

THE ANALYSIS OF SUSTAINABILITY-STATIONARITY-STABILITY TRIADA

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Abstract

Clarifying the concept of Sustainability is important for a better understanding of the economic phenomena/processes/systems' response to external shocks.

The paper aims to define the concept of Sustainability in conjunction with the concepts of Stability and Stationarity using the logical analysis-method of sufficiency predicates. Next, I will analyze the relationship between those three concepts.

The results of the paper will be useful in analyzing economic growth models and in formulating public policies. Also, clarifying these concepts is an important step in defining other economic concepts such as Economic Sustainability, Fiscal Sustainability and Institutional Sustainability.

Keywords: Sustainability, Stability, Stationarity, Sufficiency predicates.

JEL classification: F49,O43,R11.

A. Introduction

The Sustainability, Stationarity and Stability are key-concepts in understanding the economic phenomena. They belong to the same conceptual family having similarities and differences. The present document focuses on elucidating these concepts and analyzing the relationship between these notions.

B. Methodology

To fully clarify these notions, I am using the instrument of logical analysis-method of sufficiency predicates. This method implies the use of concept's attributes that fully describe the analyzed notion. (Dinga E., 2009, page 91)

Hence, we may define the abstract concept AC as being the set comprised of the predicates that fully describe the notion:

$$AC = \{P_1, P_2, \dots, P_n\} \quad (1)$$

Where: Abstract Concept-AC

Sufficiency Predicates- $P_1, P_2, \dots, P_n$

Therefore, the process of defining the abstract concept AC implies the following steps:

1. **Identifying the list of attributes/sufficiency predicates** that describe the abstract concept AC
2. **Qualitative analysis**
 - i. Completeness- verifying if the list of the identified attributes fully describes the concept
 - ii. Independence- checking the independence of the pairs of attributes
 - iii. Consistency-checking the consistency of the pairs of attributes

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C. The Concept of Sustainability¹²⁸

In my opinion, the Sustainability Concept is defined by the following sufficiency attributes:

- Auto-Replication-AR
- Preservation-P
- Conservation-C

In conclusion, from logical point of view, the concept of Sustainability is described by the following equation:

$$S = (AR) \wedge (P) \wedge (C) \quad (2)$$

Where: $\wedge$ - symbol for logical conjunction; S-Sustainability; P-Preservation; C-Conservation

Consequently, I will define the concept of Sustainability as the ability of a phenomenon/process/system to replicate itself and to preserve its capacity of auto-replication while preserving its structure.

i. Completeness Analysis

- Auto-Replication-AR is the ability of a phenomenon/process/system to replicate itself
- Preservation-P is the ability of conservation of the aptitude of auto-replication
- Conservation-C-The ability of a phenomenon/process/system to maintain its parameters within an interval, with or without the help of an external device.

Analyzing these predicates, we may conclude that they completely define the concept of Sustainability

ii. Independence analysis

The independence analysis presumes that none of the attributes is the logical result of another. Therefore, we have the following:

- **AR does not involve P and vice versa:** the ability of a phenomenon/process/system to replicate itself does not involve that the system/process/phenomena has the ability of conserving the aptitude of auto-replication and vice versa- the ability of conservation of the aptitude of auto-replication of a phenomenon/process/system does not involve that phenomenon/process/system has the ability to replicate itself
- **AR does not involve C and vice versa:** the ability of a phenomenon/process/system to replicate itself does not involve that the system/process/phenomena has the ability to maintain its parameters within an interval, with or without the help of an external device to preserve its structure and vice versa- the ability of a phenomenon/process/system to preserve its parameters within an interval, with or without the help of an external device does not involve the ability of a phenomenon/process/system to replicate itself
- **P does not involve C and vice versa:** the ability of a phenomenon/process/system to conserve the aptitude of auto-replication does not involve that the system/process/phenomena has the ability of preserving its parameters within an interval, with or without the help of an external device and vice versa - the ability of a phenomenon/process/system to preserve its parameters within an interval, with or without the help of an external device does not involve the ability of a phenomenon/process/system to conserve its aptitude of auto-replication

In the following tables we may see the results of the Independence Analysis.

