economis truth, in view of the fact that macroeconomics was born from the Great Depression, a prolonged slump that originated in the United States 80 years ago.

Keywords: Linear Programming, Macroeconomics, Thetical Economy, Antithetical Economy, Bubble Economy

Introduction

While the prolonged recession Japan has experienced during the last 20 years, along with the global downfall in stock prices triggered by the 2008 U.S. sub-prime loan crisis, adversely affected general consumers, the two events also presented significant difficulties within the study of economics. It should be noted that macroeconomics was born from the Great Depression, a prolonged slump that originated in the United States 80 years ago, when John Maynard Keynes introduced the principle of effective demand (Keynes, 1936).

It is the position of this paper that Japan's Heisei recession and the U.S. sub-prime loan crisis have revealed a new fundamental economic truth, one at least equivalent to the theory advocated by Keynes.

In explaining this position, the author created the term "Thetical Economy and Antithetical Economy in Macroeconomics," a version of an expression quite common in operations research(Kinoshita, 2009, 2011a). The author named the two economic phases, or Thetical Economy and Antithetical Economy, after logical models used in the Hegelian dialectic (Hegel, 1807). The introduction of this concept into conventional macroeconomics establishes a tidy system. And the author proposes that Thetical Economy and Antithetical Economy in linear programming, or one of the most widely used tools in operations research (OR), can embrace several important factors developed independently since the 1930s.

According to the author (Kinoshita, 2012b, 2013), in a thetical economic phase, capital expenditures of private corporations grow, creating an impetus towards the maximization of profits (the spirit of capitalism, as explained by Max Weber(Weber, 1904).

In this case, as Adam Smith (Smith, 1776) once wrote, the "invisible hand of God" works to lead the economy to a significant growth (the role of the market). The government, on the other hand, needs to become intent on financial reforms, by going against the direction of the market role (the role of the government). This is because if the government role aligns with that of the market, it could cause crowding out, which then could bring about an acceleration in the inflation rate.

However, once every few decades a bubble economy pops up in a complicated web of dreams and desires in the private sector and eventually bursts. This is when the economy enters an antithetical economic phase.

With this, the value of property purchased on credit during the bubble period collapses, and the efficiency of investment drops below the market interest rate for corporations with debt. As a result, as described by Max Weber, corporations stay away from capital expenditure and aim to minimize debt rather than maximize profits. In other words, during an antithetical economic phase in macroeconomics, the goal of corporations shifts from maximization of profit to minimization of debt, leading the economy to shrink (the role of the market).

In the meantime, the government needs to become intent on increasing public spending, going against the direction of the market role (the role of the government). This is because if the role of the government aligns with that of the market, it could cause the economy to slide into a deep recession, which then could aggravate deflation.

The author in this paper formulates the above two phases, or Thetical Economy and Antithetical Economy, by treating them as primal and dual

problems of linear programming, and describes their meaning. In doing so, the paper shows that important economic factors in the two phases in fact form dualisms in their respective areas.

The author ultimately wishes to put an end to a classic debate in economics (Stiglitz, 2007) : The debate between the so-called classical and/or neoclassical school of economists (Adam Smith, Ricardo, Marshall, Mills, Hayek, Freedman, etc.), who maintain that "the market is the only principle that supports capitalism," and the Keynesians (Keynes, Hicks, Samuelson, Modigliani, Lucas, etc.), who maintain that "one needs to recognize the role of the state for capitalism to work, in addition to the market principle."

This debate, however, is based on the assumption that there are two different perspectives to describe the same economics. What the author is proposing in this paper is that there is in fact a unique perspective in each of two different types of economics (Thetical Economy and Antithetical Economy in macroeconomics).

Changing the Perspective in Macroeconomics

The author advocates a change of perspective in traditional macroeconomics. While conventional wisdom tells us that macroeconomics is a collection of microeconomics, the author views macroeconomics as a collection of management issues (corporate behaviors), which leads to a change shown in Figure 1. In addition, the author maintains that corporate management issues are clearly different in a thetical economic phase and an antithetical economic phase. Simply put, in Thetical Economy, investments are prompted by a management environment in which the efficiency of investment is high (healthy financial status). As a result, corporations seek to maximize their profits.
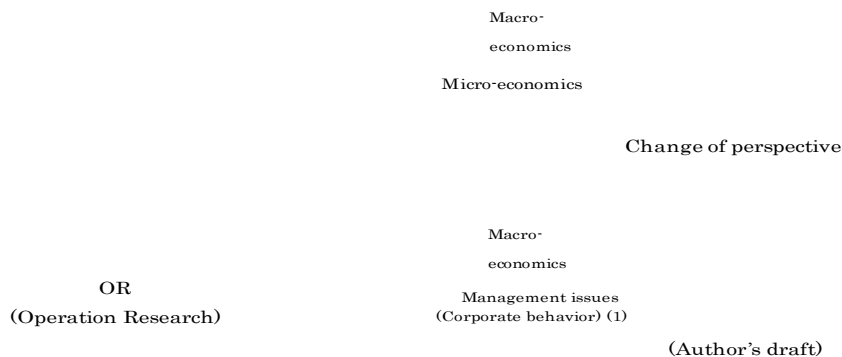

Macro-
economics
Micro-economics

Change of perspective

Macro-
economics
Management issues
(Corporate behavior) (1)