¹²⁸ The clarification of the Concept of Sustainability was presented by the author at the International Conference "Law, Public Administration and Medicine, Liability for Democracy", ICPLA 6th edition, October 26-27th 2017, Tg. Mures, Romania- "THE RELATIONSHIP BETWEEN ECONOMIC SUSTAINABILITY AND ECONOMIC GROWTH"

Table 1. The Independence Analysis for Sustainability's list of Sufficiency Predicates

Sufficiency Predicates	AR	P	C
AR	NA	X	X
P	X	NA	X
C	X	X	NA

iii. Consistency analysis

The consistency analysis assumes that none of the predicates is contradictory with another. Therefore, we have the following:

- **AR does not contradict P:** the ability of a phenomenon/process/system to replicate itself does not contradict that the system/process/phenomena has the ability of conserving the aptitude of auto-replication
- **AR does not contradict C:** the ability of a phenomenon/process/system to replicate itself does not contradict that the system/process/phenomena has the ability to preserve its parameters within an interval, with or without the help of an external device
- **P does not contradict C:** the ability of a phenomenon/process/system to conserve the aptitude of auto-replication does not contradict that the system/process/phenomena has the ability of preserving its parameters within an interval, with or without the help of an external device.

In Table 2 we can follow the results of the Consistency Analysis.

Table 2. The Consistency Analysis for Sustainability's list of Sufficiency Predicates

Sufficiency Predicates	AR	P	C
AR	NA	X	X
P	X	NA	X
C	X	X	NA

D. The Concept of Stationarity¹²⁹

The Stationarity Concept is defined by the following sufficiency attributes:

- Invariance-I
- Predictability-PD

Thus, from logical point of view, the concept of Stationarity is defined as it follows:

$$ST = (I) \wedge (PD), \quad (3)$$

where: $\wedge$ - symbol for logical conjunction; ST-Stationarity; PD-Predictability

Therefore, I will define the concept of Stationarity as the ability of a phenomenon/process/system to preserve the value of its status parameter, during a certain period of time, in response to external shocks, without the intervention of external device and to predict the parameter's response to the external shocks.

i. Completeness Analysis

Considering the meaning of the sufficiency predicates Invariance and Predictability:

- Invariance-I- the value of the status parameter remains unchanged under external shocks without the intervention of external devices
- Predictability-PD-the ability of the system to predict the parameter's response to external shocks

¹²⁹ The concept of stationarity used here has not the meaning from mathematics. The phenomena/systems/processes characterized by this concept are dependent of time.

we may conclude that they completely define the concept of Stationarity.

ii. Independence analysis

The independence analysis assumes that none of the attributes is the logical result of another. Therefore, we have the following:

- **I does not involve PD and vice versa:** the ability of a phenomenon/process/system to maintain the value of its status parameter unchanged under external shocks without the intervention of external devices does not involve that the system/process/phenomenon has the ability of predicting the response of its parameters to external shocks and vice versa.-the ability of system/process/phenomenon to predict the response of its parameters to external shocks does not involve the fact that it has the ability to maintain unchanged its parameters.

iii. Consistency analysis

The consistency analysis assumes that none of the predicates is contradictory with another. Therefore, we have the following:

- **I does not contradict PD and vice versa:** the ability of a phenomenon/process/system to maintain the value of its status parameter unchanged under external shocks without the intervention of external devices does not contradict the system/process/phenomenon's ability of predicting the response of its parameters to external shocks and vice versa.-the ability of system/process/phenomenon to predict the response of its parameters to external shocks does not contradict the fact that it has the ability to maintain unchanged its parameters.

E. The Concept of Stability

The Stability Concept is defined by the following sufficiency attributes:

- Elasticity-E
- Predictability-PD

So, from logical point of view, the concept of Stability is defined as it follows:

$$S = (E) \wedge (PD) \quad (4)$$

where: $\wedge$ - symbol for logical conjunction; S-Stability; PD-Predictability

Consequently, I will define the concept of Stability as the ability of a system to coming back to its parameters' initial values, modified as a result of external shocks, with the help of an external device, and to be able to predict its parameters' response to the external shocks.

i. Completeness Analysis

- Elasticity-E- The parameters of a phenomenon/process/system returns to initial values of the modified parameters, with the help of the external devices
- Predictability-PD- the ability of a phenomenon/process/system to predict the parameter's response to external shocks

Analyzing these predicates, we may conclude that they completely define the concept of Stability

ii. Independence analysis

The independence analysis presumes that none of the attributes is the logical result of another. Therefore, we have the following:

- **E does not involve PD and vice versa:** the ability of a phenomenon/process/system to coming back to initial values of its modified parameters, with the help of the external devices, does not involve that the system/process/phenomena has the ability of predicting the parameters' response to external shocks

iii. Consistency analysis

The consistency analysis assumes that none of the predicates is contradictory with another. Therefore, we have the following:

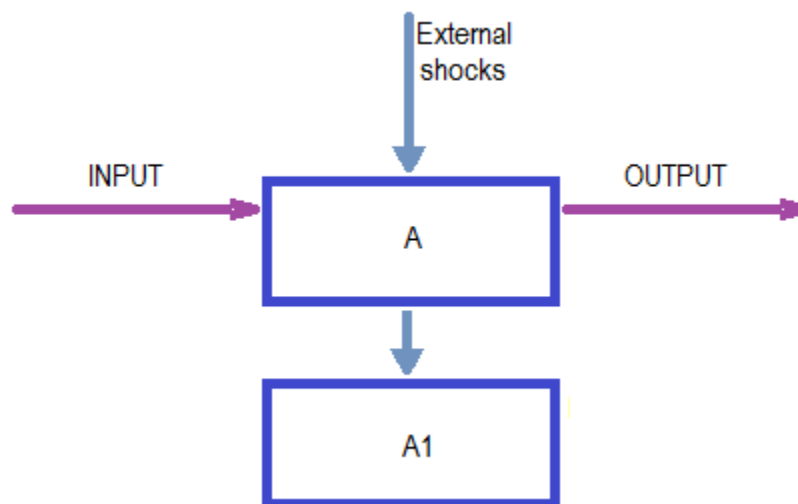
- **E does not contradict PD:** the ability of a phenomenon/process/system to coming back to initial values of its modified parameters, with the help of the external devices, does not contradict that the system/process/phenomena has the ability of predicting the parameters' response to external shocks

F. The relationship between Sustainability, Stationarity and Stability

To analyze the relationship between these three concepts I will show how a stationary, sustainable and stable system responds to external shocks.

The next figure shows how a stationary process/phenomenon/system works under external shocks:

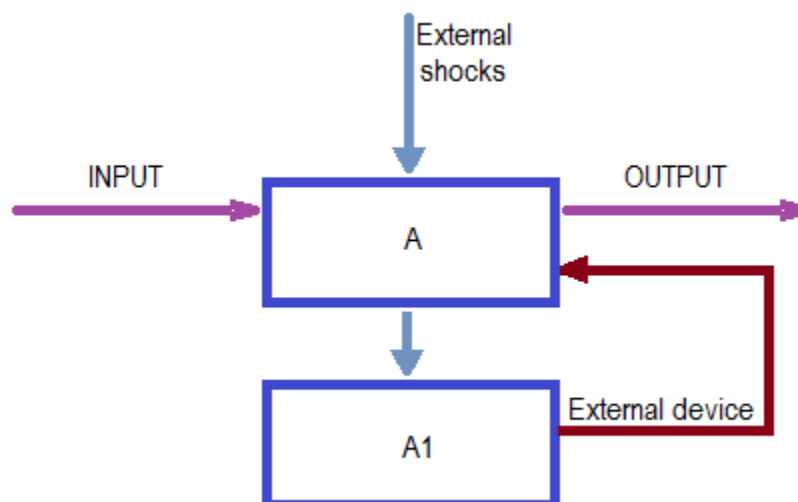
Figure 1. The response of the Stationary System's parameter to external shocks