OR
(Operation Research)

(Author's draft)

Figure 1 Relationship between Macroeconomics and Management Issues

Management issues (corporate behavior)

Corporate behavior

Efficiency of investment is high (Primal problem condition)

Efficiency of investment is low (Dual problem condition)

Make investment (Increase investment)

Avoid investment (Reduce investment)

Healthy financial status

Unhealthy financial status (bad debts)

Maximization of profits (Primal problem objective function)

Minimization of debts (Dual problem objective function)

Linear programming

(Author's draft)

Figure 2 Corporate Behavior

On the other hand, in Antithetical Economy, private corporations stay away from (or reduce) investment because the efficiency of investment is low (financial status is not good). As a result, corporations aim to minimize their debt (see Figure 2)

Behavior of Corporations and Government in Thetical Economy
In Thetical Economy in macroeconomics, corporate behaviors are expressed by an objective function that maximizes profit. It also should be noted that corporate behaviors in a thetical economic phase can be expressed using a formula for the primal problem of linear programming (see Formula (1)). In other words, corporations will behave in such a way as to maximize profit, which is expressed by the objective function under various conditions.
Formulation of the primal problem: (1)

$$\max \sum_{j=1}^{n} c_j x_j$$

s.t.

$$\sum_{j=1}^{n} a_{ij} x_j \le b_i, \quad i = 1,2,\ldots,m$$

$$x_j \geq 0, \qquad j = 1,2,\dots,n$$

Where,

x_j : The number of units produced for product j

$c_j(\text{profit\_rate}) = P - (1 + r)h$, where P is price, r is interest rate, and h is cost

a_{ij} : The amount of cost incurred for the production of a unit of product j under the cost category i

b_{ij} : Required funds (debt) under the cost category i

Conclusion: Maximization of profit

(Author's draft)

In a thetical economic phase, the government would behave in a manner shown in Formula (2). It demonstrates that the government would inject minimum amounts of tax payer money into administrative services to satisfy its nation's aspiration level (minimum satisfying level). It also signifies that the government would take actions to reform its finance (cutting back government deficits), as is expressed by the objective function in Formula (2), under its conditions.

Formulation of the dual problem: (2)

$$\min \sum_{j=1}^{n} r_j x_j$$

s.t.

$$\sum_{j=1}^{n} \alpha_{ij} x_j \geq \beta_i, \quad i = 1,2,\dots,m$$

$$x_j \geq 0, \quad j = 1,2,\dots,n$$

Where,

x_j : The number of units produced for administrative service product j

r_j : The amount of injected tax payer money (the amount of tax payer money spent for the production of a unit of administrative service product j)

α_{ij} : The level of satisfaction of a resident i achieved by the production of a unit of administrative service product j

β_i : Aspiration (satisfaction) level of a resident i towards overall administrative services

Corporate behaviors and government behaviors in a thetical economic phase show a relationship of duality. As a result, corporate behaviors can be explained by the theorem of the primal problem of linear programming, whereas government behaviors are explainable by that of the dual problem of linear programming.

Behavior of Corporations and Government in Antithetical Economy

In Antithetical Economy in macroeconomics, the objective of corporate behavior is to minimize debt. Corporate behavior in an antithetical economic phase can be expressed using the dual problem formula of linear programming (see Formula (3)). In other words, corporations will behave in such a way as to minimize debt, which is expressed by the objective function under its conditions.

Formulation of the dual problem: (3)

$$\min \sum_{i=1}^{m} u_i b_i$$

$$\text{s.t.}$$

$$\sum_{i=1}^{m} \alpha_{ji} u_i \geq c_j, \quad i = 1,2,\dots,m$$

$$u_i \geq 0, \quad = 1,2,\dots,m$$

u_i : Unpaid balance rate for the cost category i,

$\quad u_i = 1 - amorization\_rate$

Conclusion: Minimization of debt

(Author's draft)

In an antithetical economic phase, the government would behave in a manner shown in Formula (4). It demonstrates that the government can borrow money (it can issue government bonds), which is worth r_j, from financial institutions, and that it can increase public spending to construct social infrastructure. There is good demand for funds (government bonds) in this economic phase, and the government would continue to increase deficits, by expanding public spending to fill the supply-demand gap emerged during this phase.

Formulation of the primal problem: (4)

$$\max \sum_{i=1}^{m} u_j \beta_j$$

$$\text{s.t.}$$

$$\sum_{j=1}^{n} \alpha_{ij} u_i \leq r_j, \quad i = 1,2,\dots,m$$

$$u_i \geq 0, \quad j = 1,2,\dots,n$$

where,

u_i : The amount of taxpayer money spent for raising the level of satisfaction of a resident i by a unit

In other words, corporate behaviors and government behaviors in an antithetical economic phase show a relationship of duality. As a result,

corporate behaviors can be explained by the theorem of the dual problem of linear programming, whereas government behaviors are explainable by that of the primal problem of linear programming.

Thetical Economy in Macroeconomics

By applying a thetical economic phase proposed in Chapter 3 to macroeconomics, the following is obtained.

Suppose Y is the gross domestic product, C is total consumer spending, and I is capital expenditure of economic entities (corporations, etc.) in macroeconomics. Then, the equation below holds.

$$Y = C + I$$

GDP Y is equal to the gross domestic product and, in Thetical Economy, I increases. For example, when investment increases by a unit (ΔI), the GDP increases by:

$$\Delta I + a\Delta I + a^2\Delta I + \cdots = \frac{\Delta I}{1 - a}$$

If we assume the consumption coefficient "a" to be 0.9, an increase of a unit in investment results in an increase of $10\Delta I$ in the gross demand ($C + I$). This can be obtained by solving a simple macro-economic model shown below.

A macro-economic model:

$$Y = C + I$$
$$C = aY$$

Y: Gross domestic product, C: Consumption, I: Investment, Assuming Consumption coefficient $a = 0.9$,

Solution is as follows.

$$Y = 10I$$
$$C = 0.9Y$$

The same result can be obtained by solving the macro-economic model using the differential equations shown below.

Differentiation of the macro-economic model:

$$dY/dI = dC/dI + I$$
$$dC/dI = 0.9dY/dI$$

As a result, the following solutions are obtained.

$$dY/dI = 10$$
$$dC/dI = 9$$

Thus, differentiation and increment are expressed as below.

$$dY/dI = \Delta Y/\Delta I$$
$$dC/dI = \Delta C/\Delta I$$

In other words, in Thetical Economy, an increase of ΔI in initial investment leads to an increase in consumption, resulting in an increase of

$10\Delta I$ in demand, which is 10 times larger than the increase in initial investment (when the consumption coefficient is 0.9).

The multiplier effect is expressed as $\Delta Y = 10\Delta I$.

Therefore, the equation

$$Y \equiv C + I \qquad (4)$$

will hold, being consistent with Say's Law which says all goods supplied will be consumed.

$Y \rightarrow C + I$ (Say's Law)

Therefore, the following equation can be obtained from the equation (5).

$$Y - C = S \equiv I$$

This means that all savings will be invested. Since corporations are in a financial environment where investments are booming, economic conditions can be controlled by manipulating market interest rate. In this economy, monetary policies are effective.

Antithetical Economy in Macroeconomics

By applying the concept of Antithetical Economy proposed in Chapter 4 to macroeconomics, the following statements can be made.

Suppose Y is gross domestic product, C is total consumer spending, and I is capital expenditure of economic entities (corporations, etc.) in macroeconomics. Then, the following equation holds.

$$Y = C + I$$

GDP Y is equal to gross domestic product and, in Antithetical Economy, I decreases. For example, when investment drops by a unit (∇I), GDP decreases as follows:

$$\nabla I + a\nabla I + a^2\nabla I + \cdots = \frac{\nabla I}{1 - a}$$

If we assume the consumption coefficient "a" to be 0.9, one unit of decrease in investment results in a decrease of $10\nabla I$ in gross demand ($C + I$). This can be obtained by solving a simple macro-economic model as was the case in Thetical Economy. The only difference is in the initial investment, which decreases instead of increasing.

In other words, in Antithetical Economy, a drop of (∇I) in the initial investment leads to a decrease in consumption, ultimately resulting in a decrease of $10\nabla I$ in demand, which is 10 times larger than the decrease in initial condition. It is a reverse multiplier effect.

$$\nabla Y = 10\nabla I$$

Therefore,

$$Y \geq C + I \qquad (6)$$

will hold.

As a result, manufactured goods are not consumed fully, in contradiction to Say's Law. Instead, it is necessary to rehabilitate the economy by creating effective demand. This is where Keynes' principle of effective demand comes into play.

$Y \leftarrow C + I$ (Principle of effective demand)

From this and the formula (6), the following is obtained.

$$Y - C = S \geq I$$

This means that not all savings are spent on investment. Corporations shift their goals from investment to payback of debt, and the government needs to fill the shortage of demand with financial policies. In this economy, increasing government spending is effective.

$Y \equiv C + I + G$ (Financial action)

Notice a difference between the equation (5) and the inequality (6). The equation (5) is an identity, while the inequality (6) is a formula to solve equilibrium points of demands and supplies.
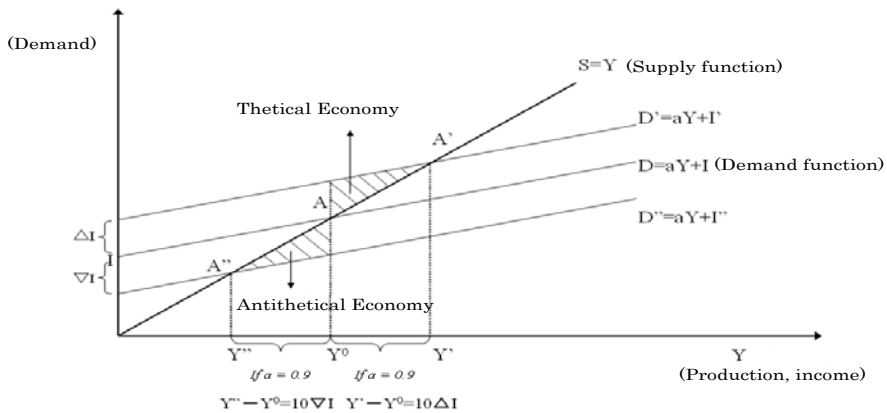
The equation (5) says that demands ($C + I$) always equals to supplies (S) in thetical economic phase. Because demands ($C + I$) are larger than supplies (S), amounts of supplies beyond demands do not appear. Or, on a posteriori, supplies (S) seem to create its own demands ($C + I$). If we are in the thetical economic phase, the relation is always held and we do not think equilibrium points.