Source: Author

In our attempt to finding the relationship between Sustainability, Stationarity and Stability we will identify, in the next figure, the response of the Stability System's parameter to external shocks:

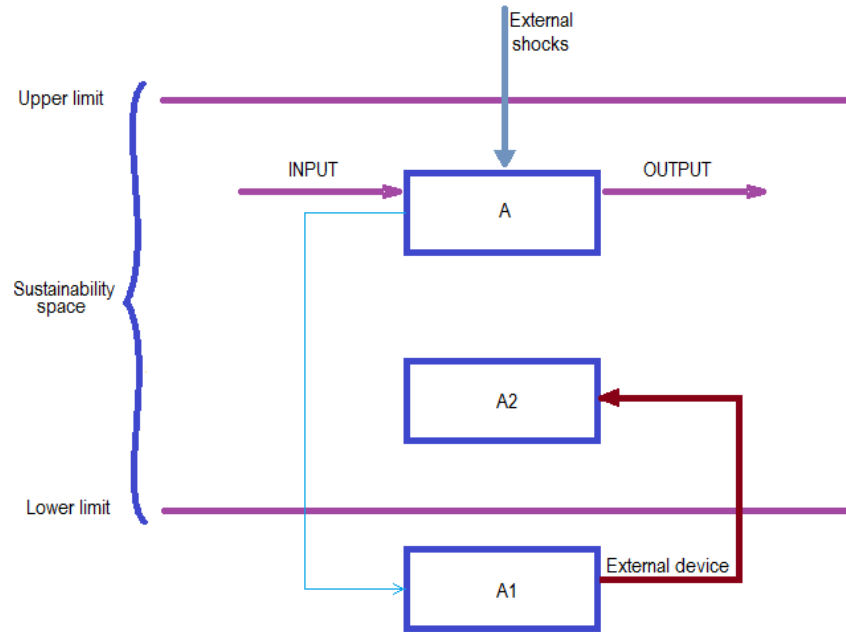
Figure 2. The response of the Stability System's parameter to external shocks



Source: Author

Next figure demonstrates the response of a sustainable system/process/phenomenon to an external shock:

Figure 3. The response of the Sustainability System's parameter to external shocks



Source: Author

G. Conclusions

1. The concepts of Sustainability, Stationarity and Stability are part of the same conceptual family. In the following table we may follow the similarities and differences between Sustainability, Stationarity and Stability from logical analysis point of views (sufficiency predicates):