But if we are in the antithetical economic phase, supplies (S) are larger than demands ($C + I$), and we have to think equilibrium points of the supplies and the demands. In the other words, we have to solve the inequality for equilibrium, which is the formula (6). Or, the formula (6) cannot express on any identity.

Theorem of Duality in Macroeconomics

What has been explained in Chapter 5 and 6 can be expressed by a chart shown in Figure 3. The two shaded areas in the chart represent Thetical Economy (representing Say's Law, the area on top right) and Antithetical Economy (representing the principle of effective demand, the area at bottom left). Figure 3 shows that a duality exists in economics. Therefore, the economic subjects explained in Chapter 5 and 6 can be summarized as shown in Table 1.

Finally in this chapter, the author proposes "theorem of duality in macroeconomics."

Thetical Economy and Antithetical Economy in the chart show a relationship of duality.

I: Investment Y: Gross domestic product
D: Demand S: Supply
a: Consumption coefficient

Figure 3 Thetical Economy and Antithetical Economy (Author's draft)

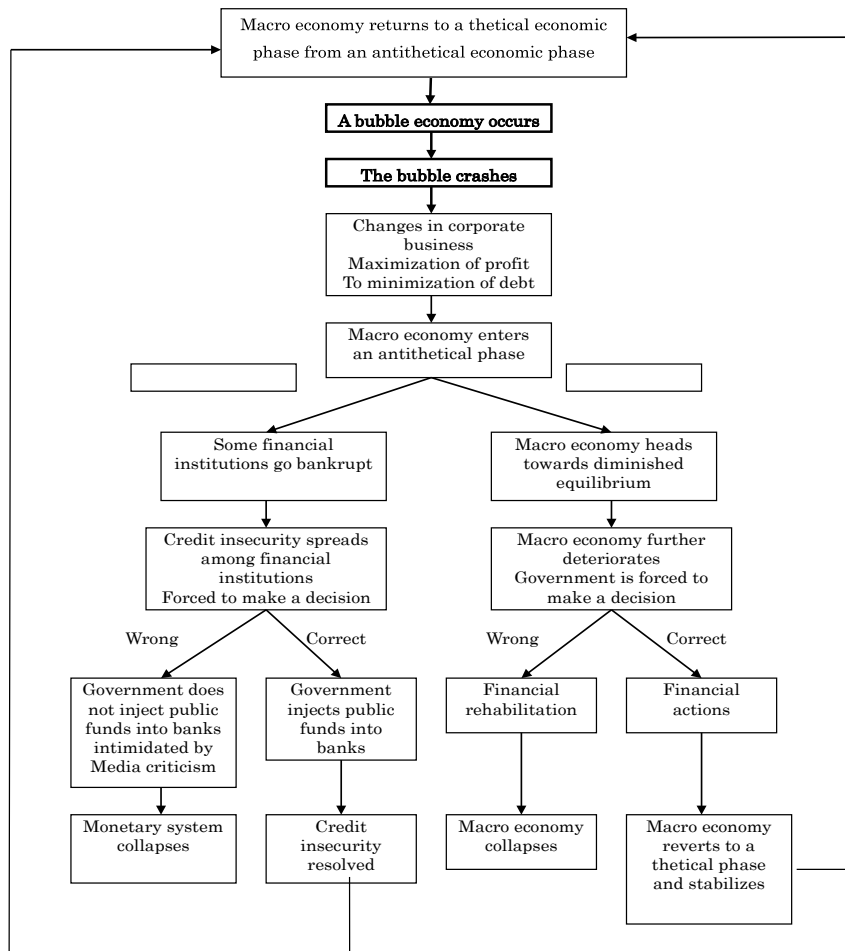Table 1 Summary of duality in macroeconomics

	Thetical Economy	Antithetical Economy
1) Law	The invisible hand of God	Fallacy of composition
2) Behavioral principle (corporation)	Maximization of profit	Minimization of debt
3) Behavioral principle (government)	Financial reform	Increasing public spending
4) Say's Law	Supply creates demand	Not effective Results in insufficient demand
5) Principle of effective demand	Not effective A shortage in supply, i.e. crowding out may be possible	Demand creates supply
6) Monetary policy	Effective	Not effective Lowering the interest would not tempt corporations to borrow money
7) Financial policy	Not effective	Effective The government is the biggest consumer
8) Interest	Normal rate (inflation)	Ultra-low rate (deflation)
9) Unemployment	None	Present
10) Saving	Savings are invested	Savings will not be invested
11) OR analysis (corporation)	Primal problem in linear programming	Dual problem in linear programming
12) OR analysis (government)	Dual problem in linear programming	Primal problem in linear programming

(Author's draft)

38

The author defines Thetical Economy as the one to which Formula (1) and (2) are applicable, and Antithetical Economy where Formula (3) and (4) can be applied. Say's Law (supply creates demand) works in Thetical Economy, while the principle of effective demand (demand creates supply) is an established rule in Antithetical Economy. All subjects in Thetical Economy and those in Antithetical Economy form a relationship of duality.

In other words, the Heisei Recession in Japan and the U.S. sub-prime loan crisis in 2008 are both the examples of Antithetical Economy, as are shown in the lower-left shaded area in Figure 3. (Shortage in demand causes the economy to be an antithetical type). In these situations, economic subjects are explained by the right column of Table 1.

Based on these observations, a process that causes the economy to move into an antithetical economic phase, and a remedy to bring the economy back to a thetical economic phase can be described by the flowchart in Figure 4.

(Author's draft) Figure 4 Flowchart of Economic Cycle

Analyzing Four-Phase Economic Cycle

As demonstrated in the preceding paragraphs, the author proposed Thetical Economy and Antithetical Economy of macroeconomics by utilizing the technique of operations research (OR).

However, as was stated in the first part of this paper, when the economy moves from Thetical Economy to Antithetical Economy, it naturally goes through a bubble economy, followed by its bursting. This means that there are four economic phases, or (1) Thetical Economy, (2) bubble economy, (3) the bursting of the bubble, and (4) AntiThetical Economy, which constitute a full economic cycle. The author analyzes and identifies how each phase is to be formed in the ensuing paragraphs.

In this chapter, the author first analyzes how Thetical and Antithetical economies are to be formed. He then goes onto the analysis of bubble economy and its collapse in the Chapter 9.

According to the author, a thetical economic phase and an antithetical economic phase are described as subsets of Y-D space. A thetical phase is a set of points in Y-D space:

$$\text{Thetical}(y_0) = \{ (y, d) | y > y_0 \text{ and } d \geq y\}.$$

An antithetical phase is a set of points in Y-D space:

$$\text{Antithetical}(y_0) = \{(y, d) | y < y_0 \text{ and } d \leq y\}.$$

Elements of these subsets are affected by y_0 whose supply is equal to an economic equilibrium point, or a full employment income. In the simple model of macro economy, a thetical phase and an antithetical phase are represented by two triangle areas shown in Y-D plane (Figure 5).
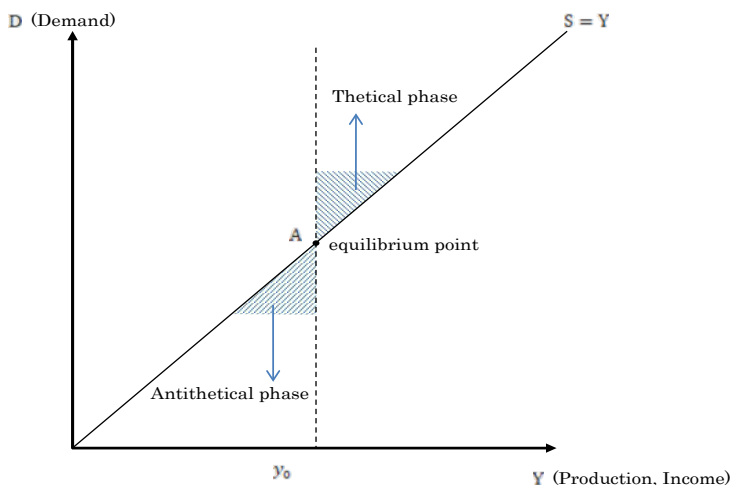

Figure 5 Thetical phase and antithetical phase in economic space in the simple model of macro economy. Y denotes gross domestic product, D signifies demand and S represents supply. These phases have a relationship of duality. (Author's draft)

If a state (y, d) is in a thetical phase, supply is defined as follows:
$$Y \equiv C + I.$$
The Say's law is applicable in this case.

While, if a state (y, d) is in an antithetical phase, supply holds a relationship as follows:
$$Y \geq C + I.$$
The principle of effective demand comes into play in this case.

Bubble economy

In this chapter, the author defines a bubble economy as follows: If a state (y, d) is in a thetical phase and the value $\left[\frac{\partial Y}{\partial I}\right]_{(y,d)}$ is sufficiently large, the state (y, d) is in a bubble economy. And he defines the bubble bursting as follows: When there can be seen a partial change, or $\frac{\partial Y}{\partial I}$ from value $\frac{\partial Y}{\partial I} > 0$ to value $\frac{\partial Y}{\partial I} < 0$, in any state in a bubble economy.