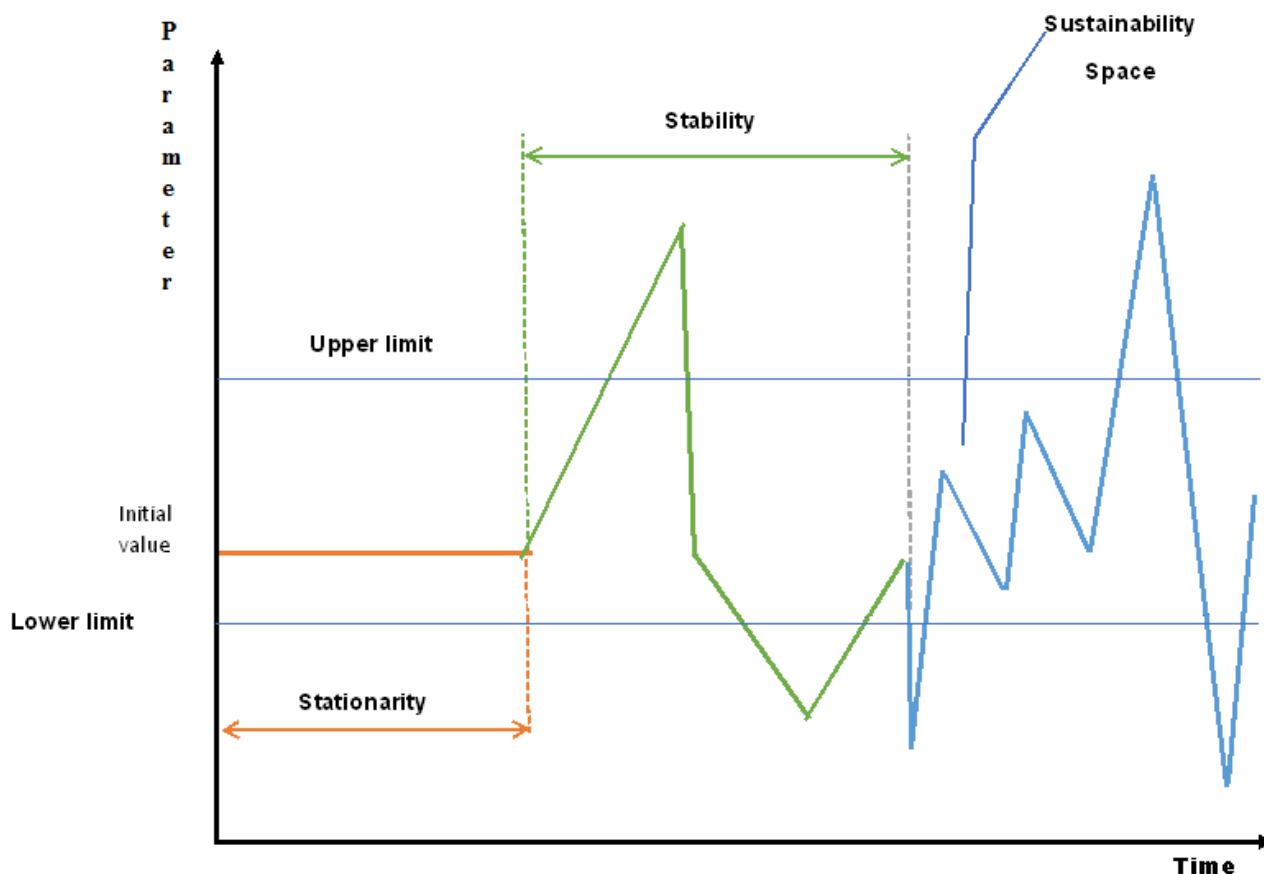
Table nr 3. The relationship between Sustainability, Stationarity and Stability

Attributes	AR	P	C	I	E	PD
Concepts						
Sustainability	X	X	X			
Stationarity				X		X
Stability					X	X

The table underlies the fact that the most complex concept out of the analyzed triada is the concept of Sustainability. Even though these three concepts do not share any attributes we may observe that the Sustainability's attribute of Conservation is an extension of the Elasticity attribute of Stability and Invariance attribute of Stationarity. The Sustainability and Stability Concept have in common the need for an external dispositive to function. Moreover, the Stability and Stationarity concepts have in common the attribute of Predictability.

2. The relationship between the Sustainability, Stationarity and Stability is highlighted in the following diagram:

Figure 4 – The relationship between Sustainability, Stationarity and Stability



Source: Author

H. Future Directions to Be Approached

- I. The analysis could go further to define the concepts of Institutional Sustainability, Institutional Stationarity and Institutional Stability. And identify the relationship between these concepts. That action would be useful in defining the potential European Fiscal Union.
- II. The results should apply to the European Union Institutional System and identify ways (norms, organizations, enforcement mechanisms) that can help in building a sustainable institutional system

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