The author then explain a mechanism of the bubble bursting shown by the simple model of macro economy through variations of consumption coefficient a (Kinoshita, 2011b). If a state is in a thetical phase, in the simple model of macro economy, the following relationships can be obtained.
$$\frac{\partial Y}{\partial I} = \frac{\partial C}{\partial I} + 1.$$
$$\frac{\partial C}{\partial I} = a \frac{\partial Y}{\partial I}$$
Now, it is deduced as follows:
$$\frac{\partial Y}{\partial I} = \frac{1}{(1 - a)}$$
Thus, a mechanism of the bubble bursting can be described through the behavior of exogenous variable a: ○,1 first, an economy of real world is demonstrated in a thetical phase economy. ○,2 the consumption coefficient a increases and comes close to 1, and the state is in a bubble economy. ○,3 the consumption coefficient a surpasses 1, resulting in the bubble bursting $(\frac{\partial Y}{\partial I} > 0 \rightarrow \frac{\partial Y}{\partial I} < 0)$. ○,4 the value $\frac{\partial Y}{\partial I}$ is sharply down, and an economy of real world is found to be in an antithetical phase. The mechanism is illustrated in Figure 6.
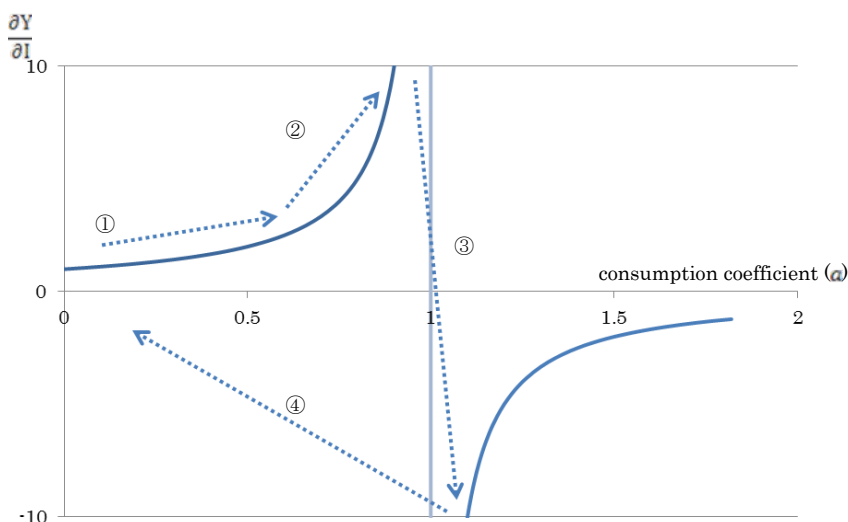
Figure 6 Mechanism of bubble bursting: $\circ$,1 a state of economy is in a thetical phase, $\circ$,2 a state is in a bubble economy, $\circ$,3 bubble bursting, $\circ$,4 a state of economy is in an antithetical phase.
(Author's draft)

Discussions

In the author's definition, a bubble economy is different from economic growth. A concept of economic growth based on the simple model of macro economy is demonstrated in Figure 7. When corporate investment increases (δI), the equilibrium point moves from A to A', heading toward the expanded equilibrium. When corporate investment increases to I_1, then the economic equilibrium point moves to A_1. As a result, the economy expands more, which is accompanied by an increase in consumption. When corporate capital expenditure grows to I_2, the economic equilibrium point moves to , spurring the economy to grow further. During the process of the transition of economic equilibrium points $A \rightarrow A' \rightarrow A_1 \rightarrow A_2$, the consumption coefficient a is constant in the demand function.

$$D = aY + I.$$

When the consumption coefficient a is 0.9 in the simple model, for instance, the multiplier effect is expressed as follows:

$$\frac{1}{1-a} = \frac{1}{1-0.9} = 10.$$

This means that economic growth with the multiplier effect is 10 times (Figure 7). The author defines this type of economic expansion as "economic growth," and he hopes that readers will remember this definition whenever it is mentioned in this paper.
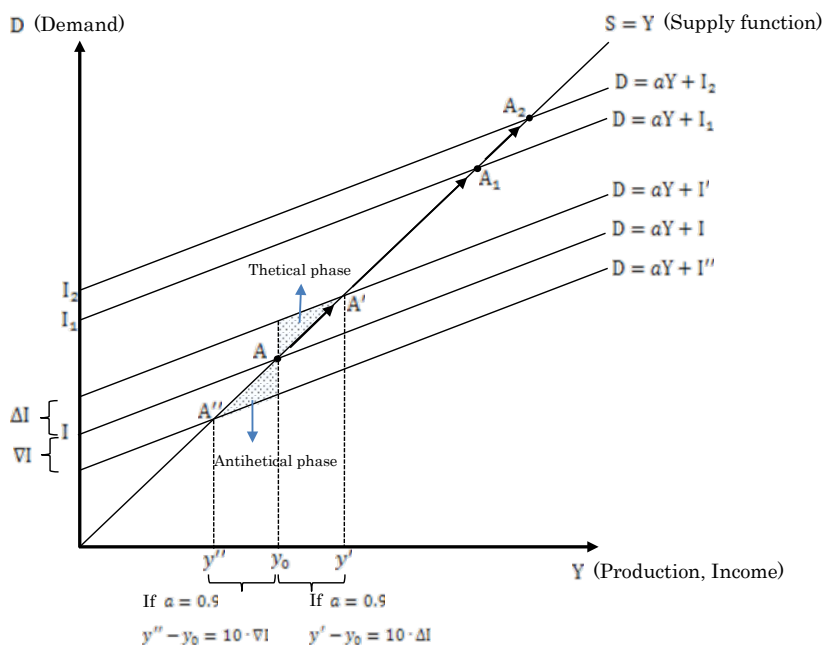
Figure 7 Concept of economic growth. I represents investment, and a signifies consumption coefficient. (Author's draft)

An increase in private sector demand, during the process of economic growth, may prompt not only companies to expand capital expenditure, but also individual consumers to engage in speculation. In the United States, for example, even a shoeshine boy purchased stocks for speculation during the 1920s. In Japan, housewives, elderly people, and even students engaged in speculation during the so-called Heisei Bubble of the early 1990s. The housing bubble of the United States occurred as an increasingly large number of low-income earners started taking out sub-prime loans after 2005, before U.S. house prices began their steep decline, which triggered the sub-prime crisis in 2008. It was another example of speculative behavior by common folks in the U.S.

In such a state, the consumption coefficient a in the demand function $D = aY + I$ is infinitely close to 1. As a result, its economic effect, or multiplier effect, represented by $\frac{1}{1-a}$ in the simple model of macro economy, grows without limit.

Under such circumstances, the economy expands infinitely, even without an increase in corporate capital expenditure. Our definition of a bubble economy in Chapter 9 expresses such a state without abnormally high investment effect. We demonstrated a bubble economy in Figure 8. The

economy expands when the consumption coefficient of individual consumers is closer to 1, even without an increase in corporate investment in facilities. And the economic equilibrium point moves from A' to A_1, and to A_2. This is the state of a bubble economy.
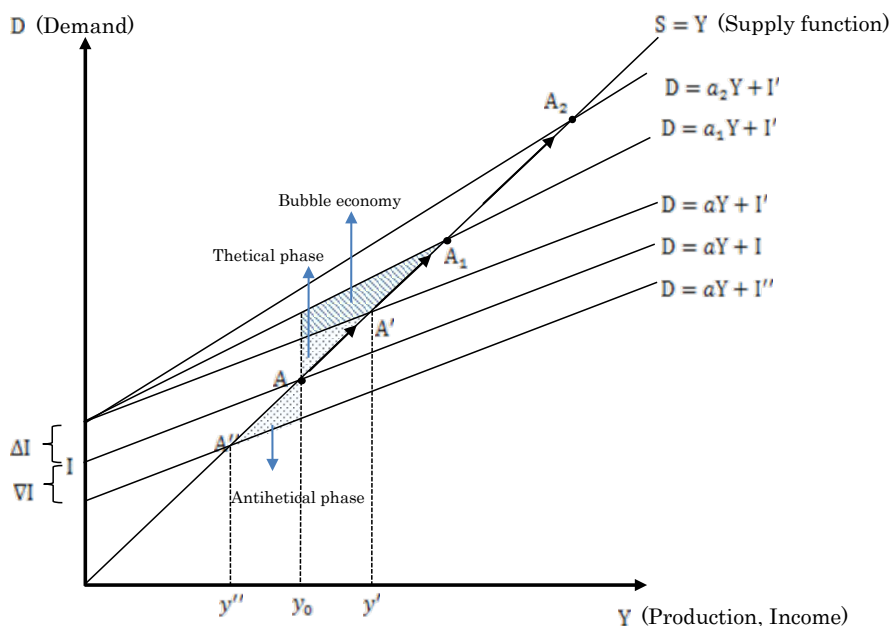

Figure 8 Bubble economy. (Author's draft)

A bubble economy is often mistaken to be "an outstanding state of the economy." History shows that once an individual gets a forbidden taste of "a bubble economy," his or her enthusiasm for speculation tends to be accelerated. During "the Tulip mania" in the first half of the 17th century in the Netherlands, the fad became so excessive that the price of a single tulip bulb rose as high as the price of a house. However, once the consumption coefficient of this "forbidden state of bubble" becomes marginally above 1, the bubble bursts. The process is shown in Figure 9.

If the consumption coefficient a is 1.1, for instance, in the simple model, it turns out to be as follows:

$$Y = C + I$$
$$C = 1.1\,Y$$

The solution for the simultaneous equations is as follows:

$$Y = -10\,I.$$

It means that when consumption coefficient grows larger than 1, and corporate capital expenditure increases by a unit δI, the economic equilibrium point falls sharply, and the bubble bursts as shown in Figure 9.

The economic equilibrium point moves from A to A' in this case. Once people come to recognize this downturn, they tend to refrain from economic activities, which include not only speculation but also consumption. As a result, the overall consumption of the economy shrinks back, and the consumption coefficient marks less than 1.

After the collapse of a bubble economy, consumption activities return to normal. As a result, however, the economy suffers a great lack of demand as shown in Figure 10. The author defines this state "collapse of a bubble economy" as was shown in Chapter 9, in which he described the bubble bursting.
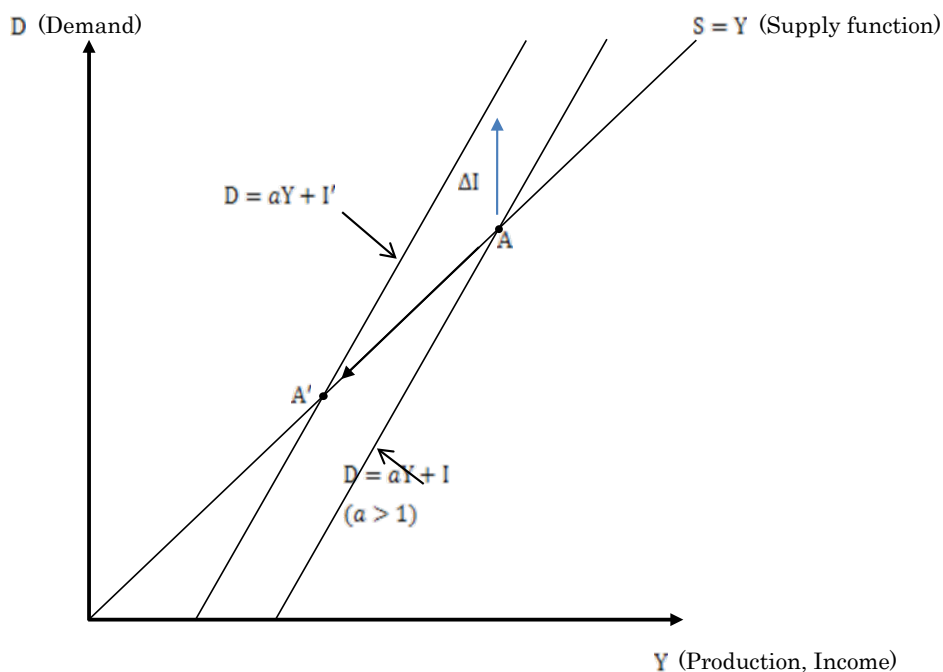

Figure 9 Mechanism of occurrence and collapse of a bubble economy.
(Author's draft)

As shown in Figure 9, private-sector demand for capital falls sharply. Companies stay away from capital expenditure because investment efficiency goes down to dire levels.

In other words, because the value of assets purchased on credit during the bubble period collapses, the efficiency of investment drops below the market interest rate for corporations with debt. As a result, companies discontinue investing in facilities, and shift their business priorities from profit maximization to debt minimization.

In this state, macro economy moves from a thetical phase to an antithetical phase, with corporate goal shifting from profit maximization to debt minimization. Meanwhile, due to low investment efficiency, companies stop borrowing money from banks to make investments. Instead, they become intent on paying down debt. As a result, money is tucked away in the banking system.
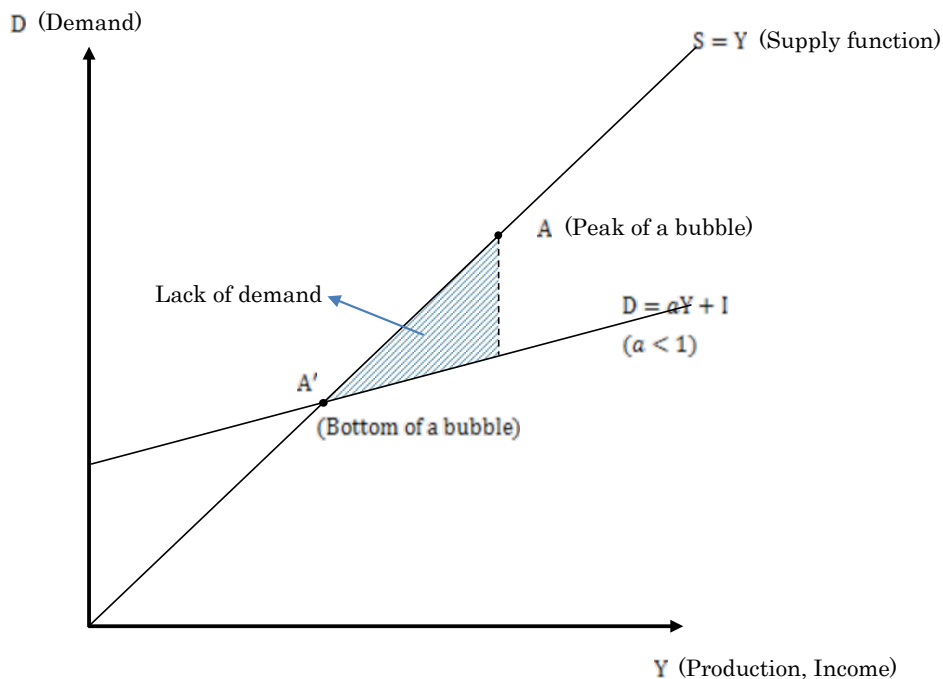

Figure 10 Lack of demand. (Author's draft)

Conclusion

In this paper, the author Kinoshita proposed Thetical and Antithetical economies in macroeconomics by utilizing the technique of operations reserach (OR). The author also analyzed how the economy goes through four phases, or Thetical Economy, bubble economy, the bursting of the bubble, and Antithetical Economy, which constitute a full economic cycle, and identified how each phase is to be formed.

As a result, the author defines a thetical phase and an antithetical phase in macro economy as subsets of economic space. These are models based on independent definitions. Under these definitions, he describes a bubble economy and the bubble bursting through investment efficiency $\frac{\partial Y}{\partial I}$. In the simple model of macro economy, since the investment efficiency is

expressed as an inverse proportionality of consumption coefficient, a bubble economy and the bubble bursting can be described through the variations of consumption coefficient. Also, in the simple model, the bubble bursting only occurs when the consumption coefficient a surpasses 1.

While the author Kinoshita describes the mechanism, there is no discussion in what way this description is valid for the real economy in this paper. The prolonged recession in Japan over the last 20 years and the 2008 U.S. sub-prime loan crisis are used as an onset to the analysis, but there is for example no reference to the role the banking and the financing sector played in in het US crisis, as many authors do when they try to explain the crisis .

In this way the rather simple solution the author suggest by framing the essential problem of economy as a problem of linear programming, dominated alternately by a classical free market phase and a Keynesianse state intervention phase, maybe undermined by the facts of real economy. The author proceeds studies how validate his theory and verify his statements on real economy.

Also models of the author do not consider neither the role of financial system, nor the role of innovations and technical progress in the economic dynamics. And the author doesn't refer any business cycle models apurpose. Because this research is still on a step which analyse pure static state of economy. Next step of the research is comparison of other dynamic models and other business cycle models.

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